CONTENTS

Well records

Geology and mineral resources of the Galesburg quadrangle and Monmouth quad.
By R. S. Poor
1935

Chapter I - Introduction

Location and Extent

The Galesburg quadrangle is located in the northwestern part of Illinois, about 35 miles south of Rock Island and includes about one-third of Knox County and a smaller portion of Warren County (Fig.). The area contains approximately 221 square miles, being about 17.3 miles long, north and south, and 13 miles wide.

The Monmouth quadrangle is also shown in Figure I. It joins the Galesburg on the west and covers an area of equal size, and lies wholly within Warren County.

Purpose and Scope of the Report

The purpose of the report is to make all known geologic data available to the citizens of the area and to any others interested in the mineral resources of the region.

The area contains several covered seams of coal. ~~which may some time prove~~ At least one of these seams has already proven to be of more than local importance, others will probably be more widely developed in the future. Those near the surface are used locally at the present time. Shale and clay suitable for the manufacture of brick and tile is now being used within the Galesburg area and this report shows that there is a great additional quantity of suitable material available, which as yet, is undeveloped.

Possible stripping coal areas are indicated.

The general descriptive material and especially the geologic history should be of value to teachers and students within this and adjacent areas.

Previous Work

Very little data has been published on the Galesburg area.

A. H. Worthen in 1870 made the first geological report upon Knox and Warren counties. This early work is now considered classic in Mississippi Valley geology.

[1] Worthen, A. H., Ill. State Geol. Surv., Report IV (1870) 288-300, 313-324.

Portions of the area were studied by Leverett.[2] His work was largely reconnaissance and included only Pleistocene deposits.

[2] Leverett, F., The Illinois Glacial Lobe U. S. Geol. Surv. Mono. 38 (1899).

~~Recently,~~ Culver in 1925 mentioned portions of the area in his report on "Coal Resources of District III"[1] and Udden gives a log of one of the deep wells in Galesburg in his bulletin on "Some Deep Borings in Illinois."[2]

[1] Culver, H. E., Ill, State Geol. Surv., Cooperative Mining Series Bull. 29 (1925).

[2] Udden, J. A., Ill. State Geol. Surv. Bull. 24 (1914).

Jelliff's papers treat interesting aspects of the region.

Jelliff, F. R., Fishing with a hammer (fossils in Coal Measure shales near Galesburg, Ill.), Ill. State Academy of Sci. Trans. Vol. 16, pp. 335-341, 1923

(over)

Field Work and Acknowledgments

The field work on which this report is based was done in the Summer of 1926. The Galesburg quadrangle was worked by R. S. Poor and his assistant H. B. Willman. The Monmouth quadrangle was worked by L. E. Workman and his assistant, . The work on the Pleistocene was supervised by Dr. M. M. Leighton, Chief of the Illinois Geological Survey, and Dr. G. H. Cady supervised the work on the Pennsylvanian.

Dr. T. E. Savage and Dr. J. Marvin Weller checked the fossils. Mr. J. E. Lamar of the Survey staff gave assistance on the non-fuels and ran certain laboratory tests. Mr. F. C. Baker, Curator of the Illinois State Museum of Natural History, identified the Pleistocene fossils.

The owners and operators of the Galesburg Mining Company and the Purington Paving Brick Company were especially helpful. Many citizens of the area rendered invaluable service. This is especially true of Mr. Fred R. Jelliff of Galesburg who gave freely of his time and knowledge to make the work more thorough and enjoyable.

Published sources of information have been acknowledged in the text.

Guide to the Interpretation of Geologic History

General statement

One of the oldest principles in geology and one which gains abundant support by field evidence, is known as the Lyellian Principle of Uniformitarianism, which states that present day processes in nature are not different from those of any past geologic age. This means that if we are to unravel the history of the past as recorded in the rocks, surface forms, etc., we must study the processes now going on in nature which produce similar forms today.

Topographic map and land divisions

The basis for mapping the geologic formations of any area is the topographic map. (See Plate I). This map shows accurately three distinct features, topography, drainage, and culture.

The showing of topography, i.e. hills, plains, and valleys, is accomplished by means of brown lines, known as contour lines. A contour line connects all points of equal elevation above sea-level. A contour interval is the vertical distance between two successive contour lines. This interval distance is 20 feet on the Galesburg map. The base of reference is average sea-level, which is taken as zero. Very accurate elevations are brought inland by the United States Coast and Geodetic Survey and bench-marks, so-called, are established at various places. Several of these are located on the Galesburg map, e.g. see printed on topographic map under city of Galesburg, B. M. 773. These are permanently located as round brass plates in the foundation of a building, as the Galesburg Post-Office, or on a concrete post deeply driven.

The drainage features are shown in blue. Permanent streams, i.e. those flowing throughout the year in normal seasons, are indicated in solid blue. Intermittent streams are indicated by dotted blue lines. Lakes are solid blue, and swamps, such as are found around Horseshoe Lake, are indicated by a special pattern.

The cultural features, i.e. roads, railroads, houses, towns and other works of man are accurately located and shown in black.

The topographic division of the United States Geological Survey selects a precisely located point and draws through it an east-west line known as a base line, and a north-south line known as a principal meridian. East-west rows of townships north or south of the base-line are known as tiers, and are designated as T. (Township tier) 1 N. (North). T. 2 N., T. 3 N., etc., or T. 1 S. (South), T. 2 S., T.3 S., etc. These symbols are placed along the north and south margins of the map at the center of the tiers of the townships.

Rows of townships, east or west of the principal meridian, extending north-south are known as ranges and are enumerated as R. (Range) 1 E. (East), R. 2 E., R. 3 E., etc or R. 1 W. (West). R. 2 W., etc. These symbols are placed along the east and west margins of the map at the center of the rows of townships.

Fundamental Geologic Processes[1]

Introductory Statement

A mere description of the rocks of a region and a discussion of their economic uses does not constitute a geological report. Geology, in a broad sense, is the history of the earth--the record and the interpretation of the changes it has incurred. The earth is not a finished product; under our observation agencies are everywhere changing its surface at the present time, though the rate of such changes is very slow compared with the rate of progress of human events. These agencies have been operative throughout the past, and some of their results have been nothing short of revolutionary. Once or repeatedly areas now land were below the sea for long ages; regions now of gentle relief were the sites of lofty mountains; some districts where now there is fertile farming land were the scenes of volcanic eruptions, and others were buried beneath thousands of feet of glacial ice; areas now frigid supported palms, fig trees, magnolias, and other subtropical plants.

Many of the events of earth history are recorded in the rocks, that is, the rocks are the products of past conditions. The present environment represents

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1 This section has been adapted from the report on the Geology and Mineral Resources of the Kings Quadrangle, by J. H. Bretz, State Geological Survey Bull. 43, pp.211-217, 1923.

the cumulative result of the past environments. Consequently an appreciation of the geology of any region as it is today involves an adequate comprehension of the geological history of that region. By studying the rock formations and interpreting their features as nearly as possible in accordance with current phenomena, geologists have worked out a considerable portion of the past history of the earth. They have subdivided geologic time into significant intervals, each of which is characterized by a suite of conditions that is reflected in the rocks that represent the interval. The major subdivisions are eras and periods (Table I, p. 26). The transition from one to the other of these major subdivisions was marked by some momentous change that had world-wide effects. Some but not all of these great changes are recorded within the area of the Galesburg quadrangle.

Running water, ground-water, wind, and man constitute the agencies that are now actively engaged in creating geological changes in the Galesburg quadrangle. Their results are gradational and tend to bring the surface of the whole area and adjacent areas to an accordant level. Degradation, or wearing away, is everywhere occurring on the slopes and uplands, and aggradation, or building up, is in progress to some extent on the lower tracts.

Work of Running Water

The average annual rainfall in this region is 34 inches, of which more than a third, perhaps a half, flows down the slopes and converges in the definite water courses. Most of the smaller streams are intermittent and exist only during and immediately after rains and the melting of snow. Others are permanent and persist with a greater or lesser flow throughout the year. These streams, whether intermittent or permanent, are generally more or less muddy, and when in flood they carry sand in suspension and roll pebbles along their bottoms. Such action, continued through centuries, inevitably lowers the surface of the region by removing loose material and abrading more substantial deposits.

Measurements of the rate of flow of many Illinois rivers indicate that the run-off per square mile of their drainage basins averages nearly 700,000 tons of water per year. If in its course to the permanent streams this run-off descended a slope averaging 50 feet to the mile, it would produce an average of nearly four and one-half horsepower operating on every square mile of the surface. After the water is concentrated in streams, its work is even more pronounced and conspicuous. The adequacy of running water to wear down the land through long intervals of time is thus apparent.

Work of Ground-Water

The portion of the precipitation that sinks into the ground constitutes ground-water. All but the uppermost portion of soils and porous rocks is continually saturated. The upper limit of the saturated rock and soil is called the water-table. In general it is nearer the surface in valleys than on hills. The bottoms of many valleys are below the water-table, in which instances springs and seeps may issue at or below the water-table along the lower parts of the valley-slopes and the streams that occupy the valleys will be permanent. Depressions whose bottoms are below the water-table will be occupied by lakes or swamps. Wells must be dug or drilled below the water-table in order to assure a permanent source of water. Most quarries, mines, and other excavations that extend below the water-table fill with water unless pumps are constantly operated to remove it.

Ground-water rarely produces mechanical effects like those which result from surficial run-off, because generally it only seeps slowly through pores and cracks in the rocks. But it effects other changes by other means, chief of which is solution. The ground-water which issues as springs or seeps or is obtained from wells frequently carries in solution great quantities of mineral matter which it has obtained from the rocks through which it has passed. It is this dissolved material which makes water "hard". When precipitated it constitutes the mineral deposits around springs and forms the scale in teakettles, steam-boilers, and water-pipes. Calcium carbonate, the dominant constituent of limestone, is the chief substance dissolved by the ground-water.

Ground-water also reacts on the rocks by means of three chemical processes--hydration, oxidation, and carbonation--all of which tend to disintegrate the solid rocks and reduce them to soil. The three processes are chemical combinations of water, oxygen, and carbon dioxide, respectively, with some minerals or their constituent elements. The oxygen and carbon dioxide are absorbed from the air by the falling rain. Oxidation is best revealed by the rusting of iron-bearing minerals in rocks and their eventual development as reddish-stained soils. Carbonation first produces calcium carbonate, which is dissolved by the ground-water.

Work of Stagnant Water

Plant debris may be preserved from decay only when it accumulates in expanses of standing water, such as lakes and marshes, where the material gradually becomes peat or muck. Such deposits are now being formed in undrained depressions in the recently glaciated areas of northeastern Illinois, northern Michigan, Wisconsin, Minnesota, and southern Canada. Swamp deposits of peat and muck that were developed in ancient geologic epochs were buried beneath other sediments, and subsequent compression has changed them into beds of coal, such as those which form the principal source of mineral wealth of the Galesburg area.

The organic acids that result from the decay of plant material leach and deoxidize the underlying soil of its more soluble and more highly oxidized minerals, so that a white or light gray clay is formed. Such clays are found underlying most coal beds. They are called fire-clays, because most of them, when burned, form brick which is especially resistant to high temperatures (fire-brick).

Work of Wind

Wind, which is simply air in motion, produces only mechanical changes. When it is bearing loose material it acts like a sand-blast and wears away exposed surfaces of indurated rock. It removes loose material from one place (erosion or degradation) and deposits it in another (aggradation). The material borne by the wind under ordinary conditions must of necessity be composed of small particles--dust and sand--but under unusual conditions fine gravel and even larger fragments may be moved. Soil may be blown away from areas in which the moisture or vegetation is insufficient to hold it. Sand will accumulate in the lee of any obstacles and there form sand dunes. The finer constituents may be carried as suspended dust for miles and may be deposited as a widespread mantle of loess.

The geological changes above outlined are known to have occurred in this region intermittently in the past, as well as in the present. Other gradational changes, of which three will be outlined in the following topics, alternated with them.

Glaciation

In the Galesburg quadrangle most of the non-indurated rock, commonly called the subsoil, is non-stratified stony clay. It contains boulders and pebbles of rocks utterly unlike the subjacent bedrock. Granites and fine-grained lavas which have solidified from a former molten state; gneisses whose twisted and gnarled structures tell of tremendous pressures and movements in the throes of mountain-making; red quartz porphyry (an igneous rock consisting of a red, microcrystalline ground-mass in which are set crystals of glassy quartz and pink-to-red feldspar) whose parent ledges are probably north of lakes Superior and Huron; an immense amount of limestone; and a great variety of other types of rock foreign to the region are represented in the surficial gravel of road cuts and stream beds.

These rocks have been introduced by an agency which carried and deposited particles of all sizes, from huge boulders to the finest clay, in intimate association. Further, it has dragged them under great pressure, because they are beveled, planed, polished, and scratched and the surface of the bedrock has been smoother, grooved, and marred with long parallel scratches that show the direction in which the debris was moved. Neither wind or water can do this. There is but one gradational agent which does these things, and that is glacial ice. The stony clay which it deposits is known as till, or sometimes as drift.

Marine Sedimentation

The indurated rock, or bedrock, of the region is stratified and consists of sandstones, shales, and limestones. Records of wells and other borings reveal that these rocks extend to a depth of more than 3,000 feet at least. Originally these formations were unconsolidated sands, muds, and calcareous ooze deposited in layers or strata at the bottoms of shallow seas that opened into oceans which then surrounded the continent of North America. When the sands were deposited the shores of the ancient seas were not far inland from this region. The currents created by waves and tides were strong enough to carry the sand grains along the bottom for some distance from the land from which the material was derived. When the calcareous ooze was deposited the shores were perhaps farther inland from this region and the water was probably a little deeper and surely much clearer and less disturbed by waves and currents. The ooze consisted largely of the shells and other hard parts of marine animals living in the seas, with which organic debris only mud fine enough to be carried in suspension far from the land was mingled.

Subsequent to the deposition of these marine sediments the originally incoherent materials have become indurated, partly by compression but largely by cementation. The cement consists of mineral matter which was introduced in solution in ground-water and was precipitated between the grains of the unconsolidated material.

The consolidated formations can rarely be traced continuously between two places where they may be exposed. The identification or correlation of scattered outcrops must be based on certain features or criteria, which are unique to the formation, and which are widely distributed in it.

One reliable criterion for correlation is fossils, which are the impressions or petrifactions of plant or animal organisms that lived in the region while the sediments were being deposited. The existence of fossils has been known for many centuries, but the fact that each of the different formations in one region contains different assemblages of such forms and that any one formation contains the same assemblages wherever it may occur was first recognized in

England about 125 years ago. This fact is now established as one of the most important of geological principles. After careful study of the embedded fossil forms, sedimentary formations may be correlated across great gaps, perhaps some hundreds of miles wide, in which no outcrops of these formations occur.

Diastrophism

The stratified bedrock, with its entombed marine fossils, is undisputable evidence that several times in the past the Galesburg quadrangle was inundated by embayments of the oceans. The region now stands several hundred feet above sea-level. These two facts indicate that since the last strata were deposited the region has been raised, the sea-level has been lowered, or both movements have taken place, to create a differential approaching, if not attaining, a thousand feet. Movements in the body of the earth, manifested by warpings of its exterior, explain such changes in altitude. Downwarp of the ocean basins would draw off the waters; upwarp of the continent, or a part of it, would convert areas covered by shallow water into land. Such movements constitute diastrophism.

Should the region as it now exists be again submerged beneath the sea, mud, sand, or calcareous materials would again be deposited, and these would rest on the present irregular surface. The contact between the new deposit and that already deposited would be as irregular as the present topography.

(Pl.) Such contacts are termed unconformities. If marine strata occur both above and below an unconformity, the following succession of events is recorded: (1) the presence of the sea over the region and marine deposition; (2) the withdrawal of the sea and the action of degradational agents; and (3) the return of the sea and the renewal of marine deposition.

Weathering

The sum total of all unobtrusive processes by which solid rock is reduced to an unconsolidated condition is known as weathering. In addition to the processes and agencies already mentioned, the following are worthy of note: (1) differential expansion and contraction of solid rock from daily changes in temperature; (2) expansional force of the freezing of water in pores and crevices; (3) wedge work of plant roots growing in cracks in the rock; and (4) the burrowing of animals. It is obvious that any rock, however firmly indurated, must slowly disintegrate as a result of the attack of these varied agents during the passage of years. Thus a mantle of unconsolidated material--physically and chemically unlike the underlying parent rock--is formed on all outcrops of indurated rock, save those too steep to retain it. This loose material is appropriately termed mantle-rock. Its upper portion, with which is mingled the carbonaceous matter of decayed plant tissues, forms the soil.

Chapter II

Physiography

Relief and Drainage

The maximum relief in the Galesburg quadrangle is approximately 310 feet. The highest point is a small hill 861 feet above sea-level occurring in section 33 of Sparta Township, and the lowest point lies between 540 and 560 feet in the northeast corner of section 10 of Chestnut Township where Brush Creek flows out of the area to join Spoon River farther east. (See Plate I).

The surface of the Galesburg quadrangle is a plain which has been but slightly dissected, and the greater number of the valleys are narrow and shallow. In a few places along Brush Creek, valley walls 80 feet in height may be found, but such heights are not common. These areas lie within the Interior Glaciated Plains.[1] They form a dissected upland plain. All parts of the region thus

[1] Fenneman, N. M. Physiographic divisions of the United States: Annals of the Assoc. of Amer. Geogr., Vol. 6, pp. 19-98, 1916.

defined have a somewhat similar geologic history recorded in their glacial deposits and physiographic features. The surface of the level upland prairies is gently rolling due to the irregularity of deposition of the glacial drift and of the subsequent wind-blown loess, and the pre-glacial bed rock topography. Most of the principal valleys follow pre-glacial valleys. The veneer of loess has tended to smooth out the marked irregularities of the drift and produce a reasonably uniform mantle of rich soil over the upland prairies. (Fig. 10). The uplands are included in the main watershed which extends a northeast-southwest direction across the north one-half of the quadrangle, and represent that portion of the original loess-covered, drift-formed plain.

This watershed can be traced from northeast to southwest on the topographic map as an ill-defined elevated upland. The streams of this area are too young to produce important erosion slopes. The valley walls are modified by slumping, and as a result numerous small talus accumulations are produced at the base of slopes. In a few cases landslides have altered the course of small streams and have exposed bed rock.

It is of some interest to note that more than 85 per cent of all the outcrops in the quadrangle occur on the south and west sides of the valleys. These valleys have *asymmetrical cross-sections. An excess of the afternoon sun's rays received by the east and north sides causes excess slumping on those sides. This displaces the streams to the south and west sides, and the extra cutting causes more rock exposure on these sides.

*Consider also glacial stagnation in E-W valleys.

The abrupt widening of Cedar Creek and Brush Creek in a few places is due to the differential hardness of various elements of the Pennsylvanian strata. The greater part of the valley flat development, however, is normal. Most of the debris removed from the uplands and valley walls is carried into the larger valleys below. Meandering streams remove a large part of this but some is left as talus. During the process of meandering the sidewalls of valleys are undercut and and a valley floor is widened. At times of flood, streams are swollen and carry great volumes of debris. Occasionally Cedar, Haw, and Brush creeks have been sufficiently overloaded to build definite valley flats.

Cedar, Brush, Haw, and Court creeks with their numerous small tributaries are working headward into the main drainage divide from the southeast. These creeks are tributaries of Spoon River, which in turn joins Illinois River near Havana, Illinois.

On the northwest side of the drainage divide Cedar Creek (known generally as Cedar Fork) has its source a short distance north of the city of Galesburg. Its gathering ground includes several square miles of gently sloping country which supplies, at times of very heavy rains, a larger quantity of water than it can remove rapidly. As a result, portions of the city have been flooded from time to time. While this is distinctly an engineering problem, four possibilities for the removal of this flood hazard may be suggested: viz, *(1) straighten the stream channel, remove all excess debris from the stream-bed, and make its gradient steeper, (2) divert some of the headwaters down Court Creek by means

* Since the area was first studied in 1926 by the writer the City and county have done as suggested in my (1) & (3)

of a drainage ditch or large tile drain, (3) build a retention reservoir near the headwater, and (4) encase the stream in a drain tile of adequate size to handle a volume of water at least greater than the volume of its present channel. Considering sanitation and permanency, this last procedure would be the best plan.

Side-wall retentions, cross-damming stream-heads, straightening of the channels, and other methods may be employed for the control of small streams. The adaptability and efficiency of these depend upon the size of the drainage area, stream gradient, character of material over which it flows, amount of rainfall, and rate of deposition.

History and Culture[1]

The Pottawattomie, Fox, and Sax Indians were the early inhabitants of this area. They were concentrated south of the present position of Lake Bracken. Camp Shaubena, at Lake Bracken, was so-named for one of the friendly chieftains.

The first whites settled in Henderson township in 1827. They gradually converted a poorly drained prairie into a fertile plain. The inventors of the scouring plow and corn-planter were among these early inhabitants.

About the middle of the 19th century (1836) a committee decided upon the present site of Galesburg as a suitable building site for a college. Soon Knox College, one of the better small colleges, was founded. The city of Galesburg began with this college as a nucleus.

Galesburg has a population of approximately ~~26~~ 30,000 people according to U.S. Census for 1930. It is an important division point for the Chicago, Burlington, and Quincy Railroad. It is also served by the Atchison, Topeka, and Santa Fe Railroad. Educational facilities, through Knox ~~and Lombard~~ college~~s~~, and a modern grade and high school system, good churches, hospitals, civic club buildings, wide paved streets, and street ~~railways~~ bus system make the city one of the most desirable.

Abingdon is a town of ~~3,000~~ 2,771 people. ~~Hedding College and St. Mary's Academy are located there.~~ It has a military school. The town is served by the Chicago, Burlington, and Quincy and Minneapolis and St. Louis railroads. Manufacturing of porcelain ware by the Abingdon Sanitary Manufacturing Company is an important industry.

Galesburg is connected with Burlington, Iowa, Chicago, ~~and~~ Peoria, ~~by~~ Quincy, Rock Island and southern points by paved state highways.

1 Information furnished by F. R. Jelliff, Galesburg, Illinois.

~~pabed State Highways.~~ A ~~new one to Rock Island is proposed~~.

The estimated rural population is ~~10,000.~~ 11,672 Knoxville has ~~1,800;~~ 1,867 while DeLong, Hermon, and Utah are small rural communities.

History of mining

At least three coal veins have been worked in the quadrangle. In the NE. $\frac{1}{4}$ of section 32, Henderson Township, coal was mined in 1841. A shaft was sunk here in 1875. In 1859, G. W. Gale mined the so-called "Scotch Coal" in Cedar and Floyd townships, which was used for the production of gas in the Galesburg Gas Works in the early sixties. In 1876, Ross and Woodward sank a shaft in the vicinity of Log City, northwest of Galesburg. This mine was operated for a number of years and furnished coal to Galesburg and much of the adjacent territory. In 1878, Alex Baird sank a 50-foot shaft in the same area. During this time a Mr. Stream operated a small mine in the SE. $\frac{1}{4}$ of the SW. $\frac{1}{4}$ of section 28, Sparta Township.

East of Galesburg, along both sides of Court Creek, were numerous small drift mines and some stripping.

In Chestnut and Orange townships along Brush Creek considerable early drifting and stripping was done. In the early eighties M. B.Hardin operated a mine in section 8, Indian Point Township. These mines for years supplied Abingdon and the surrounding community.

In the late eighties the Pioneer Paving Brick Company,east of Galesburg, sank a 60-foot shaft which supplies the necessary coal for their kilns. Knoxville got its coal from shallow mines in sections 29 and 32, Knox Township, fifty years ago.

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[1] Information furnished by F. R. Jelliff, Galesburg, Illinois, See also A. H. Worthen, Ill. State Geol. Surv. Report IV (1870).

Revise

At present the Galesburg Mining Company has sunk a shaft to a good coal thought to represent the Rock Island coal No. 1. Their mine is 5 miles east of Galesburg along the Santa Fe Railroad. At present its production is small but a spur from the Santa Fe is being installed and future prospects are good.

A small shaft mine in the N. ½ of section 16, Orange Township, has been operated for several years by Mr. Bert Lewis. The consumption is entirely local. In 1841, it was discovered that the shale above Colchester coal (No. 2), so well exposed along Court Creek east of Galesburg, was suitable for making vitrified paving brick. The Pioneer Brick Company was started and has maintained a healthy gradual growth since that time and has sometime since been succeeded by the Purington Paving Brick Company.

A similar shale of the same age was worked for brick at Abingdon. The plant is not now in operation.

In early days sandstone was quarried for building stone along one of the branches of Court Creek, north of Knoxville, A limestone conglomerate in the BArefoot region farther north furnished the material for Hope Cemetery wall-fence seventy years ago. This conglomerate has been used locally also for bridge buttresses.

Climate[1]

For convenience in discussing the climate of Illinois the State has been divided into five districts. These quadrangles lie near the southwestern corner of the so-called Central Northern District.

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[1] Data from Bulletin 208, Univ. of Ill. Agric. Exp. Sta. (1918), and later papers.

The records in this district of the sixty years from 1856 to 1915 show an average annual rainfall of 34.26 inches. From March to August the area receives 20.35 inches, or 59.4 per cent of its rainfall. The average precipitation in winter is 5.8 inches; in spring, 9.6 inches; in summer, 10.75 inches; and in fall, 8.11 inches. The lowest annual rainfall recorded was 23.13 inches in 1901, and the highest 49.25 inches in 1902. May is the month of greatest rainfall, with an average of 4.05 inches, and June is next, with 3.74 inches. January is the month of lowest rainfall, the average for the sixty years being 1.88 inches. The lowest rainfall recorded in this district during the growing season was .10 inch at Aledo in July, 1913. The heaviest rainfall for any month was 20.03 inches at Monmouth in September, 1911.

The average temperature for the forty year period from 1876 to 1915 is 49.2 degrees. The average winter temperature is 24.7 degrees; of spring, 48.3

degrees; of summer, 71.8 degrees; and of fall, 51.9 degrees. The lowest temperature recorded in the district was -30 degrees in February, 1905, at Aledo, while the highest was 112 degrees at Ottawa, in 1901. This gives a range of 142 degrees. These towns are outside these quadrangles but they show the probable variation. The average dates for the latest and the earliest killing frost are May 2 and October 15, giving an average growing season of 166 days.

The entire State of Illinois lies within the belt of prevailing westerly winds.

Transportation

These areas are served by the Chicago, Burlington and Quincy; Atchison, Topeka and Santa Fe; Galesburg and Western; Minneopolis and St. Louis; Rock Island and Southern railroads. ~~and The Illinois Traction System.~~ Galesburg is an important terminal for the C. B. & Q line. Most of the coal from southern Illinois passes through Abingdon and Galesburg enroute to Chicago via this line. Shipments from Iowa and points west pass through Monmouth and Galesburg via the same line.

A concrete road (State Highway No. 41) runs from the south to Galesburg and continues northwest as State Highway No. 28. Several improved oiled roads traverse both quadrangles. The remaining sections of the area are traversed by earth roads always passable except during the rainy seasons.

Chapter III

Descriptive Geology

Introduction

A country-wide study of sedimentary rocks has given the following subdivisions of geologic time. This is a generalized table from widely scattered parts of the world and in no one place is the entire section found.

Table I

Subdivisions of Geologic Time

Era			Period
Cenozoic	(Modern life) (Age of Mammals)	Quarternary	Recent Pleistocene
		Tertiary	Pliocene Miocene Oligocene Eocene
Mesozoic	(Medieval life) (Age of reptiles)		Cretaceous Comanchean Jurassic Triassic
Paleozoic	(Old life) (Age of invertebrates)		Permian Pennsylvanian Mississippian Devonian Silurian Ordovician Cambrian
Proterozoic	(Older life)		
Archeozoic	(First life)		

The eras were not of equal length. In general, the earlier ones were the longer. The Paleozoic era has been estimated to be twice as long as the Mesozoic and more than three times as long as the Cenozoic.

For pre-Penn. see PSP MS2

PENNSYLVANIAN SYSTEM

General Statement

The Pennsylvanian as introduced by Williams in 1891, is the middle subdivision of the Carboniferous system of older nomenclature, which included Mississippian and Pennsylvanian in United States and was extended to include also the Permian in England. The term "carboniferous" is retained by the United States Geological Survey as formerly employed.

In most parts of the world the Pennsylvanian system contains coal, though by no means is it the only system yielding coal in countries outside of the United States. In fact, certain other systems contain more coal in foreign countries than does the Pennsylvanian or "Upper Carboniferous", e.g. the Jurassic of Europe. Permian rocks of many regions also yield coal as do the Mississippian rocks of northern England, Scotland and some parts of the United States also contain a few productive seams and a few unworkable beds of ~~this~~ Mississippian age.

The term "Coal Measures" has long been applied to the coal-bearing Pennsylvanian or Upper Carboniferous rocks of the United States. In the Mississippi valley region these rocks were deposited unconformably upon the irregular eroded surface of the "Lower Carboniferous" or Mississippian system.

Pennsylvanian Rocks of Western Illinois

The area included in the term "Western Illinois" is that west of Illinois River. This report deals specifically with the southwestern part of Knox County and most of Warren County, included in the Galesburg and Monmouth quadrangles. (See Fig.).

Until the time when the field work upon which this report is based was done there had been little detailed work in this area. Generalized reports had been published covering wide studies in this area, known as District III. The eastern limits of this district west of Illinois River were vaguely defined as being the irregular line of outcrop of Worthen's coal No. 5 or, where this coal is not present, the outcrop of coal No. 6 was used. Thus, according to these early generalizations, the Pennsylvanian beds in the district range in thickness from a feather edge on the west to more than 250 feet on the east.

These early studies were largely of a reconnaissance nature and cannot be expected to be as reliable as subsequent detailed work. This report is based upon a detailed study of a comparatively small area and is therefore more specific in delineation of outcrops, more definite in description of the succession of strata and in the correlation of beds with those found in adjoining areas.

Pennsylvanian strata in the Monmouth and Galesburg areas are covered with glacial drift except where some of this has been removed by erosion of the larger streams. The lower limit of the Pennsylvanian in this area is its contact with the older Mississippian rocks. In the Galesburg area the Burlington limestone is thought to be the oldest Mississippian formation in contact with the Pennsylvanian. The same is true in the Monmouth area although it is possible that the Burlington may be locally absent in which case the contact with the Hannibal shale would be difficult to recognize. The base of the Pennsylvanian is exposed only in one place in the Galesburg area, where Pennsylvanian shale overlies Burlington limestone and chart. This, of course, is not the lowest Pennsylvanian known in these areas and this contact merely serves to show that the surface of the Mississippian rocks on which the Pennsylvanian was deposited was irregular. In all probability there were hills of Burlington chert that stood out as islands in the early Pennsylvanian seas and swamps. The presence of fragments of this chert in the basal Pennsylvanian conglomerate indicates that the Burlington was subjected to long erosion prior to the Pennsylvanian deposition.

The Pennsylvanian system consists of shales, sandstones, underclays, coals, limestones, and conglomerates, listed in order of their decreasing abundance. Its maximum thickness in any one place in these 2 quadrangle areas is 230 feet as determined by boring one of the Galesburg city wells, but its average thickness is much less. The total Pennsylvanian here to 295 ft. The surface of the Mississippian (Burlington) is probably not one of high relief even though sufficient drillings are lacking to say accurately. Topographic maps of the Monmouth and Galesburg areas show that the relief of the present surface is not great, rarely exceeding 100 feet. The Pennsylvanian system may, therefore, be visualized as a wedgelike layer thickening toward the east and south and thinning to nothingness on the west. Certain strata in Iowa formerly coextensive with Illinois rock have been severed by the Mississippi River. The accompanying sketch will serve to make this clear. For a clear understanding of the structure of these areas this conception is most important. There is a gradual decline of the pre-Pennsylvanian surface eastward, which is due to erosion but a slight structural decline toward the central portion of the Illinois coal basin has probably been a controlling factor.

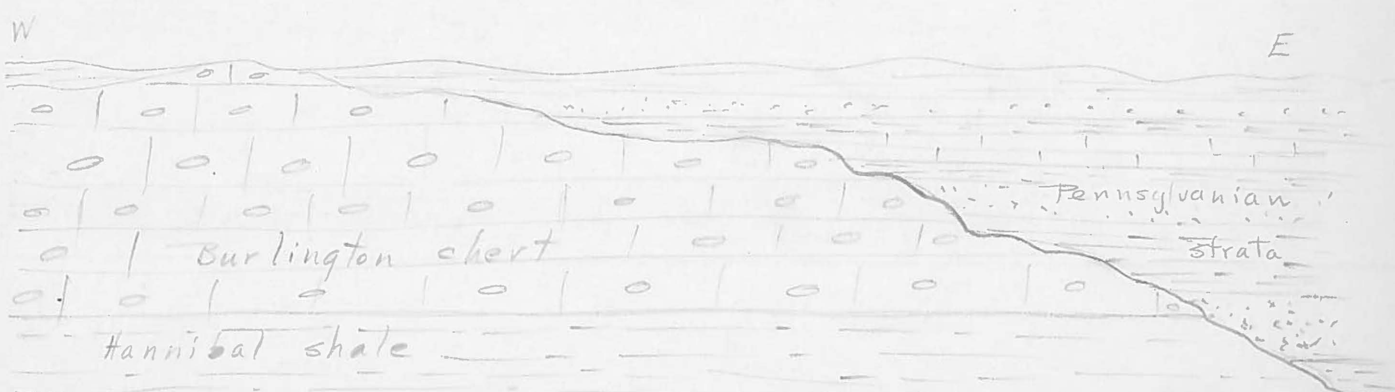

Diagram showing the general relations of the Pennsylvanian to older strata in the Galesburg and Monmouth areas. The Mississippian rocks doubtless rise higher east of these areas. Each system also has some dip south and east.

Subdivisions

"The Pennsylvanian system in Illinois is divided into 3 formations------Pottsville, Carbondale, and McLeansboro------which, according to paleobotanical evidence, are approximately equivalent respectively to the Pottsville, Allegheny, and Conemaugh formations in the Appalachian province. The paleobotanical data reveal that all Pennsylvanian strata between and including coals No. 2 (Murphysboro) and No. 6 (Herrin), and possibly No. 7 (Danville), in Illinois belong in the Alleghany formation, but thus far they do not reveal the precise horizons at which the upper and lower boundaries of the formation may be drawn, except that the lower (Pottsville or Alleghany) limit occurs somewhere between the base of the Murphysboro (No. 2) coal and the "fireclay" series that is commercially exploited at various places in the state. Consequently the local names Carbondale and McLeansboro were adopted in place of Allegheny and Conemaugh, and for convenience the boundaries between the formations were arbitrarily drawn respectively at the base of the underclay beneath the Murphysboro (No. 2) coal at first and later at the base of the coal itself and at the top of the Herrin (No. 6) or Danville (No. 7) coal."(1)

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(1) Wanless, H. R., Geology and Mineral Resources of the Alexis Quadrangle, Illinois Geol. Surv., Bull. 57, p. 47, 1929

When Dr. Wanless stated the above in 1929 accurate data necessary in mapping more definite formation boundaries were lacking. Since that time much new information has been gathered and part of these results are incorporated in this report.

The Pennsylvanian rocks in the Galesburg and Monmouth area belong to the Pottsville and Carbondale formations and are so designated in the legend on the geologic map (Plate I). The stratigraphic section in the Galesburg quadrangle is the longest of any of the adjoining areas, running through the entire Pottsville and to within 20 feet of the top of the Carbondale, a total thickness of 295 feet. These formations are separated at the base of a persistent bed of coal that is correlated with the Colchester coal of western

Illinois, which in turn has long been considered the equivalent of the Murphysboro (No. 2) coal of southern Illinois.

The Monmouth and Galesburg areas were surveyed in 1925 and 1926 as was the Alexis Quadrangle by Dr. H. R. Wanless. During the field work everyone acquainted with the details of the stratigraphic succession was impressed by the repetition of sequence, even in widely separated outcrops. Detailed identification of fossil species was not possible in most cases, therefore lithologic sequence was relied upon for local correlation of strata. The two areas here described present a wide variety of lithologic differences within a given sequence but from valley to valley over the entire area most of this sequence was readily recognizable. As Wanless points out in his Alexis report (p. 48), this repetition of a sequence of beds was quite noticeable. The writer believes it is fair to say however, that none of those in the field realized the significance of these repeated sequences at the time. Speaking for myself (Poor) only I admit that the significance of the cyclical arrangement of strata did not impress me while working in the Galesburg area in 1926. It was not until after Wanless, Weller, Ekblaw, and Willman had traced these sequences over much of Western Illinois that the writer became convinced that these cyclical arrangements were actually of important correlative value. Udden's work in 1912 [1] around Peoria opened the way for

(Although Fred R. Jelliff offered an explanation for the cyclical arrangement of the coals and their associated strata as early as 1881 in a unpublished paper read before the Knox County Teach Association meeting in Galesburg. Jelliff's idea was essentially that used today") the present interpretation, The reliability of the cyclical arrangement of beds as a factor in correlation and as a guide to historical interpretation has not been thoroughly tested by the "acid test"---time, but, results in Kansas, Iowa, Missouri, Oklahoma,[2] and Alabama[3] as well as Illinois seem to indicate the dependability of the scheme.

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(1) Udden, J. A., Geology and Mineral Resources of the Peoria Quadrangle, Illinois, United States Geol. Surv. Bull.506, 1912.

(2) Wanless, H. R. and Weller, J. M., Correlation and Extent of Pennsylvanian Cyclothems, Bull. Geol. Soc. of Amer. Vol. 43, pp. 1003-1016, 1932.

(3) Poor, R. S., Cyclic Sedimentation in the Pennsylvanian Strata of Alabama, Abst., Journ. Ala. Acad. of Science, pp. 31 1933.

(4) Wanless, H. R., Geology and Mineral Resources of the Alexis Quadrangle. Illinois. Ill. Geol. Surv. Bull. 57, pp. 48-49, 1929.

In this report the term cyclothem is used to designate each of the natural sequences. In the Alexis report Wanless states "numbers are herein applied to the suites (cyclothems), but after more extended studies have revealed the most typical outcrops of each suite it will probably prove desirable to supplant the numbers with names derived from the localities at which such outcrops occur."[4] The names referred to above have since been supplied by Wanless[1] and the term "cyclothem substituted for suite".

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1 Wanless, H. R., Pennsylvanian Cycles in Western Illinois, Ill. Geol. Surv. Bull. 60, pp. 179-193, 1931. J. M. Weller's work in the Vermont area in 1932 showed the Bernadotte in Wanless' paper to be below Rock Island (No. 1) coal, and not above. The Lower Delong of this report is the Bernadotte of Wanless in Bulletin 60.

The Liverpool cyclothem in the following table is a typical cyclothem and comprises, from bottom to top, a sandstone or sandy shale (Isabel), an underclay, a coal (No. 2), a black laminated shale, a limestone (Oak Grove), and a gray Shale (Purington). The sandstone, and in this case the limestone nodules, the underclay, and coal are believed to have been formed under continental conditions; while the black laminated shale, upper limestone, and gray shale are marine deposits.

General Succession of Pennsylvanian Strata in
Western Illinois, especially adapted for Galesburg and Monmouth
Quadrangles*

Carbondale formation

Brereton cyclothem
Basal sandstone (Cuba sandstone member).

St. David cyclothem
Canton shale; with stray limestone (?) in one outcrop.
St. David limestone, local - especially local in southern part of area.
Black shale
No. 5 coal
Underclay
Non-fossiliferous, fresh-water limestone, in two beds with shale between.
Shale, thin
Conglomerate in thin layer.

Summum cyclothem
Shale, thin
Hanover limestone (glauconitic, locally conglomeratic, and sandy).
Soft shale with large concretions.
No. 4 coal, local.
Underclay.
Fresh-water limestone
Shale, with limestone knots along joints.
Stray coal (?)
Pleasantview sandstone
(Important unconformity)

Liverpool cyclothem
Purington shale, with "ironstone" concretions; not sandy except in upper part.
Oak Grove member, consisting of four thin, distinctive beds of limestone with intervening thin fossiliferous shales and includes cone-in-cone layer
Black "pimply shale with large concretions
Francis Creek shale, local 0'-10'
Coal No. 2

*The thicknesses vary from place to place. These will be given for each outcrop described later in the report.

Pottsville Formation

Underclay
Fresh-water limestone in nodules
Isabel sandstone
Lower Liverpool ? cyclothem or Greenbush cyclothem
Gray Shale
Coal
Underclay
Fresh-water limestone ?
Sandstone ?
Wylie cyclothem
Thin shale
Coal (No. "1 1/2")
Underclay
Seahorne cyclothem
Thin crumbly greenish shale, with limestone nodules at top at one or two places
Coal
Underclay, thick
Sandstone ("Stigmarian")
Upper Delong cyclothem
Shale, thin
Coal, in 2 or 3 streaks, separated by clay layers less than an inch thick
Siltstone, thin
Middle Delong cyclothem
Coal, 1 to 3 inches thick
Clay, 3 to 4 inches
* Lower Delong cyclothem
Blue shale, 1 foot or so
Coal, 1 inch or so
Underclay, thin
Sandstone, thin
Seville cyclothem
Shale, dark, with "ironstone" concretions or chert locally at top
Limestone, very local
Shale, local
No. 1 coal, very local
Underclay, thin
"Stigmarian" sandstone (Bernadotte)
Hope Creek cyclothem
Shale (?)
Persistent coal
Underclay
Sandstone local
~~Unnamed~~ Tarter cyclothem X { Shale, blue 1'-6'; Coal, 0'-1' (Black lingula-bearing shale may be over the coal.); Underclay 2'; Sandstone 0-1' }
Babylon cyclothem
Shale
Coal
Underclay
Sandstone, thick, with enlarged quartz grains

Burlington limestone (Mississippian)

* The Bernadotte of Wanless in Alexis quadrangle, Ill. Geol. Surv. Bull. 57, and also in Bulletin 60.

Pottsville ~~Series~~ Formation

The name Pottsville was first applied to the basal conglomeratic series of the Pennsylvanian strata.[1]

1-Platt, W. G. & Platt, F., Report on Progress in the Cambria and Somerset district of the bituminous coal fields of Western Pennsylvania; Part I, Cambria; Second Geol. Surv. of Pa. Report of Progress, HH, P. xxvi, 1877

The name was probably derived from the town of Pottsville, Pa. In Illinois it is used as a formation name for the lower part of the Pennsylvanian system, which consists principally of sandstones and underclays. Coal beds are few and of minor commercial importance.

As can be determined from the geologic map, the Pottsville (shown in yellow and brown) outcrops only in the southwest and southeast corners of the Galesburg area but it apparently underlies the entire area. ~~It~~ Rock Island (No.1) coal of Pottsville age is mined by the Galesburg Mining Company east of Galesburg, ~~the city.~~ and by the Knoxville Mining Co. east of Knoxville, just east of the Galesburg quadrangle. In the Monmouth area the Pottsville has a rather extensive outcrop in more or less linear belts extending from north to south. Very little Pottsville is to be found west of longitude 90° 40", but east of this line the remaining area is doubtless underlain by rocks of this age. The main coal of the Pottsville is Rock Island (No.1) coal. It's distribution is discussed later.

In the SE$\frac{1}{4}$ Sec. 14, T. 9 N., R. 1 W. (Berwick Twp.) the contact of the Pennsylvanian with the underlying Burlington chert of Mississippian age may be seen along the north wall of Cedar Fork. The extent of the outcrop is limited and therefore it is not possible to give much detail concerning the nature of the contact. The upper surface of the chert is greatly weathered and cavernous. Outcrops in the Monmouth area however ~~show~~ the relation between the 2 formations to be distinctly disconformable. The exposure on Cedar Fork referred to above shows the following:

Pennsylvanian (Probably Babylon cyclothem)
Shale, gray, mottled black. Weathers mouse-gray. Occasional sandy phase of the shale becomes conglomeratic, with well-rounded black and white chert pebbles in sand matrix.............................7 - 6

Mississippian System

Burlington

Chert, white, brittle, much iron-stained, fossiliferous...............11 - 6

This contact is certainly unconformable and since it is impossible to determine the structure of the shale ~~is impossible to determine~~ the contact appears entirely erosional. Similar relationships between the Pottsville and the Burlington may be seen at various points along Cedar Creek north of Monmouth on the Monmouth quadrangle, especially in sections 8 and 9, T. 11 N., R. 2 W. (Monmouth Twp.)

The Pottsville formation is subdivided into 9 cyclothems and a part of a tenth. Possibly another may be added. For names and details of these cyclothems the reader is referred to pages 34 & 25 where the entire general succession for the areas is given. "The development of the Pottsville cyclothems in the Galesburg and Monmouth region is intermediate between the thinner sections of southern Fulton County and the thicker sections along the Mississippi River in Rock Island County. However, the Pottsville coals appear to develop their maximum thickness in the Galesburg region."*

Babylon cyclothem

These strata, which constitute the ~~lower~~ basal part of the Pottsville formation,

*Wanless, H.R. - Personal correspondence.

are exposed in several places in Berwick Township, Galesburg area, along the lower end of Cedar Fork. The section given above is such a one, but here as in many places the entire Babylon is not present. On the west side of Cedar Fork in the NW$\frac{1}{4}$, SW$\frac{1}{4}$ Sec. 14, T. 9 N., R. 1 W., which is almost directly across from the above outcrop, the following may be seen in the valley wall.

Pennsylvanian

Undetermined cyclothem (May be Tarter)

Fragments of sugary sandstone; float.

Babylon cyclothem

Coal blossom at top of cut	0 - 0
Underclay, light gray	5 - 0
Clay, rusty, calcareous, with calcareous or ironstone concretions	6-10-0
Shale, blue gray, well laminated, poorly exposed	6 - 8 est.
Sandstone, light gray, sugary, granular, and conglomerate with abundant small chert and weathered limestone pebbles	1 - 0

Mississippian system

Burlington chert	6- 8 - 0
Base concealed.	

No other Babylon sections have been recognized on the Galesburg sheet.

In the Monmouth quadrangle however, outcrops of the Babylon cyclothem are abundant along Cedar Creek north of Monmouth. The following section measured by Workman along the west side of Cedar Creek shows a very complete lower Pottsville succession.

Pleistocene; Glacial till, not studied.

Pennsylvanian:

Seville or Lower DeLong cyclothem:

Clay....................about	6 - 0
Coal	0 - 5
Sandstone, poorly bedded, soft, gray and fossiliferous	4 - 9

Pope Creek cyclothem:

Coal	0 - 3
Sandstone, brittle, calcareous	0 - 3
Shale, soft, gray-black, micaceous, fine sandy, poorly bedded	2 - 3
Sandstone, massive, light gray, fine-grained, friable, micaceous	3 - 7

Babylon cyclothem:

Coal, uniform, good, some sulfur	1 - 6
Shale, soft, dark gray, with plants fossils	1 - 6
Sandstone, light gray, fine-grained, irregular bedding, with many plant fossils	4 - 9
Chert conglomerate, matrix of sand, contains some chert fragments 6" in diameter, the average is 1"	0 - 9

Mississippian system

Burlington

Chert, white to light gray with sand and sandy clay	2 - 0
Chert, weathered black, in a matrix of gray clay	0 - 7
Clay, green, containing weathered black chert	0 - 6

Many other Babylon outcrops occur along Cedar Creek and its tributaries. The contact of the Babylon with the Burlington rocks is shown repeatedly in the north-central part of section 8, T. 11 N., R. 2 W. about $\frac{1}{4}$ mile southeast of Carbon Hill School.

The Babylon is quite variable in thickness, ranging from a few inches in many areas to as much as 25 feet in the section along Cedar Fork Creek (Galesburg area) given above. The irregularity of the surface of the Mississippian rocks is in part responsible for this variability, since the basal sandstone member of the Babylon is frequently developed in what may be called a channel phase, where large quantities of the sand accumulated as valley fill along pre-Pottsville stream channels. Erosion of Babylon prior to Pope Creek deposition is also responsible for some of the variation is thickness.

Tarter Cyclothem

This cyclothem was introduced by Wanless after field work in these areas was completed. It has not been definitely recognized in the Galesburg and Monmouth quadrangles.

Pope Creek Cyclothem

The Pope Creek strata are very poorly exposed in the Galesburg area. The interval is represented in many places by concealed areas which is probably due to the fact that the cyclothem contains no persistent erosion-resisting sandstone layer. Such sandstones as do occur are local and probably discontinuous. There are only two outcrops in this quadrangle which are known to contain Pope Creek strata. One of these is in the extreme southwest corner of the map and contains the following succession of rocks:

Pleistocene; not studied in detail.

Loess	16 - 6
Till	25 - 0

Pennsylvanian system:

Pottsville formation:

Pope Creek cyclothem:

Sandstone, some massive layers, mostly thin-bedded. Apparently lenticular..................5 - 6
Sandstone, with coal partings very thin..........0 - 4
Coal, ~~thins and swells~~ variable thickness.........0 - 6
Shale, light gray...............................7 - 0

Babylon cyclothem:

Coal, 8" exposed, more covered...................0 - 8-12
Shale, dark gray................................6 - 0
Creek level.

~~About~~ The only other outcrop of Pope Creek worth recording occurs on the north side of Harmon Creek just west of the C.B.& Q. R.R. in the SE$\frac{1}{4}$, NW$\frac{1}{4}$, sec. 9, T.9N., R.2 E., whose succession follows:

Pottsville formation:

Covered interval with several 4"-6" slabs of sandstone and also some thin and shaly ss........20 - 0

Seahorne cyclothem:

Shale, gray.....................................5-6- 0
Sandstone, massive, white, Stigmaria fragments in basal part, and in float.............2-3- 0

Delong (Lower, middle & upper) cyclothems:

Covered interval, with gray & black shale float. 5 - 0

Seville cyclothem:

Sandstone, white, very resistant, abundant fossil plant fragments, cross-bedded......... 0 -8-10

Pope Creek cyclothem:

Covered interval, ~~blk.~~ black & gray shale float....... 3 - 0
Sandstone, white, in $\frac{1}{2}$"-1" layers, friable.....1-1$\frac{1}{2}$- 0
Sandstone continues below creek level.

It will be noticed that the so-called "persistent coal" of the Pope Creek cyclothem is not present in the last section. For this reason it is possible that the Seville should be extended and the Pope Creek not assigned.

In the Monmouth map area however there are numerous good Pope Creek exposures. The best ~~section~~ lower Pottsville section in the two areas under discussion ~~is~~ was given on page ~~12.~~ ~~38.~~ 39. In this section the Pope Creek is well developed.

In addition there are several good sections of these strata on the Monmouth quadrangle along the lower stretches of Cedar Creek, especially in sec.20, T.9 N., R.1 W. (Berwick Twp.). About 75 feet east of the road bridge along the west side of the NE$\frac{1}{4}$ of this section the following succession is exposed along the creek bank:

Pottsville formation:

Seville cyclothem: (Bernadotte sandstone)

Sandstone, shaly, gray, friable.................... 1 - 0
Sandstone, light gray, slabby, soft................ 0 - 8

Pope Creek cyclothem

Coal... 0 - 7$\frac{1}{2}$
Shale, "fire clay", stained with limonite........ 0 - 5
Sandstone, gray, soft, shaly, with Stigmaria...... 0 - 10
Sandstone, Stigmarian, hard, light gray, undulating
base cuts out some underlying shale..........1' 4" to 2'8"

Babylon cyclothem:

Sandstone, very shaly, soft....................... 4 - 4
Upper 2'5" is soft, gray, sandy shale grading
laterally to shaly sandstone
Lower 1'11" carbonaceous, soft, shaly sandstone,
more carbonaceous at base with thin stringers of
coal.
Coal... 0 - 10
Shale, "fire clay", light gray, slightly sandy,
greasy, fossiliferous........................ 0 - 10
Water level of Cedar Creek. Elevation 621'

Other Pope Creek outcrops may be found along Cedar Creek north of Monmouth. (The reader's attention is called to the occurrence of two streams named Cedar Creek in the Monmouth area. One in the southeast corner of the map and the other north of the town of Monmouth.)

Seville Cyclothem

The Seville cyclothem is one of the most easily recognized in the Galesburg area, since the so-called "Stigmarian Sandstone", now known as the Bernadotte, is one of the easiest to determine. The root-stem Stigmaria is an easy fossil plant to recognize (see figure —) and it is fairly common in the Bernadotte. Also, the sandstone containing these remains is commonly sulphurous or yellow in appearance in contrast with the usual brown, gray, or white of most of the other sandstones in the region. The rock usually shows partially secondary enlargement of the quartz grains, which makes the rock very hard (quartzitic). A broken edge is sharp as the grains and cement alike are broken, whereas merely loosely cemented sandstones break irregularly around the grains rather than through them. The Bernadotte is usually very massive and not thin-bedded.

Partial sections of the Seville in the Galesburg map area have already been given on pages 39, 41 and 42, but coal No. 1 is not well developed in any of these. In fact, this coal is not well exposed in the Galesburg map area, however, there is one outcrop on the north edge of the Avon quadrangle that is not described in the report on that area which deserves description. It occurs on the west wall of Cedar Creek NE$\frac{1}{4}$, SE$\frac{1}{4}$ Sec. 23, T. 9 N., R. 1 W. (Berwick Twp.) and shows the following:

Pleistocene:

Loess..10 - 0
Glacial till... 8 - 0

Pottsville formation:

Seville cyclothem:

Limestone, dark-gray, irregular bedded, fossilferous, argillaceous........................ 2 - 0
Coal...0 - 6 - 8
(There has been some coal removed here and the outcrop is badly disturbed and covered. There is undoubtedly more than 1 foot of coal).

Pope Creek and Babylon cyclothems:
Covered interval...18 - 0

Burlington limestone

Chert	4 plus
Limestone, crinoidal	4 - 6 - 0

Savage[1] states that a limestone like the upper one in this section, but exposed a few hundred yards away, is the cap-rock of Rock Island (No. 1) Coal.

(1) Savage, T. E., Geology and Mineral Resources of the Avon and Canton Quadrangles, Illinois. Bull. 38 Ill. Geol. Surv., pp. , 1921

In the Monmouth map area the Seville is better developed and is well exposed in a number of places. One of the best of these is near the center of section 15, T.11 N., R.2 W., along a tributary of Cedar Creek north of Washington School (Monmouth Twp.). Here the following section was measured by Workman:

Pottsville formation:

Seahorne cyclothem:

Clay, greenish gray, slightly gritty	0 - 4
Clay, yellow & light gray, gritty	0 - 6
Sandstone, soft, light gray, with a $3\frac{1}{2}$" sandy clay parting 6" above base	2 - 4

DeLong cyclothem (Upper, Middle):

Coals, 3 coals each about $\frac{1}{4}$" separated by clay seams, equally spaced, persistant	0 - $4\frac{1}{2}$
Clay, gray, micacious, gritty & soapy	0 - 9

Lower Delong:

Coal, soft and powdery	0 - $3\frac{1}{2}$
Clay, brownish gray, powdery	0 - $\frac{1}{2}$
Sandstone, light brownish gray, micaceous	1 - 0

Seville cyclothem:

Shale, black & light brownish gray, with some gypsum, plant fossils. Some fissility	3 - 2
Sandstone, grayish brown, shaley, fossiliferous, micaceous, irregular bedding	0 - 6
Shale, dark blue, gray, micaceous, soft, slightly sulphurous. Some plant fossils. Grades upward in upper 8" to sandy dark gray brown shale	3 - 11
Sandstone, gray, coaly, thinly & unevenly bedded	0 - 5
Coal	1 - 6
Clay, gray, sandy	0 - 11
Sandstone, gray, unevenly bedded, soft, fine grained, micaceous, coaly, some pyrite concretions (Bernadotte ss)	3 - 6

Pope Creek cyclothem:

Shale, dark, bluish gray	2 - 6

The underclay of Rock Island (No. 1) coal is usually sandy and sulphurous. It rarely exceeds 3 feet in thickness and apparently has no commercial value under present ceramic specification.

Rock Island (No. 1) coal is so called because it is the principal coal mined near Rock Island, Illinois. Coals of the Monmouth and Galesburg area are known to be the same as No. 1 coal of the Rock Island region because the coal has been traced from one area to the other in outcrops, drill-holes, and in mines. The coal varies from about 1 inch to 5 feet in thickness. The typical development in well known areas is 4½ feet. It occurs in lenses that thin rapidly on the margins and often disappear entirely. As a rule over wide areas, the thicker the limestone cap-rock the thicker the coal and better quality ~~the~~ it has. This is not always true however, because east of Knoxville the coal is thickest and best when it is overlain by the greatest amount of black shale. The coal is commonly separated from its cap-rock by this black shale ("slate" of miners) and in places the shale makes a fair roof. Most of the mines "brush" very little of the shale unless it is badly broken and therefore more likely to fall.

Rock Island (No. 1) coal consists of an upper bench of hard, bright shiny coal, 10–22 inches thick, and a lower bench of somewhat duller coal 18 to 34 inches thick. Occasionally the two benches are separated by a thin bed of black carbonaceous shale. Such occurrences are reported by Wanless* in the Alexis area. So far as known no outcrops in the Monmouth area show this parting and none is reported in the mines in the Galesburg area. It does appear in a few drill holes.

* Wanless, H.R. - Geology and Mineral Resources of the Alexis Quadrangle, Ill. Geol. Surv. Bull. 57, p. 58, 1929.

The limestone cap-rock, where present, is an evenly bedded, dark blue or gray, nearly pure limestone ranging from 1 to 3 feet in thickness. It nearly always contains ~~ass~~ abundant dwarfed Fusulinella fauna.

The limestone cap-rock is often overlain by a shaly limestone called "blue-rock," ranging from 6 inches to 4 feet 8 inches in thickness.

The "blue-rock" is best developed in the Monmouth area at an exposure considered by Workman to be the best in the area. It is located on the south cut-bank of Cedar Creek in the NW ¼, sec. 15, T. 11 N., R. 2 W. (Monmouth Twp.), just north of Chicken Mine.

Quaternary period

Pleistocene: glacial till and loess --- not studied

Pennsylvanian system:

Pottsville formation:

Seahorne cyclothem:

Sandstone, badly weathered (Wanless considers this may be a higher sandstone, probably Isabell (Liverpool cyclothem) --- 3-6

Sandstone, olive-green to brown, coarse, friable, fairly soft, slightly micaceous. Medium bedded, some plant remains. Upper part lighter green gray, tan & white --- 6-6

Upper Delong cyclothem

Coal ------------ ~~0-4~~

Clay, light gray ------------

Coal ------------ } 0-6

Clay, light gray ------------

~~Coal~~ Clay, medium gray, sandy, lower part brown

Middle Delong cyclothem

Coal ------------ 0-1

~~Clay, medium gray, sandy, lower part brown --- 0-2~~

Clay — (~~upper part of shale below.~~) — ?

Lower Delong cyclothem

Shale, dark blue-gray, greasy, soft, slightly micaceous ------------ 4-10

Clay, sulfurous, slightly gritty, light gray -- 0-5
Clay, light brown gray, some grit, 1" brown gray at top -- 0-6
Sandstone, violet tinted light gray, fine,
some small mica flakes, sulfurous --- 0-2½
Clay, greenish & yellowish gray, some grit } ~~0-1½~~
Clay, porous zone, limonite filled -- } 0-7 ~~0-1¼~~
Chert, porous, white to light gray. Upper
1'6" hard with dense chert inclusions.
Lower 1'2" more wavy with blue-gray
(shaley?) laminations, -------- 2-8

Seville Cyclothem

Shale, dark gray, soft, non-calcareous -- 0-4
Clay, light gray, hard, not gritty, non-calcareous 0-2
Shale, gray, soft, limonite stains ---- 0-2½
Limestone, "Blue-rock", shaly,
light blue gray, fossiliferous zone at top -- 4-8
~~Limestone, "Cap-rock" dark medium blue gray,~~
Limestone, "Cap-rock", medium dark blue,
contains much pyrite -------- 1-6
Coal, Rock Island No. 1 mostly
below creek level (elevation 660) --- 0-3

Delong Cyclothem

The type locality for this cyclothem is along Brush Creek about 2 miles south of Delong, Knox County.

The succession has been divided by Wanless into Lower, Middle and Upper Delong. In its entirity the series does exceed 10 or 12 feet in thickness in these areas.

The type section is located in the NE 1/4, NE 1/4, Sec. 8, T. 9 N., R. 2 E. (Chestnut twp) along the south wall of Brush Creek. It shows the following succession of strata.

Pleistocene	
Loess	13-0
Glacial till	12-0
Pennsylvanian system	
Carbondale formation	
Liverpool cyclothem	
Shale, gray	1-0
Shale, black "papery, pimply"	1-2
Shale (Francis Creek) gray	1-0
Coal (Colchester) No. 2	2-8
Underclay, gray, much limonite	10-0
Sandstone (Isabel) thin-bedded	7-0

Greenbush cyclothem
Ironstone concretions - - - - - - 0-2
Shale, gray - - - - - - - - - - 1-0
Coal - - - - - - - - - - - 0-2
Shale, gray - - - - - - - - - 5-6
Wylie cyclothem
Coal - - - - - - - - - - 1-10
Shale, gray - - - - - - - - 2-6
Seahorne cyclothem
Coal, bony - - - - - - - - - - 0-2
Shale, gray with calcareous concretions 4-6
Sandstone, Stigmaria present - - - 0-8
~~Upper~~ DeLong cyclothems
Upper
Shale, gray green, silty - - - 2-4
Coal - - - - - - - - - - 0-1¼
Clay, hard brownish gray - - 0-1½
Coal - - - - - - - - - - 0-1¼
Siltstone - - - - - - - - - 0-7
Shale - - - - - - - - - - 0-2
Middle
Coal - - - - - - - - - - - 0-1½
Clay, hard purplish, upper
part is underclay of coal - - 2-8

Lower

Coal	0-3
Clay, dark blue gray	0-7
Clay, light blue gray	0-11

In order to see the above section it was necessary to carefully clean off all slope wash material and vegetation and literally go over the surface inch by inch. One cannot see this succession without this preliminary work.

L. E. Workman, co-author of this report, was the first to recognize the correlative value of the thin coal of the Delong series. Several of his sections have been given on previous pages. The persistence of such a thin series over wide areas offers an important problem in the origin of coal beds. How such thin beds of coal can be so widespread and so regularly spaced vertically is not easily explained.

Seahorn cyclothem

The type outcrops of this cyclothem are along Seahorne Branch near Enion, Fulton County.

The Seahorne is characterized by the basal Seahorne sandstone which is sometimes filled with Stigmarian remains. In this respect it is like the Bernadotte (Stigmarian) sandstone of the Seville cyclothem. The latter is more massive bedded, more densely cemented (quartzitic) and does not possess the sugary whiteness of the Seahorne.

Numerous sections containing the Seahorne have been given on preceding pages. Its coal is thin and not always present. The Seahorne limestone is absent over most of these quadrangles.

Wylie Cyclothem

The type locality of the Wylie is along a ravine about 2 miles northwest of Wiley School, near Blyton, Fulton County. It was named by H.R. Wanless.

The Wylie cyclothem is thin, consisting of a 6 to 10 inch coal with ~~its~~ a sandy underclay and an over-lying gray shale usually less than 4 feet thick.

Numerous sections have been given on previous pages which include the Wylie. On the areal maps (Plates ____ & ____) it has been mapped with the Delong, Seaborne, and Greenbush cyclothems.

Greenbush Cyclothem

The type exposure of the Greenbush is along tributaries of Swan Creek in Greenbush Township, Warren County, ~~just west of Avon~~. It was named by H.R. Wanless.

The Greenbush cyclothem is not well developed in either the Galesburg or Monmouth areas. Portions of the section occur at scattered places over the area mapped with the Wiley, Delong and Seaborne.

A fairly good section of the Greenbush and/or Lower Liverpool ~~will be found~~ is given on pages 49 & 50. Such details on this cyclothem are not often available in these areas.

The Greenbush is characterized in most parts of western Illinois, according to Wanless,[1] by an upper gray shale from 3 to 20 feet in thickness, occasionally an inch or two of dark to black shale, a coaly streak or 1 or 2 inches of coal, and a shaly and micaceous underclay commonly about 5 feet thick which completes the sequence. ~~The type locality is along Swan Creek in the Northwest part of the Avon quadrangle.~~

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[1] Wanless, H. R. Private correspondence.

Carbondale ?

Liverpool Cyclothem

This is the most important portion of the Pennsylvanian strata in these areas. It contains the valuable Purington shale and the most widespread ~~coal,~~ Colchester (No. 2) coal. Most of the small drift ~~coal~~ mines of the area are in this seam, although a few are mining Springfield coal (No. 5.)

The stratigraphic relation of the Liverpool to older formations is unconformable in places and gradational in others. Its relations with the younger strata will be described under the next cyclothem.

Strata Beneath Colchester Coal No. 2

These strata consist of the Isabel sandstone, fresh-water limestone in nodules and an underclay in age order as given. The following section was made along a tributary to Brush Creek which heads in the northeast corner of Indian Point Township in Knox County, about ¼ mile east of Cashman School. The section is a combination of several small sections along this ravine measured by the writer, and also by Wanless.

Section along tributary to Brush Creek ½ mile east of Cashman School, Sec. 12, T. 9 N., R. I E. to N. E. ¼, Sec. 6, T. 9 N., R. 2 E.[1]

Pleistocene

Loess and drift..............................10 to 15 - 0

Pennsylvanian system

Carbondale formation

Summum Cyclothem

Sandstone, (Pleasantview), light yellowish gray to gray, somewhat spotted with brown slightly micaceous; average bedding $\frac{1}{2}$ to 1". Carries characteristic millstone concretions, light blue gray, hard, slabby. Fairly large mica flakes showing on wavy bedding planes. Rather shaly bedded toward base..5 to 6 - 0

Liverpool cyclothem

Shale,(Purington) olive gray to blue gray, sandy, regularly bedded up to 2 and 3 inches, well laminated, carrying blue gray coarse grained limestone concretions........ 4 to 5 - 0

Concealed... 10 - 0

Shale, (Purington Cont'd.), blue gray, slightly sandy, well bedded, with conchoidal fracture,

Continued on p. 48

Becomes less sandy at base....................15 to 20 - 0

Oak Grove Member:

Limestone, blue gray, fine grained, ~~one bearing~~ carrying casts of pelecypods and gastropods..0 - $1\frac{1}{2}$ to $2\frac{1}{2}$

Shale, light blue to blue gray, thin-bedded, conchoidal fracture, not sandy.....................4 - 0

Limestone, dull gray, weathering to dull brown, fine grained, very fossiliferous, blue Ambocoelia present where thin, but abundant where it has a thickness 3" to 4"............0 - 1 to 4

Shale, black, thin-bedded, with abundance of Aviculopecten....................................1 - 8

Limestone, blue gray, fine grained, with hard regular bed, very fossiliferous, with Aviculopecten and other pelecypods...........0 - 1 to 2

Shale, black, thin-bedded, with abundant Aviculopectens. Some flattened, blue gray, fine-grained limestone concretions which are also very fossiliferous, with mostly pelecypods. Lower part less fossiliferous....................................1 - 6

Clay, gray and yellowish to bluish............... 0 - 1

Clod, blue gray, slabby, hard.................0 - 1 to 2

Limestone, hard, gray to blue gray, fine grained, weathers to dull gray, uneven surface. Very fossiliferous, Marginifera abundant........ 3 - 8

Clod, soft, clayey, yellowish gray, fossiliferous... 0 - 4

Shale, blue gray, evenly bedded up to $\frac{1}{4}$" beds, Nonfossiliferous as seen. Not sandy............ 0 - 8

Limestone, blue gray, fine-grained, hard, concretionary bed; fossiliferous, showing gastropods and Astartella. Sometimes two limestone beds, with 1 - 2" shale parting....... 1 - 0

Shale, gray to blue gray, slightly sandy, unevenly bedded, beds up to 1" thick. Fossiliferous, Astartella and crinoids, former abundant. Carries blue gray thin concretions at base............................. 1 - 5

Shale, blue gray, even-bedded, greasy, no fossils showing. Carries thin dark gray, fine-grained limestone concretions up to 1"x 6"x 8". Becomes dark blue gray to black at base and more thinly bedded.......3 to 4 - 0

Limestone, blue gray, medium-grained, hard, slabby, fossiliferous, with large corals and crinoids. (Basal Oak Grove member).......0 - 2 to 4

Shale, soft, black, flaky.......................0 - 5

Shale, hard, black, fissile, with pyritic nigger-head concretions, "pimply" toward middle part.................................2 - 1

Shale, blackish gray, soft, thin bedded.........0 - 3

Shale, gray, thin-bedded, slightly sandy, spherical weathering evident, with few scattered discoidal pyritic concretions........7 - 0

Colchester Coal (No. 2)...........................2 - 4

Pottsville Formation

Underclay of No. 2 coal:

Clay, blue gray, blocky, hard...................1 - 0

Clay, dark blue to purplish gray................0 - 2

Clay, gray, blocky..............................0 - 8

Clay, gray, blocky, rusty, sandy................0 - 4½

Clay, shaly fracture, gray, somewhat rusty, slightly sandy, laminated......................2 - 10

Shale, gray, even bedded, sandy, laminated......1 - 6

Clay, gray olive, sandy, calcareous, blocky.....2 - 2

Sandstone, (Isabel), light yellowish gray, micaceous, laminated, poorly bedded in beds up to 1" thick in upper 3', massive beds up to 7 - 10" in lower part. Granular texture....7 - 10

Lower Liverpool cyclothem

Shale, olive gray to blue gray, slightly sandy, evenly bedded, wavy, uneven upper surface on which the Isabel rests.............1 - 7

Limestone, dull brownish to purplish gray, fine grained, non-persistent................0 - 1 - 2

Shale, blue gray, dark, evenly bedded, fairly thin, conchoidal fracture, greasy when moist, becoming black near base..........................3 - 2

Coal...0 - 3

Clay, sandy, micaceous, dull dark blue gray, hard.................................0 - 2

Clay, dark blackish, soft, slightly sandy..0 - 8

Covered interval...........................6 to 8 - 0

Sandstone, blue gray to olive gray, micaceous, rather fine-grained, carries lenses of coal 1 to 2 inches thick and 2 to 4 feet long. The sandstone is cross-bedded and massive up to 1 and 2 ft. thick with shaly beds carrying an abundance of carbonaceous material and mica on the bedding planes. Some pyritized logs 6 inches in diameter. Several coaly seams near base, all lenticular and ranging up to ½" in thickness. No coaly seams at the base proper............... 10 to 12 - 0

Greenbush Cyclothem

Shale, gray, not sandy, thin, evenly bedded.......0 - 7

Coal, ¼" to ½", thickens to 2" downstream....0 - ¼ to 2

Clay, light purplish gray....................0 - 1 - 1½

Coal, coaly clay ¼", thickens to ½" good coal....0 - ½

Clay, dark purplish gray, hard, blocky..........0 - 3

Clay, gray, blocky, hard........................0 - 10

Clay, gray, with calcareous nodules, sandy.......2 - 8

Sandstone, gray to bluish gray, micaceous, massive bedded, carries carbonaceous flakes and carbonized stem impressions.........4 - 0

The detailed section given above is the longest known in these 2 map areas. It is especially significant because it demonstrates the cyclical or rhythymic character of the sedimentation in this area better than most localities. It ~~still~~ may be observed that the beds immediately overlying the coal are marine in origin, as indicated by their fauna, and that they gradually give way upward to fresh-water deposits characterized by non-fossiliferous fresh-water limestones and finally by an underclay (or swamp soil) and its overlying coal completing the cyclothem. This alternation from marine to fresh-water conditions is the most significant stratigraphic fact of these areas. In a later chapter on historical geology the origin of these cyclothems will be discussed in ~~gr~~ detail.

The basal member of the Liverpool cyclothem is the Isabel sandstone. It is a very prominent member of the ~~section~~ stratigraphic succession in the southwest part of the Galesburg quadrangle and the adjoining portion of the Monmouth. The channel or massive-bedded phase of the Isabel is especially well developed in sections 34, 35 and 36 of Floyd township and sections 1, 2, ~~and~~ 3, 10, and 11 of Berwick township in Warren County. The exact identity of this sandstone has not been determined because the most satisfactory type of evidence was lacking. The ravine between the 2 secondary roads in the north-central part of section 3, T. 9 N., R. 1 W. (Berwick twp.) shows Colchester (No. 2) coal, and possible the Lower Liverpool Coal has been mined here too below No. 2, and in the next ravine east in this same section there is a continuous ~~section~~ exposure of a very sandy shale which is found ~~on top of~~ repeatedly grading upward from the massive channel phase of the Isabel sandstone. Good exposures of the more massive portions of the sandstone occur along the south wall of the tributary to Cedar Fork which parallels the M. & St. L. R.R. in section 35, Floyd township. The elevation of Coal No. 2 is about 660' and the top of the sandy shale mentioned above and all known occurrences of the massive sandstone lie well below this level.

The trend of the Isabel channel is approximately N. 45° E. and it passes under No. 2 coal in the SW corner of Cedar township, Knox County. The probable trend of this channel system is shown in figure ?

The Isabel sandstone is not easily distinguishes from the younger Pleasantview sandstone of the Summum cyclothem especially in their so-called non-channel phases. In the channel phase the Isabel is yellow gray to gray, commonly spotted with brown from the oxidation of pyrite grains, commonly slightly coarser grained than the Cuba or Pleasantview sandstones. In this phase the Isabel is well cross-bedded, with abundant impressions of drifted logs and in certain areas, as mentioned above as occurring in the NE¼ of section 3, Berwick township, the channel may be filled with rather evenly bedded sandy (occasionally non-sandy) shale, which usually contains rather abundant plant fragments. The thickness in these areas varies from 2 feet to 35 feet. The greatest thickness is section 11 and 21 Berwick township, ~~and~~ Warren County.

~~It is possible that as this channel is traced farther southwestward ~~into~~ that a place may be found where the heavy channel phase may be found directly below~~

Colchester Coal No. 2

The Colchester (No. 2) coal in these areas is usually less than 3 feet in thickness, the variation is from 10 to 32 inches. It is under very little cover in most places, and its outcrops are innumerable. Dozens of small prospect pits occur at this horizon and in many places the coal has served as a private supply for a few families. ~~In the summer of 1926 there was one small wagon mine working the Colchester No. 2 seam at near the center of the north line of section 16, Orange township~~

The coal is of only average quality as the laboratory tests given on page 100 show. It has a semi-brilliant luster and breaks with a splintery fracture in the duller layers doubtless due to the large amount of attritus composing this portion of the seam. The bright (anthrazylon) layers break with a sub-cubical fracture. The coal is generally uniformly bright however, and the banding is not pronounced. Pyrite (FeS_2) is locally common but in general the sulfur content of the seam is not uncommonly high. It is said to burn with considerable quick heat and low ash. The regional structure of the Colchester in this area as generalized from accurately leveled outcrops may be seen on the structure map (Plate).

Strata above coal No.2

This group of strata is the most easily identified of any in these areas. In the general section on page 34 it will be noted that the Francis Creek shale occurs locally. It may be seen in the exposure below the Lake Brackin spill-way and at a few other scattered places along Brush Creek in the Galesburg area, and in Coldbrook[1] Township along Cedar Creek near the eastern margin of the Monmouth quadrangle, especially in section 20.

Above the Francis Creek there is a persistent black, brittle shale. Where the Francis Creek is absent this black shale rests directly upon coal No. 2. The shale is thinnly laminated and contains an abundance of small concretions. (See figures ____ page_____). The laminae of the shale appear to drape themselves over these $\frac{1}{4}$" to $1\frac{1}{2}$" concretions, suggesting that the concretions have grown between the layers of shale epigenetically and have gradually forced them apart. The bumps thus produced give to the shale the appearance that has suggested the name "pimply" for it. The shale is uniformly black on fresh fracture, although it weathers to a dull dove gray. It is usually brittle and locally shows distinct fissility. Its thickness varies from a few inches to as much as 3 feet in its characteristic development. Where the Francis Creek is present it is not usually difficult to differentiate it from the overlying black, brittle shale as the contact between the two is sharp and contrasting. The upper limit of the black shale is often not so clearly marked however, as it may grade upward into the more shaley phase of the Oak Grove. The calcareous character of all members of the Oak Grove, especially its limestone layers, serve to make confusion of the contact much less likely.

The most conspicuous member of this group of strata above coal No. 2 is this so-called "pimply" black, papery shale. It has a greater resistance to weathering than the other members of this group and also it has a very widespread occurrence. Almost any area on the coal ~~geologic~~ map (plate ?) showing coal No. 2 ~~shown as Liverpool~~, will show this shale, but it is especially common along Cedar Fork, and also along the upper part of Brush ~~Creek~~ and Court Creeks.

The Oak Grove member of the Liverpool is a fairly persistent group of four 2 to 4 inch beds of fossiliferous marine limestones with intervening fossiliferous shales. The member is named for Oak Grove School in section 23 of Cedar township, Knox County, where it is exposed in a ravine just north of the school. The limestone is very hard and ~~granular~~ dense with a concretionary structure. It weathers to a shaly surface which is usually crowded with fragmentary shells of Marginifera, Aviculopecten and Ambocoelia. These shells are nearly always weathered white and serve as distinct markers of the horizon. The intervening shales are also crowded with shells of these genera locally. On the upper side of the topmost layer of limestone there is sometimes ~~commonly~~ a 3 inch layer of cone-in-cone. This peculiar structure is not well understood although it is thought to be a phenomenon of crystallization.

The Purington shale marks the top of the Liverpool cyclothem. It is the material used in brick-making at the Purington Paving Brick Company and for this reason the name "Purington" was adopted for it. Its normal thickness in this area is 35 to 45 feet. This thickness is reached at the Purington quarry. ~~and is thought to persist south of this locality to south of Knoxville along the headwaters of Haw Creek.~~ The Purington shale is widespread in its occurrence. Areas known to be 15 or more feet in thickness are indicated on plate ?. The shale attains a thickness of 50 feet 1½ miles east of Abingdon in NW¼ section 2 of Indian Point township.

Test drilling reveals that the shale continues unevenly in several directions from the Purington quarry, mainly north and east, and the supply is considered ample for future needs. The upper part of the bed becomes quite sandy locally and as the sandy phase increases in thickness the usuable portion of the shale decreases. Typically the shale is a bright pearl gray on fresh fracture. It contains very little grit. The bedding is well defined and the layers break with the customary fissile-like conchoidal fracture parallel to the bedding while the break right angles thereto is splintery. The better shale is said to have a blocky break determined in the manner just described.

Scattered throughout the Purington, but slightly more abundant near the base, are a great many discoidal ironstone concretions which carry a pelecypod fauna. These concretions are usually less than 8 inches in diameter, but a few reach 12 inches. The average thickness of these is estimated as 1 inch at the center to margins which taper to a thin edge. The main body of the shale also contains larger, less fossiliferous concretions or "niggerheads". The range from the size of an orange to that of a large watermelon. Calamites and other large plants have been found in these.

Stratigraphic relations and correlation.

The Liverpool Cyclothem is the equivalent of Suit IV in the Alexis area as reported by Wanless.[1] In the Alexis area, as well as the Galesburg and

[1] Wanless, H. R., Personal communication. See also Geology and Mineral Resources of the Alexis Quadrangle, Ill. Geol. Surv. Bull. 57, p. 49, 1929

Monmouth areas, the basal sandstone (Isabel) of the Liverpool is very irregular in thickness due to the filling of old channels eroded before the Isabel was deposited. This makes recognition of the Isabel contact difficult to assign since the sandstone appears locally to cut out all strata down to and sometimes into the Seville. Wanless states that "the sequence of beds above this (the Seville cyclothem) in the Alexis quadrangle is greatly disturbed by uneven channel cutting of the basal sandstone of the Liverpool cyclothem (Isabel), and

~~[1] Wanless, H. R. Personal Communication.~~

shales filling channel areas cut before the deposition of the Isabel sandstone. It therefore seemed wise..........to await the differentiation of this interval into separate cyclothems until reporting an area where the division was more clearly shown. Suite No. III (of the Alexis area) therefore may include the Lower, Middle and Upper Delong, the Seahorne, Wiley and Greenbush cyclothems (of the Galesburg and Monmouth areas)". Areas containing the Isabel sandstone have been platted on plate ? and the probable direction of the channels indicated.

The Liverpool cyclothem is separated from the overlying Summum cyclothem by an important erosional unconformity. After studying the relationships of the Carbondale formation cyclothems over all of western Illinois, Wanless concludes that "the relations of the Purington shale and the overlying Pleasantview sandstone are of two sorts. (1) in some places the Oak Grove limestone bands are overlain by a considerable thickness of gray clay shale with flattened oval ironstone concretions (belonging to the Purington), which becomes increasingly sandy toward the top, until definite thin bands of sandstone and associated shale are encountered. In such localities, the sandstone is rarely more than 5 feet in thickness, grading up into sandy shale and then the fresh water limestone horizon below coal No. 4 (or the Summum cyclothem). This is considered a non-channel phase of the sandstone. (2) In other places the Purington shale of the type mentioned above, is entirely absent or much thinner than normal (35-40 feet is normal), and the clay shale or even the limestone beds are immediately overlain by the sandstone, which here occurs in much thicker beds and is somewhat coarser grained. The contact is usually sharp and may show a notably irregular base. The margins of these 'channel' areas are usually quite steep and closely adjacent outcrops may exhibit the two relations."[1]

The channel phase of the Pleasantview may be seen below the spillway of Lake Bracken. ~~West of the bridge over Brush Creek below~~ Near Bracken dam the following section was measured along the creek wall.

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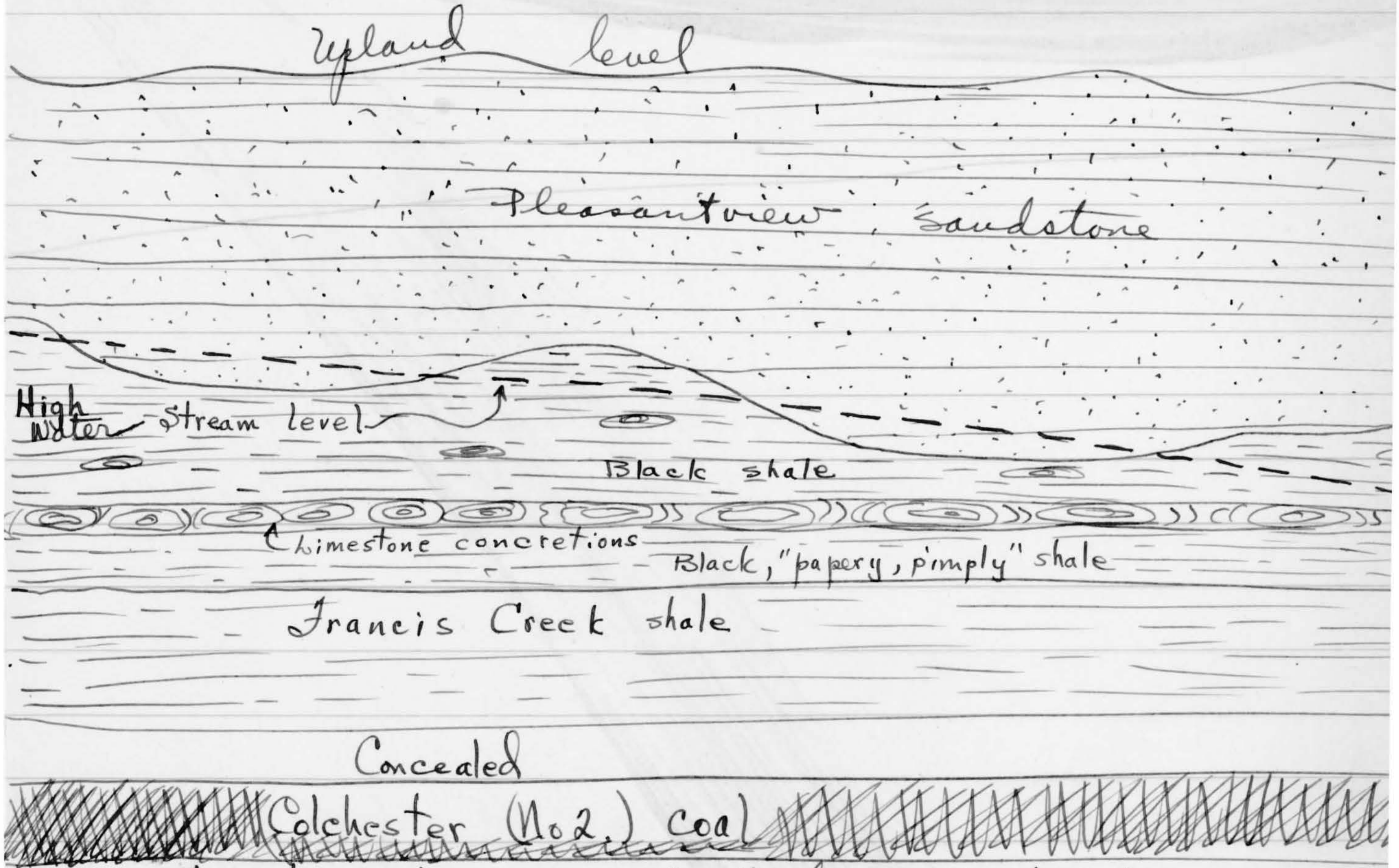
[1] Wanless, H. H., Personal Communication.

Wrong section

~~Pleistocene~~
~~Loess and leached till........................6 - 0~~

~~Pennsylvanian system~~

~~Carbondale formation~~



Low water stream level conceals the lower part of No-2. coal.

Sketch of Pleasantview channel at Lake Bracken spillway cut.

Pleistocene

Loess	7–0
Gumbotil	4–6
Till	42–6

Pennsylvanian system

Carbondale formation

Summum cyclothem

Sandstone, greenish gray, thin to thick-bedded. Lower contact irregular. (Pleasantview sandstone)	8–6

Liverpool cyclothem

Shale, black, thin-bedded, with several bands of thin discoidal concretions. Few fossils here. One large 1' concretion of limestone	4–6
Shale, black, thick-bedded	1–0
Limestone concretions, dark gray to black	0–10 to 14
Shale, black, "papery" in lower part. Upper 6" soft. Many small concretions.	2–0
Shale, thin to thick-bedded, gray, (Frances Creek shale)	5–0
Concealed	2–0
Colchester (No. 2) coal	1–6

Base below creek

Summum Cyclothem

This group of strata lies above the Liverpool cyclothem and is widespread

~~on~~ in these two areas but, so far as known, it contains only one and possibly two beds of stratigraphic importance; its basal sandstone the Pleasantview, and the Hanover limestone near the top.

The channel phase of the Pleasantview has just been described where best exposed. Its non-channel phase is assumed to be present everywhere the sandstone is thin. ~~Wanless has suggested that it seems to be feasible to prepare a topographic map of these old pre-Pleasantview channels. When this is done (if sufficient data can be collected) it may shed some much needed light on~~ the ~~perplexing problem of the origin of so-called "non-channel" sands.~~ The nature of the Pleasantview sandstone in its two types of contacts with the underlying Purington shale has been described on pages 55 and 56. The sandstone itself is difficult to distinguish from the older Isabel sandstone at the base of the Liverpool cyclothem. Generally it is not so coarse-grained. Places in its thin-bedded portion contain abundant well-preserved plant fossils. The writer is indebted to Mr. Fred R. Jelliff of Galesburg for showing him several fine ~~collecting~~ collecting grounds in this rock. The best locality is in the NW¼ sec. 17, Knox Twp. north of the Purington Brick plant on the east side of the Santa Fe R.R. on the west side of the east Purington Lake. ~~The place back of the old Purington Brick works is most excellent.~~

The strata above the Pleasantview consists of limey shales, fresh-water limestone, an underclay and coal No. 4. Coal No. 4 is local in occurrence. It is exposed in a number of places along a tributary to Pope ~~Henderson~~ Creek in Henderson Township, north of Galesburg. In the NE¼ of Sec. 32, T. 12 N., R. 1 E. on the spur of land west of the first ravine west of the bridge over this tributary ~~Henderson Creek~~ on the north-south road between Sec. 32 and 33 the following outcrop of the Summum cyclothem occurred before Lake Storey was built by the A. T. & S. Fe R.R.

Pennsylvanian system

Carbondale formation

St. David Cyclothem

Represented here only by 1 to 3 inch slabs of Randall conglomerate in the float, associated with clay and shale fragments with some limestone pieces and numerous concretions. This conglomerate contains subangular fragments of limestone and some chert. Some pelecypods pseudomorphed by limonite have been seen in it elsewhere.

Summum cyclothem

Clay shale, mostly gray, with bands of brown ~~and some white.~~ Some limestone concretions of the small branching type (possibly rhizo-concretions) in the lower part	7 - 0
Clay, dark gray with limestone septaria from 2 to 8 inches in diameter	1 - 0
Clay, brown to gray with small limestone concretions	3 - 0
Limestone (Hanover) gray, platy, weathers white, fossiliferous	0 - 5
Shale, soft, gray with dense limestone concretions. These sometimes exceed 1 foot in diameter, and are dark gray to black and weather buff	4 - 6
Concealed	2 - 0
Shale, black, dense and fairly soft	2 - 0
Clod	0 - 4
Coal No. 4, only 1 foot exposed when visited	1 - 0
Creek level	

East of this outcrop, in the NW$\frac{1}{4}$ of Sec. 33, T. 12 N., R. 1E., coal No. 4 is exposed in a 3$\frac{1}{2}$ foot outcrop just north from the second house east of the road corner labelled ~~with~~ elevation 761. This outcrop is also now under Lake Storey. This is thought to be the greatest thickness of this coal in these areas. It thins as one goes east and is probably absent over much of the area ~~here~~ included in this report. It apparently developed along an old channel swamp and should not be expected to be widespread. It is probably the southward extension of the Soperville coal, which is thought to have had somewhat the same type of origin. Wanless states that "the Soperville coal is a very local deposit. ~~Where seen~~ the outcrops near Soperville, ~~[illegible]~~ include a coal about 2 feet thick, which is the No.5; and a coal about 4-5 feet thick, which is No. 4, beneath the Hanover limestone. The coal mined at Soperville is reported, I believe, to be as much as 7 feet thick. If it rests right on the Pleasantview sandstone, it is probably a discontinuous coal beneath the No. 4 seam. This lower seam has been called tentatively the Lower Summum. This coal is of workable thickness at certain localities in the Canton, Havana, Vermont, Beardstown and Roodhouse quadrangles. It is limited to those areas where the Pleasantview sandstone has unconformable relations to the underlying strata. It has no underclay, or very little, and commonly rests directly on the sandstone. The real No. 4 coal above often dips into, and thickens in those restricted areas where this lower coal (the Lower Summum) is of considerable thickness. Outside of these restricted areas, it is entirely absent."[1] The 3$\frac{1}{2}$ foot seam of No. 4 coal mentioned above, and all other known exposures of this seam, present a coal which is very difficult to distinguish, by its own characteristics, from coal No. 2. In a few places there is a $\frac{1}{4}$ inch clay parting about 18 inches below the top of the seam. It contains a predominance of anthroxolyn (bright) layers and breaks with a sub-cubical fracture. The available analyses are insufficient to make comparisons of composition.

~~The Hanover limestone member is a peculiar rock in that its composition is~~

[1] Wanless, H. R. - Personal communication.

Other thin exposures of coal No. 4 are known along Middle, Court and Haw Creeks. It is shown on the coal map (Plate 3) along the lower stretches of Haw Creek where it is 20-30 feet below Springfield (No. 5) coal and also well above Colchester (No. 2) coal. In all others areas however ~~the~~ coal No. 4 is too thin and too close to No 5 (usually only 5-6 feet below) to make it impractical to map it as a separate unit.

It is thought to be worthwhile to give the sections which are known to be below Lake Storey. Others for coal No. 5 will be given later.

Since the best sections of No. 4 coal are covered by Lake Storey the following section along the east side of Haw Creek in the short ravine extending nearly to the center of Sec. 10, T. 10 N., R. 2 E.

Pleistocene.

Loess, with many concretions - - - 4-0

Pennsylvanian system

Carbondale formation

Summum Cyclothem

Shale, gray - - - - - - 0-6

Coal, No. 4, badly weathered,
thickness uncertain - - - - 2-0

Covered, black limestone float --- 8-0
Sandstone (Pleasant view), thin-
bedded, very shaley in places ----36-0
Liverpool cyclothem
Shale (Purington) dark gray,
irregular upper surface, Contains
some fossiliferous ironstone con-
cretions -------- 6-0
Limestone, black, soft, fossiliferous
concretionary -------0-10
Shale, black "papery + pimply," soft at top -2-0
Coal (No. 2) -------- 0-4
Base concealed

The Hanover limestone member is a peculiar rock in that its composition is quite heterogeneous. Its varied character has prompted the practice by some of calling it "crazy rock." It occurs in slabs from 1-4 inches thick and its total thickness rarely exceeds 12 inches. The color is generally greenish to bluish gray, although pink to reddish shades are fairly common. The green color is caused by the mineral glauconite (hydrous silicate of potassium and iron), and the red is due to iron oxides. The texture is distinctly granular and often sandy. The Hanover frequently contains large, rounded, smooth concretions; ~~some have~~ one measured 14"x16"x22". The concretions are fossiliferous and the limestone also contains a variety of forms with the brachiopod Derbya crassa predominating. Fish plate fragments and teeth have been found. (See section on page 62). The Hanover is not always a limestone. In some places it changes within a relatively short distance to a brownish gray, glauconitic, calcareous shale and locally to a conglomerate. The Summum cyclothem is widespread in the Galesburg area but is found only in the northeast corner of the Monmouth quadrangle, as will be seen on the ~~geologic~~ cyclothem map, Plate_____. The Hanover limestone however, is found mostly in the area east of Galesburg along Court Creek and the upper stretches of Haw Creek.

St. David cyclothem

The St. David was not recognized in the Monmouth quadrangle. It has probably been removed by erosion. In the Galesburg area it is not widespread, and as shown on the cyclothem ~~geologic~~ map it occurs north and east of Galesburg and west ~~and in~~ of Knoxville. An outlier of these rocks also occurs south and east ~~another small area south of the city as an outlier in the southeast corner of~~ of Abingdon in Indian Point township. ~~Galesburg Township and adjoining townships. A third area may be seen around the town of Knoxville.~~

The rocks of this cyclothem consists of a non-marine series of conglomerate, shale, fresh-water limestone, underclay and Springfield (No. 5) coal, followed above by a marine series of shale, and limestone.

The basal conglomerate of the St. David occurs in thin layers, usually not exceeding 1 inch. Its greatest ~~total~~ thickness reaches 1' 10" in a ravine in the NW¼ of Sec. 16, Knox township, just east of the north-south road. This exposure is 1 mile east and ¼ mile north of Randall Post Office. ~~This conglomerate~~ It is suggested that this be called the Randall conglomerate. It consists of small subangular limestone pebbles bound by a matrix of limonite and recrystallized limestone. This conglomerate is difficult to distinguish from that which sometimes replaces the Hanover limestone of the Summum cyclothem. The presence of glauconite in the Hanover is the most dependable characteristic. The St. David conglomerate is sometimes cemented to the overlying fresh-water limestone. It contains dark blue gray limestone pebbles up to $\frac{1}{4}$ inch in diameter, some rounded and some nodular. Some of the pebbles resemble the calcareous nodules found in many limey clays. In some instances the pebbles are phosphatic and a few are composed of chert. At the type section of the Randall conglomerate it contains a few of the dense black limestone nodules which occur above No. 4 coal. This proves that erosion went as far down as a few inches above Coal No. 4 in early St. David time.

One of the best exposures of the St. David is in a north-south tributary to Middle Creek along the east side of Sec. 3, T. 12 N., R. 2 E. (Knox twp.) This section shows the complete St. David in this part of the district and it also shows its relation to the Summum below and the overlying Brereton cyclothem. This is an important section for these reasons. The section follows:

Pennsylvanian system

Carbondale formation

	Ft.	In.
Brereton cyclthem		
Sandstone, (Cuba) thin-bedded (in hills above creek)	10+	0
St. David cyclothem		
Shale (Canton) dark gray in basal 4-6 feet, greenish gray in central part, upper 10 feet bluish gray. Gritty, and numerous 1" beds of sandstone. Numerous flat, non-fossiliferous and ironstone concretions	35 - 40	0
Shale, soft, black, somewhat brittle	1	0
Shale, black "pimply", with 1" limestone concretions	0	10
Covered, with coal fragments. 6-8" outcrop of coal on road nearby. (No. 5 coal)	4	0
underclay, seen but amount uncertain.		
Summum cyclothem		
Limestone (Hanover), in 2-6" slabs, dark gray, granular containing numerous fossils including many fish remains. Phosphatic nodules common. - - Variable thickness	1	2
Shale, gray with worm-like concretions (rhizo-concretions?)	0	6
Shale, mottled gray and black, non-fossiliferous	0	8
coal No. 4 horizon - covered.		
Shale, greenish gray, block	2	0
Sandstone, (Pleasantview), greenish gray, thin-bedded	10	0
Concealed		

The basal Randall conglomerate does not show in the above section, but its position with respect to No. 5 coal is well shown in a ravine just south of Hazel Dell School in Sec. 9, ~~Knox Town~~ T. 11 N., R. 2 E. (Knox Twp.). This exposure is about 1/4 mile north of the type section mentioned above. (For details see section p. 64)

The strata between the St. David basal conglomerate and coal No. 5 in age order are a thin shale, two 3-4" beds of non-fossiliferous, fresh-water limestone, and an underclay. The underclay is usually dark gray with some limonite.

Springfield (No. 5) coal

This is the uppermost coal of the Galesburg area. It ~~does~~ is not known to occur in the Monmouth quadrangle. The coal has been worked in a large number of small drift mines throughout the northeastern part of the Galesburg area, but none of them were being worked when this study was ~~made~~ concluded in 1935. According to Dr. G. H. Cady coal No. 5 in this area bears a striking resemblance to coal No. 7 east and south of the Galesburg quadrangle. The following section, according to ~~him~~ Cady shows this similarity. This exposure ~~may be~~ formerly could be seen about 50 feet north of the ~~Henderson~~ Creek bridge over the east-west road that traverses the center of Section 33, T. 1 N., R. 1 E. This section is now beneath Lake Storey.

Pennsylvanian system

Carbondale formation

St. David Cyclothem

Shale, soft, black	2 - 0
Shale, black, hard and brittle with many small limestone and sandy concretions giving a "pimply" effect. The upper contact is gradational	1 - 0
Coal No. 5	2 - 1
Shale, soft, black	2 - 6
Limestone, concretionary	0 - 3
Shale	
Limestone, mostly black, dense rounded concretions varying from 4" to 1' thick. These were not searched for fossils	1 - 0
Creek level	

The greatest thickness of coal No. 5 seen in this area is 26 inches. This exposure occurs southeast of Hazel Dell School, along a tributary ~~of~~ to Court Creek in the NE$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Sec. 9, T. 11 N., R. 2 E.

Pennsylvanian system

Carbondale formation

St. David cyclothem	
Shale, dark gray	1 - 0
Shale, soft, black	0 - 6
Shale, lower 1' black, hard, brittle, and "pimply"; upper 6" softer	2 - 0
Coal No. 5, small lenses of pyrite 5" from top	2 - 2
Shale, or underclay, light colored and soft at the top grading into black at base Several sandy layers	2 - 6
Limestone, gray, non-fossiliferous	1 - 0
Shale, soft, black	0 - 6
Limestone, concretionary, gray, discontinuous	0 - 1
Conglomerate, fine-grained, firmly cemented, black limestone pebbles	1 - 3
Summum cyclothem	
Shale, very light gray, breaks in angular pieces	2 - 0
Base concealed.	

At one time a 2 foot seam of coal No. 5 was mined by the drift method in the southwest corner of Section 10, T. 11 N., R. 2 E. along a tributary to Court Creek. Apparently considerable coal was taken from this small mine. A similar mine was opened in a 2 foot seam of coal No. 5 in Henderson Township along a north-south tributary to ~~Henderson~~ Pope Creek in the NW$\frac{1}{4}$ of Section 32. A four foot thickness of No. 5 may be seen just north of the center of section 15, T. 9N., R. 1E. (Indian Point twp) southeast of Abingdon.

Strata above coal No.5.

The strata above coal No. 5 consist of a marine black shale which is usually hard and brittle near the coal and softer in the upper part. Its thickness usually does not exceed 2½ feet. The hard and brittle lower portion of this shale contains, as a rule a large number of sandy (sometimes calcareous) concretions which are about the size of a large marble (less than 1" maximum diameter). The centers of the concretions usually contain sand grains and/or plant fragments which serve as a nucleus. This shale cannot be positively distinguished from a similar one which occurs above coal No. 2. If anything is characteristic of this one it is the fact that it grades upward into a soft black shale. The hard black shale over coal No. 2 rarely does this. Coal No. 5 is always overlain by this hard black shale. Coal No. 2 is commonly overlain by a varying amount of the gray Francis Creek shale which separates it from the hard black shale similar to that overlying No. 5 coal.

The black shale is sometimes followed in age order by a thin marine limestone. It is gray and dense and is sometimes fossiliferous. Its thickness usually does not exceed 6 inches but thicknesses of 10-12 inches have been seen. The limestone is local, especially in the southern part of the area shown as St. David on the ~~geologic~~ cyclothem map. Wanless has called this layer the St. David limestone for the town of St. David in Fulton, County, where it is well exposed. The Canton shale occurs above the St. David limestone. Where the limestone is absent the Canton is separated from coal No. 5 by a black shale which is commonly fissile, hard and brittle, and in addition there is often a medium gray fossiliferous shale less than a foot in thickness on top of the black. The Canton shale itself is usually non-fossiliferous and has a clear pearly gray color with limonite stains along its very obscure bedding planes. In one section a stray limestone layer occurs which has been interpreted by Wanless as a part of the Canton shale. This outcrop occurs along a large ravine on the north side of Middle Creek a short distance south from the east-west road in the NW$\frac{1}{4}$ of Sec. 3, T. 12 N., R. 2 E. The west section line bisects the outcrop. At this locality only 5 or 6 feet of the Canton shale was exposed when examined and below the upper 1 foot there is 2 feet of nodular limestone. The upper 1 foot of the limestone is massive and the lower part is in slabby layers 2", 4" and 6" thick. It is light gray, fine-grained and weathers light brown. The rock is non-fossiliferous, except in the lower 6" where there are a number of dark specks of irregular size and shape which may ~~be~~ represent organic remains. In a small branch to the south there is as much as 5 feet of limestone at the same horizon. Here there is an upper nodular layer 3 feet thick and a lower 2 foot massive layer separated by 1 foot of light gray shale. The entire succession is

St. David cyclothem

Shale, gray (Canton)	1 - 0
Limestone	2 to 5'
Shale, gray	1 - 0
Covered	4 - 0
Shale, greenish gray, blocky	2 - 0
Base concealed.	

So far no adequate explanation can be offered for the presence of this limestone at this horizon. So far as known no similar occurrence has been found elsewhere.

Brereton cyclothem

This part of the section is represented by a single outcrop of the Cuba sandstone in the SE$\frac{1}{4}$ of section 3 of Knox Township, along the north-south tributary to Middle Creek. The Cuba sandstone here is thin-bedded and slabby. It is medium grained and is not very firmly cemented. It occurs in the hills above creek level. The details of this section are given on page 62.

Pleistocene System

Introduction

In 1839[1] Lyell first used the term Pleistocene, but since that date

[1] See fn. on next page

the name has been redefined, and Forbes gave the present stratigraphic significance to the term in 1846.[2]

[2] Forbes, Edward, See fn 2 on p. 69

Pleistocene deposits are characteristically heterogeneous, unstratified, and unconsolidated stony clays. They are the sort of materials left by present day glaciers in Greenland, Alaska, and elsewhere. These deposits are often interspersed with more orderly stratified and assorted materials distributed by the water released by the melting ice.

The Pleistocene of North America has been divided into five glacial and four interglacial epochs. All of these ~~epochs~~ stages (See table on page 94) above ~~with the possible exception of~~ the Kansan are represented in the Galesburg and Monmouth quadrangles. The entire area has been glaciated but in places the debris has been swept away by rainwash. (The Kansan drift occurs just below the surface at the Floyd township locality given below.

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1 Lyell, C., Elements of Geology, French translation, appendix, pp 616-621, Paris, 1839, Lyell, C., Charlesworth's Magazine of Natural History, Vol. 3, p 323, fn., 1839.

Pre-Illinoian deposits

The only evidence of glacial materials older than Illinoian drift in this area occurs near the center of Section 12, T. 10 N., R. 1 W. (Floyd twp) Warren County, along a tributary to Latimer Creek. In an east-west road cut at this place a few feet of loose unconsolidated, stratified, oxidized and leached silts and sands are overlain by a completely leached peaty soil zone about 18 inches thick, and above this is 5 or 6 feet of calcareous Illinoian till. It is thought that these lower materials may represent water deposits probably in Kansan time, and that the carbonaceous zone above is the Yarmouth soil layer. This explanation seems likely since the overlying Illinoian till is markedly calcareous and the two lower layers are completely leached. The top of a flowing (artesian) well nearby is a little below that of the Yarmouth soil layer. The well passes through 76 feet of drift and produced a good flow from a sand lental. Since bed rock was not reached the exact thickness of pre-Illinoian deposits is not known. The presence of two drifts is no doubt in part

2 Forbes, Edward, (On the connection between the distribution of the existing fauna and flora of the British Isles, and the geological changes which have affected their area, especially during the epoch of the Northern Drift: Great Britain Geol. Survey Memoir, vol. 1, pp. 402-402, 1946.

responsible for the paucity of Pennsylvanian outcrops along the streams in the western portion of the area. Kansan till was identified by Dr. Ekblaw in 1935 in Sec. 14, T.9.N., R.2 E. (Chestnut Twp.) Knox County, just east of the Galesburg Quadrangle. At this place 6 feet of glacial gravel and 8-10 feet of Illinoian till occur above the Kansan. This locality is described on p. 74.

Illinoian Deposits

To distinguish one drift sheet from another and assign a definite time of deposition to it is not so easy as in the case of consolidated deposits, such as limestones. Several reasons for this have been pointed out:[1] (1) In many places, the last ice sheet to invade a region confuses all earlier glacial records. (2) Older drift sheets have sustained much

1 Bretz, H., Geology and Mineral Resources of the Kings Quadrangle, Ill. State Geol. Surv. Bull. 43 (1923) 278.

erosion, and they are fragmentary along their margins. Exact relationships of these separate portions are difficult to determine. (3) Erosion has progressed at different rates in different parts of the same drift, due to variations in rainfall and differences in stream gradients.

Illinoian till of the Labradorean field has one dependable lithologic distinction from tills of the Keewatin field; namely, jasper conglomerate (white quartzite matrix with red jasper fragments) boulders from the vicinity of Georgian Bay were not transported by pre-Illinoian ice sheets. Fragments of this rock are not common in these ~~Galesburg~~ areas, but a few were found.

Except along deeply eroded portions of stream valleys, Illinoian till covers the entire quadrangle. Where unweathered it is a bluish-gray, stony clay. It weathers to a yellowish or rusty ~~to~~ earthy-gray. The till contains considerable sand in lenticular masses of irregular size. The clay and sand represent, in part, older materials from below the till which have been ground to fragments through ice abrasion. Also, some of the clay, or "rock-flour", and sand doubtless are from fragments of rock the parent ledges of which were far to the northeast. The pebbles, cobbles, and boulders are composed of crystalline igneous and metamorphic rocks from Canada and elsewhere to the northeast. Dolomite is particularly common in the till, while limestone and chert fragments are somewhat fewer in number. Much of this material came from dolomite formations in the northeastern Illinois and adjacent parts of Wisconsin. (See Figs. and).

The drift is thickest where the pre-glacial land surfaces are most deeply buried. ~~on the watershed upon which Galesburg is located.~~ The bed-rock surface map shows a pre-glacial valley west of the center of Galesburg and trending NE-SW to south. The drift is greater than 130 feet in Sec. 1, Floyd, Township, Warren County.

Leverett[1] reports the drift to be 80 or 90 feet thick for a distance of 5 or 6 miles northeast from Galesburg, "but within a short distance in other directions rock is found at much shallower depths." The accompanying bedrock surface map shows this statement to be essentially correct and also adds many other details. He estimates a thickness of 35 feet" to fairly represent the upland average for (Knox) county."

The average thickness of drift in 6 drilled wells in Galesburg is 63 feet, although the well at Knox College ~~in Galesburg~~ passed ~~through~~ 90 feet of Pleistocene material. 100 feet of drift were drilled in the Monmouth City well. These estimates include the surface soil and loess. Several of the dug wells did not reach bed rock, others reached a bluish gray shale at the top of the Pennsylvanian which is differentiated from some glacial clays only with difficulty. The bedrock surface map shows the depth to bedrock for all wells for which reliable information could be obtained.

A study of logs from about 1600 dug wells in Galesburg furnished by Mr. Jelliff and local drillers ~~and the City Water Works Office~~ has given the following average section:

	Thickness Ft.	Thickness In.
Peorian loess		
(1) Soil, black humus		18
(2) Clay, yellow	9 - 10	
Sangamon soil		
(3) Subsoil		18
Illinoian gumbotil and till		
(4) Clay, yellow, and gravel		6- 18
(5) Clay, hard, yellow	2 - 3	
(6) Clay, blue, tight	2 - 16	
(7) Sand, white or yellow	2 - 18	

Most shallow wells in Galesburg are not dug below sand 7 which is generally a good aquifer. Impervious clay 6 above serves to hold the water in 7, frequently under sufficient head to produce some artesian effect. This generalized section is the one relied upon by all local drillers of shallow wells.

[1] Leverett, F., The Illinois Glacial Lobe, U.S. Geol. Surv. Mono. 38 (1899) 677

In nearly all parts of the area the top of the Illinoian till is found to grade up into a layer of dark-gray clay ranging from $1\frac{1}{2}$ to 4 feet thick. This clay is completely leached and oxidized. None of the outcrops showed any lamination. Its most characteristic features are (1) an irregular starch-like fracture when wet, (2) very sticky when wet, and hard and tenacious when dry, and (3) the only coarse materials are very resistant, commonly quartz or chert of small size and very well rounded.

This clay layer found on top of Illinoian and older drifts has been given various names. The one best established is "gumbotil" introduced by Kay.[1] This name was assigned in order to suggest the nature of the material and its origin.

[1] Kay, G. F., Gumbotil, a new term in Pleistocene geology, Science n.s. 44 ~~(1916)~~ pp. 637-638, 1916

Its origin will be briefly discussed later.[2]

Gumbotil was developed at two distinct topographic levels in the Galesburg quadrangle; (1) always on old uplands of Illinoian drift, and (2) occasionally at intermediate levels in pre-Illinoian valleys that were but partially filled with Illinoian drift. (Fig.). No marked differences were discerned between the two gumbotils. This second type of development is well displayed in the southeastern portion of the area.

[2] An exhaustive discussion of gumbotil and related products may be found in Leighton, M.M. & MacClintock, Paul; Weathered Zones of the Drift-sheets of Illinois, Ill. Geol. Survey [illegible] No. 20, 1930

Gumbotil was found in all parts of the area in highway and railroad cuts and also in auger drill holes. The following examples will serve to indicate many that might be given.

Cut along State Highway No. 41 on south side of Dago Slough.

	Thickness Ft.	In.
Peorian		
Soil, loessal, dark brown..........	1	9
Loess, yellow, leached.............	5	6
Loess, calcareous, gray............	1	
Sangamon		
Old soil, dark, peaty..............	1	6
Loess-like silt, gray..............	1	6
Illinoian		
Gumbotil, dark gray, leached, with small rounded pebbles of quartz and chert..................	3	
Till, light brown, leached, with large partly decomposed boulders of igneous rocks, and much chert..	4	

Gumbotil is also well exposed in the NE.¼ Sec. 23, T. 10 N., R. 1 E.

	Thickness Ft.	In.
Peorian		
Loess, yellowish, non-fossilferous, leached..............	8	
Illinoian		
Gumbotil, dark gray, leached, with small rounded quartz pebbles..	2	
Till, light brown, leached..........	2	6

In the southeast part of the Galesburg map area Illinoian gravel appears to have collected in pre-Illinoian topographic depressions with the result that sometimes it has been cemented into a conglomerate. Such appears to be the explanation of an occurrence ~~case~~ in the NE.$\frac{1}{4}$ Sec. 10, T. 9 N., R. 2 E., where the following section is exposed:

	Thickness Ft.	In.
Sangamon (?)		
Loess-like silt, dark gray.......	2	
Illinoian		
Till, sandy, with gravel and few boulders.................	6-8	
Gravel ~~Till~~, conglomerate, loosely cemented, well rounded pebbles and cobbles. Heterogeneous. Contains fragments of Pennsylvanian coal and black shale. Where thinnest a layer of peaty soil with oily odor overlies conglomerate...........	2-2$\frac{1}{2}$	
Pennsylvanian		

Also, in the bed of a small stream in the SW $\frac{1}{4}$ of Sec. 14, T. 9 N., R. 2 E. just beyond the eastern limit of the quadrangle 5 or 6 feet of firmly cemented glacial conglomerate is exposed. It lies upon greenish gray shale of Pennsylvanian ~~green~~ age, probably the Purington shale. ~~Shale.~~ It is composed of a poorly assorted heterogeneous mass of pebbles, cobbles, and boulders. The majority of the fragments are black and ~~brown~~ chert, and gray to red quartzite, but there are a few igneous and limestone pieces. Coal and black papery shale fragments are common. One pebble of white chert contained a fragment of the compound coral Favosites, while another contained a Tetracamera-like brachiopod. The conglomerate is very firmly cemented with limonite and forms a small falls in the stream. (This gravel is beneath the floodplain of the present stream and may have been cemented since the present stream terrace was formed.

In the SW $\frac{1}{4}$ of Sec. 34, T. 10 N., R. 2 W. along the south bank of Pig Creek is 3 or 4 feet of coarse Pleistocene quartz grit, or very coarse sandstone, loosely cemented with limonite.

All of these features just described are closely associated with morainal drift as shown in the southeastern corner of the Galesburg geologic map. This drift occurs in a few hummocky hills, in the southeast corner of the Galesburg area, comprising a considerable thickness (exact amount unknown) of gravelly and sandy clay and boulders, with a covering of loess. These morainal occurrences are considered a continuation of those occurring in the Avon area to the south.[1] Exact correlation of this moraine is not possible in the present state of knowledge but it is tentatively considered Illinoian.

1 Savage, T. E., Geology and Mineral Resources of the Avon and Canton Quadrangles, Illinois State Geol. Surv. Bull. 38, Plate I.

Sangamon interglacial deposits

The Sangamon soil zone was first recognized by Worthen[2] from well drilling data furnished him by Mr. Joseph Mitchell. The name Sangamon was applied to the layer since the original section came from northern Sangamon County, Illinois. It was as follows:

2 Worthen, A. H., Geol. of Illinois. Vol. 5, pp. 306-319, 1873.

		Thickness Feet
	Soil	1 - 1½
Loess	Clay, yellow	3
	Clay, white, jointed, with shells	5 - 8
Sangamon	Muck, black, with fragments of wood	3 - 8
Gumbotil	Boulder clay, blue-colored	8 -10
Till +	Hardpan, gray, very hard	2
perhaps some Pennsylvanian shale	Clay, soft, blue, without boulders	20-40

Worthen states that the bed overlying black muck is undoubtedly loess, also that the black muck indicates conditions suitable for the growth of arboreal vegetation in the interval between the deposition of the boulder clay and the overlying loess.

Near Ashland, Illinois, the Sangamon soil occupies 22 out of 84½ feet of the drift in a coal shaft section.

In Cumberland, Coles, and Shelby counties, T. C. Chamberlin and F. Leverett noted many branching tubes, 1 to 2 inches in diameter, in this old soil below 15 feet of loess. These extended more than 15 inches below the old soil zone. This and correlative evidence brought them to the conclusion that a forest existed in that region during Sangamon times.[1]

1 the weathered zone (Sangmon) between the Iowan loess and Illinoian till sheet, Leverett, F., Journ. Geol. 6 (1898) 179

"Excellent exposures of black soil (Sangamon) and leached sub-soil are found along the Santa Fe Railway in eastern Knox County. The soil may be seen distinctly at a distance of nearly one-quarter mile. It is of a deep black color resembling the surface muck found in flat portions of the uplands. The till beneath has been leached to a depth of about 4 feet. The (overlying) loess has a thickness of 12 feet and is slightly calcareous in the lower portion. The entire leaching of the till may confidently be feferred to a date earlier than the loess deposition."[2]

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[2] Leverett, F., Op. Cit.

At Galva 22 miles northeast of Galesburg a large log was removed from a 2-foot Sangamon soil layer.

The Sangamon soil zone was recognized everywhere in the Galesburg area that boring tests were made. In the northern part of the area the average thickness is about 4 feet while in the southeastern portion 2 feet is a common thickness. It is often absent on slope exposures.

Section exposed in road out in the SE. ¼ of sec. 5, T. 9 N., R. 2 E.

	Thickness Ft.	In.
Peorian		
Soil, loessial, black to grayish black, changing below into..	2	
Loess, brownish-yellow to grayish-yellow, with streaks of limonite, non-calcareous..	7	
Sangamon		
Old soil, brownish-gray at top to chocolate brown in middle with fragments of wood and much organic material, with distinct odor...............	3	
Loess-like silt, tenaceous, black to drab, with scattered sand grains..................	1	6
Illinoian		
Till, dark, pebbly, probably gradation zone from Sangamon soil into Illinoian till. Non-calcareous...............	1	

Late Iowan-Early Peorian loess

Loess is the name given to a fine-grained silt-like wind-blown deposit composed of very small angular undecomposed mineral particles. Quartz predominates, but feldspar, hornblende, calcite, dolomite, and a few other minerals are common.

The loess covered area in the Mississippi Valley is chiefly confined to the surface of Kansas and Illinoian drift sheets and the Driftless Area. It is largely included between the Missouri and Wabash rivers, occurring but a few miles west of Missouri River, and extending east of Wabash River in the vicinity of Ohio River for several miles east of Cincinnati. The loess extends for several miles east of Cincinnati. South of Ohio River the loess is chiefly limited to a rather narrow belt adjacent to Mississippi River, nearly to its mouth.[1]

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[1] Savage, T. E., The loess in Illinois, its origin and age, Ill. Acad. Sci. Trans. 8 ~~(1916)~~ pp. 100-117, 1916

The entire surface of the Galesburg and Monmouth quadrangles is loess covered except in the valleys of the larger streams where it has been removed by recent erosion. The total relief of the pre-loessian surface in these areas is thought not to exceed 150 feet.

The thickness of the loess in this area ranges from a thin film, or total absence, to 28 feet. The average thickness of loess in 77 measured sections scattered over the entire area is nine feet four inches. Measured thicknesses in various parts of the area follow. These sections are of 3 types (1) exposures, (2) coal test drillings, and (3) auger drillings. Type (2) constitute most of the data in the northeast part of the area and are not considered absolutely reliable.

Part of Galesburg area	No. of sections	Average thickness
Northwest	13	16 feet
Northeast	16	9 feet
Central	18	6 feet
Southeast	20	8 feet
Southwest	10	8 feet

The relation of the loess to underlying drift is a variable factor depending upon (1) the nature of valley slope, (2) exposure to rainfall and sunshine, and(3) direction of prevailing winds. When a stream is rapidly undercutting the valley wall is steep, and the loess breaks off abruptly at the top of the till. Its physical constitution is such that it will remain in nearly vertical cliffs although almost entirely uncemented.

In some valleys the loess is found to overlap the upper edge of the till and extend down into the valley considerably below the upper level of the drift. Such slopes are usually gentle and indicate that undercutting has not been active for a considerable length of time. The loess over the slopes below the upper level of drift may be accounted for in 2 possible ways: (1) It may have been brought down from higher levels by slumping and sheet wash; and (2) it may have been carried up by winds from flood plains or other exposed areas and deposited on the slopes where it is now found. Savage has given adequate reasons why ~~this~~ most of the loess must be considered as being in its original position of deposition.

One of the most marked characteristic features of loess is its abundant

$CaCO_3$ concretions of varied and fantastic shapes. Figure shows some of those collected in this area. Such concretions in loess have been called "loesskindchen," (little children of the loess).

In many places in the Mississippi Valley the loess contains a notable number of entire fragile shells of air-breathing gastropods. These forms represent those now living on dry woodland slopes. Only one occurrence of loess fossils has been discovered in Galesburg quadrangle. The following species have been identified by F. C. Baker, Curator, Illinois Museum of Nat. History, from a 12-foot road cut section in the SW $\frac{1}{4}$ Sec. 33, T. 11 N., R. 2 E.:

(1) Vallonia gracilicosta Reinhard
(2) Cochlicopa lubrica (Muller)
(3) Galba parva (Lea)
(4) Gonyodiscus shimekii (Pilsbry)
(5) Vertigo modesta Gould
(6) Succinea grosvenori gelida F. C. Baker
(7) Sphyradium alticolum (Ingersoll)

Of these species only No. 4 is considered a guide fossil to Peorian loess. Species (2) and (3) are the only members of this group that are represented by forms now living in Illinois. Number (3) is the only aquatic form represented. Its habitat was very shallow mud flats of temporary duration. Species (5), (6), and (7) are typically dry, cold climate land molluscs, while (1), (2), and (4) are land forms of somewhat amphibious habits.

Sand and silt terraces

A few small terraces composed of sand and silt occur along Cedar Creek in

At two places in the Monmouth quadrangle considerable quantities of glacial sand have accumulated apparently along old pre-glacial depressions. (1) The larger of the 2 deposits is located on the south side of Cedar Creek in the ~~[illegible]~~ NE ¼, of the NW ¼ Sec. 20, T. 9 N., R 1 W. (Berwick Twp.) and (2) the second is in the NE ¼ of Sec. 19 of the same township in a small ravine that crosses the east-west road.

It is difficult to say positively that Illinoian till is on top of these sand deposits, but in (1) the larger ~~this~~ is almost certainly the case. There is still the chance however that the margin of an old till valley wall has slumped down over the sand. In any event the sand is probably not older than Illinoian in age. ~~In many cases~~ In the 2 places cited the sand rests on bedrock.

~~(A sieve analysis + physical description by Lamar should be inserted here.) From Lamar's analysis a suggestion regarding possible uses may be made.~~

This should be in Economic Geology section.

the Western part of the Galesburg area. These are not of any important size. They consist of silt with some layers and lenses of fine sand overlain by a dark soil layer (probably Sangamon) and variable thicknesses of late Iowan-early Peorian loess.

The topographic situation of these terraces, i.e. along westward flowing streams, suggests that the terraces may represent outwash from Illinoian ice. However, their fine texture and nearness to the position of the former front of the ice would argue against this conclusion. The remnants are too few and small to give complete data necessary to settle this point. (Insert p. 81a here.)

Recent Deposits

The term "Recent" is used here to include deposits made since the deposition of late Iowan-early Peorian loess. Such deposits ~~are few and relatively insignificant.~~ are alluvium and dust and important only locally where they add materially to the soil supply.

Alluvium

The larger streams of the quadrangle have cut a few tens of feet into Illinoian till and overlying loess. The floors of some of their valleys are covered with recently deposited mud, sand, and gravel. Most of the material is fine and was left during flood time. This flood plain material has been augmented considerably by swamp accumulations on low wet lands.

Wind blown material

Some wind blown dust is accumulating in favorable places over the area but in such insignificant quantities that it is entirely leached as rapidly as it collects. It is safe to conclude that the rate of accumulation of wind blown material is very much lower than during late Iowan-early Peorian time, when the loess described above was deposited.

Chapter IV

Structural Geology

Structural geology is that phase of the science that has to do with the attitude of the rocks and the interpretation of their position. Their positions determine the structures which they form and these in turn can then be studied in their relation to the movements of the earth which produced them.

The best way to make these structures clearly visible is to choose some key bed and plot its elevations on a map and connect points of equal elevation with structure contours. The contours show the irregularities of the surface of the key bed. When the key bed is exposed at the surface it is possible to run accurate instrument levels upon them. Structure contours thus determined are accurate within the limit of the contour interval, which is 25 feet in this report. Where the key bed is covered elevations upon it are determined indirectly, if at all, from mine records and well logs. If an accurate record has been kept on the surface elevation the elevation of the key bed can be accurately determined. Maps of the structure of the Monmouth and Galesburg areas are given on Plates ____ ____________________________.

Structure maps are of importance, not only because they reveal the nature and time of deformation, but also because they provide data by which it is possible to determine the depth to aquifers, the probable distribution of coal beds, and localities worthy of testing for oil and gas, and other mineral resources.

Data used

The data on structural geology for the Galesburg and Monmouth quadrangles were obtained from outcrops and from the records of wells, mine shafts and test-borings for coal. Accurate elevations on Rock Island (No. 1) coal, Colchester (No. 2) coal, and Springfield (No. 5) coal were determined by a planetable survey. Other elevations were determined approximately from the topographic map and except on steep slopes these approximations have a maximum possible error of not more than 20 feet, i.e. the amount of the contour interval of the map used.

The datum points from which the Pennsylvanian structure contours in these quadrangles were determined are widely scattered over the areas, but are naturally most numerous along the deeper stream channels. The data on Pre-Pennsylvanian strata were obtained from several water wells in Monmouth, Galesburg and other towns, and from coal test drill holes.

Pennsylvanian Structures

Structure of the Rock Island (No. 1) coal.

The Rock Island (No. 1) coal does not outcrop in the Galesburg quadrangle although there is one exposure which is very near the south boundary line. This outcrop is described under the Seville cyclothem on page 44. In the Monmouth quadrangle this coal is also very local, probably most of it has been removed by erosion. The few places where a reasonably accurate elevation can be determined is shown on Plate____, but these are insufficient to indicate the structure of the seam. Wanless[1] points out that in the Alexis area "the general structure

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1 Wanless, H. R., Geology and Mineral Resources of the Alexis Quadrangle, Ill. Geol. Surv. Bull. 57, p. 111, 1929.

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of the coal (No. 1) appears to be comprised of domes separated by gentle depressions." Doubtless the same general type of structure prevails where this coal is present in the Monmouth map area. The Rock Island (No. 1) coal in the Galesburg area has not been identified in a sufficient number of the available drill logs to determine its structure, except in local coal fields where it is known to be lenticular and to rise and lower as much as 6 feet in 100 yards.

Structure of the Colchester (No. 2) coal

The elevation of the Colchester (No. 2) coal has been determined accurately in a number of places in the south half of the Galesburg area and in a few scattered places in the Monmouth area. Plate____shows the structure as determined from these elevations. The data from the Alexis area was copied from Wanless' report on that area. His statement[1] that "in the southeast part of the quadrangle the Colchester (No. 2) coal lies on the south side of a synclinal basin plunging toward the east or southeast" should be modified to indicate that the Syncline is probably plunging east-northeast rather than southeast. The altitudes of the Colchester coal in these areas range from 624 to 704, and possibly to 725 feet above sea-level.

The structures within the Galesburg quadrangle as outlined by the writer in 1927(1) have proven to be partially incorrect due to the failure at that time to make a distinction between Colchester (No. 2) coal and Springfield (No. 5) coal. After allowing for these corrections the ill-defined Court Creek dome and the Abingdom dome as then described ceased to exist. The Haw Creek dome now appears to be more of a monoclinal flexure than a true dome. At any rate the northwest closure is not clearly marked. The Colchester coal in this vicinity dips southeast about 16 feet to the mile. The structure of the large covered area in the northern half of the Galesburg area is not known but the structure map indicates that this may be a dome-like region and that probably most of Colchester (No. 2) coal has been removed by erosion.

The structure of the northeast part of the Monmouth quadrangle is poorly defined, but it appears to be a broad, ~~gently sloping~~ dome gently sloping eastward.

(1) Poor, R.S. – Oil Possibilities of the Galesburg Quadrangle, Knox and Warren Counties, Ill. Geol. Surv. Ill. Petroleum No. 9., June 18, 1927.

Structure of the Springfield (No. 5) coal

The Springfield (No. 5) coal has been eroded from the Monmouth area and the only occurrences of this coal in the Galesburg quadrangle are along creeks tributary to Pope Creek in Henderson Township, ~~Henderson~~ Court and and Middle creeks and a few isolated places along the upper part of Haw Creek. The altitudes of the Springfield coal in this area range from 715 to 751 feet, but most of them are about 740. (See coal map, plate — ?) These elevations indicate that this coal seam is essentially flat, although it is higher where Colchester (No. 2) coal is highest in the southeast part of Galesburg Township and the adjoining part of Knox Township. The data are insufficient to determine the structure more accurately.

Minor Structural Features

Small displacements of rock layers have been reported by mine operators within these areas but these minor faults are rarely seen at the surface. Such minor faults or rock displacements that occur in the coal beds are thought to be due usually to uneven settling during the time the rock was hardening.

There are a few places where the glacial ice has shoved the more firmly consolidated rock over underlying soft shales, thus producing minor flexures in the rock. Such structures are well exposed in a small ravine east of the north-south road in the SW $\frac{1}{4}$ of the NE$\frac{1}{4}$ of Sec. 23, T. 11 N., R. 1 W., Colbery Township, and at a few other localities.

Chapter V.

GEOLOGIC HISTORY

Introductory Statement

The interpretation of geologic history is dependent upon a knowledge of the rocks of the region. Theoretically, the accuracy of the interpreted history is in direct proportion to the number of good rock exposures and accurate well logs. Practically, however, the geologist is able to make reasonable inferences from a knowledge of adjacent regions even though the available record is acant. There are anavoidable imperfections in the record due to few drill records and the fact that those available are often from localized areas.

The succession of events in this area from the beginning of the Paleozoic to the latest Mississippian has been gained from the records of deep drillings and exposures along the deeper creek valleys, especially in the Monmouth area. Times of submergence, direction of advance of invading seas, and the general character of old submerged land surfaces can be described from these records with a fair degree of accuracy. The Galesburg-Monmouth map-area, so far as known, was not a site of deposition during Mesozoic and Tertiary, but the history of these intervals may be partially inferred from the nature of their depositional record left in other parts of the country. The record of a considerable portion of the Quarternary period is available in deposits occurring upon the surface of the bed rock as a mantle of glacial drift of variable thickness, and in interglacial soils.

Workman shall insert here the Pre-Pennsylvanian history. I have all of this written in 1st draft & he may want to revise it considerably or rewrite entirely.

A B Poor

Pennsylvanian period

The record is clear that most of northern and western Illinois was exposed to erosion during a considerable period in late Mississippian time. So far as known no Upper Mississippian (Chester) seas covered this part of the country. St. Louis limestone is known to occur, however, just south of the Galesburg quadrangle. Hence, the erosion interval was equal in length to the time necessary for the deposition of more than 1200 feet of sediments (Ste. Genevieve and Chester) in southern Illinois. This erosion interval was of sufficient duration to allow these quadrangles and neighboring areas to be reduced to a broad plain of low relief. There are no records showing pre-Pennsylvanian topography with more than 150 feet relief. Probably most of it has a relief of less magnitude.

Pennsylvanian time was initiated in this area by erosion also. At least, it is thought that our oldest Pennsylvanian strata are upper Pottsville in age. So then, this long interval of erosion mentioned above has produced a great gap (hiatus) in the record equivalent in time to the sum total of Ste. Genevieve, Chester, and Lower and Middle Pottsville.

The Upper Pottsville sea entered the Illinois basin in a broad advance from the southeast. The lowest portion of this basin was in White and Edwards counties. The sea was doubtless slow-advancing and shallow. In southern Illinois thick deposits of coarse sand and conglomerate were laid down. The sea was fed in part by northward flowing streams draining old land masses composed of Silurian, Devonian, and Mississippian rocks.[1]

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[1] Poor, R. S., The Character and Significance of the Basal Conglomerate of the Pennsylvanian System in Southern Illinois, Ill. Acad. Sci. 18 (1925) 369-375

The early record in Illinois farther north and west indicates marginal phases of this sea. These quadrangles lie near what appears to have been the western border of this basin. It seems likely, however, that during the latter part of the period arms of the sea extended farther west and north into Iowa and adjacent regions. Ekblaw[2] has traced out the channel phase of the Pleasantview sandstone in part and found that this stream flowed southwest with several tributaries joining it from the northwest. Pleasantview time however is in the later Carbondale time.

[2] Ekblaw, S.E., Channel deposits of the Pleasantview sandstone in Western Illinois, Ill. State Acad. Sci. Trans. Vol. 23, no. 3, pp. 391-399, 1931

Pottsville time in these areas was characterized by rather distinct alternating marine and continental conditions. The horizons carrying marine remains are relatively few but of considerable thickness. Likewise the coal-forming, continental conditions were of considerable duration. Pottsville coal in these areas varies from 4 feet to 5'6" in thickness. The swamps apparently were patchy during the deposition of No. 1 coal, since all of the known coal seams are lenticular. Yet the swamps apparently existed along irregularly subsiding shore lines, such that, after slow accumulation, marine waters could ~~or great bodies of fresh water could~~, when subsidence took place, kill out the vegetation, overflow the swamp and bury its peat under rapidly accumulating fragmental sediments. ~~The upstanding tree trunks in the La Salle and other regions were buried before they fell over.~~

~~In the hollow trunks of some of the trees left standing in old Nova Scotia Pennsylvanian coal swamps some of the insects which inhabited them were fossilized.~~

The seas were shallow and the conditions ever changing. Recently[1] it has been suggested that periodic glaciation during Pennsylvanian time was responsible for these frequent changes. Thus, in certain parts

~~2 Kemp, J. F., Geol. Soc. Amer. Bull. 33 (1922) 328.~~

of these quadrangles as many as 6 or 7 thin coals were developed between the principal coals, Rock Island (No. 1) and Colchester (No. 2). This constantly repeated alternation between marine and fresh-water sedimentation is one of the most striking features about the Pennsylvanian of Illinois. Such conditions apparently can only be interpreted as those characteristic of flat coastal plains, with swamps of fresh water and a not very distant ocean. (Repeated glacier formation & melting is a more feasible explanation than diastrophic movements to explain these alternations.

Carbondale time was not markedly different from the Pottsville. That part of this formation exposed in these quadrangles would indicate a somewhat more stable set of conditions perhaps, or at any rate a situation capable of allowing a widespread continuous swamp. Colchester (No. 2) coal maintains an average thickness of 30 inches throughout these areas as well as much of the adjoining

(1) Wanless, H.R. & Shepard, F.P.- Glacial control paper. Title not recalled. Science 1935

territory. The succession of strata above Colchester coal also indicates widespread similar conditions, since they may be found in all parts of the area in almost exactly the same characteristic development.

Post-Pennsylvanian-pre-Pleistocene interval

So far as known these quadrangles, as well as most of Illinois, remained an erosional area between Pennsylvanian and Pleistocene times. There is little evidence to prove that Mesozoic and Tertiary sediments were or were not laid down. ~~Occasional~~ Frequent smooth brown cherts on the uplands suggest Tertiary stream work.

Cenozoic Era

Pleistocene period

The Pleistocene is next to the last division of geologic time. It was probably the shortest period of all periods but one of the most critical in earth history. The distinguishing physical characteristic of this period was its extensive glaciation. It has been termed the "Great Ice Age." A thick mantle of heterogeneous material in some areas and great mechanical erosion in others give evidence to the former extent of great ice-bodies. This ice did not cover the entire earth's surface, and its former limits are fairly well known. Nearly all of the water of these ice-sheets had been taken from the ocean and precipitated as snow on the continents. It has been estimated that the decrease in temperature was sufficient to lower the snow line about 4000 feet below its present level. Oceans responded to this loss of water by a lowering of strand-line between 200 and 300 feet in some parts of the world.[1]

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[1] Pirsson, L. V. and Schuchert, C. S., Textbook of Geology, Part II (1915) 943. Daly, R. A., Amer. Journal Sci. 10 (1925) 281-313. Daly estimates the change of Late Wurm (of Europe) ~~is estimated~~ at approximately 40 meters.

There was a series of glaciations. Between each two glacial stages there existed a long mild interglacial stage. This alternation of glacial with temperate and mild climates had a marked influence on the migration and distribution of various forms of life during this period. The exposed marine life record is almost universally scanty, and of the molluscs found, at least 90 per cent are representatives of modern forms. The land life was mostly of present day ~~living~~ forms but here the percentage of extinct forms was much greater than in the seas. Lyell proposed the term Pleistocene to indicate that life of this time was very much like the present.

The following table shows the divisions of Pleistocene time in the first column as divided by Chamberlin and Salisbury. Statements concerning mammals in the second column are after O. P. Hay.[1]

1 The geological and geographical distribution of some Pleistocene mammals.
Hay, O. P., Science, n.s. 30 ~~(1909)~~ pp. 890-893, 1909

Other comments in this column are after Pirsson and Schuchert.

Divisions of Pleistocene time in North America

Wisconsin glacial stage Late Wisconsin Early Wisconsin	Spread of ice-sheets and drift. Fauna and flora driven south.
Peorian interglacial stage	Record not well determined. Formation of peat beds and soils. Wide distribution of loess.
Iowan glacial stage	Spread of ice-sheets and drift. Record not well determined.
Sangamon interglacial stage	Accumulation of peats, soils, and loess. Horses, elephants, mastodons, bison, peccaries, and tapirs probably present.
Illinoian glacial stage	Spread of ice-sheets and drift. Deposition of loess. Apparently 60 per cent of present land fauna then living. Mastodons, mammoths, horses, tapirs, bison, deer, and sabre-tooth tigers.
Yarmouth interglacial stage	Formation of peats, soils, and bluish loess. Animals same as in Illinoian.
Kansan glacial stage	Spread of ice-sheets and drift. Extinction of certain camels and horses.
Aftonian interglacial stage	A warm temperate fauna. Mastodons, elephants, horses, camels, sabre-tooth tigers, bears, etc.
Nebraskan glacial stage (First glaciation)	Spread of ice-sheets and drift. Includes pre-Kansas, Nebraskan, and Albertan drifts.

Glaciation in North America

The north one-half of North America was the main site of glaciation in this hemisphere during Pleistocene time. This phenomenon was very largely confined to the plains country rather than the mountainous. (Fig.).

During the last glacial epoch and probably former epochs there were three main centers of glacial accumulation and radiation in this country. The ice-sheet covered a total area of about 4,000,000 square miles. The Keewatin ice-sheet during the Kansas epoch was more extensive than either of the other two during any epoch. The Keewatin covered the central portion of North America southward into Missouri, as far as the present Missouri River, westward within 800 to 1000 miles of the Rocky Mountains. The Labradorean ice-sheet during Illinoian and also during a previous epoch was not much smaller, and extended from northern labrador southwestward for ~~1600~~ (1760?) miles to Ohio and Mississippi rivers. This ice-sheet covered the Galesburg and Monmouth quadrangles. The Cordilleran ice-sheet covered all of the Cordilleran area from Alaska southward into Oregon, Idaho, and Montana. Farther south there was local alpine glaciers in the Rocky Mountains.

The State of Illinois is known to have been subjected to 3, and probably 5, glacial stages; namely, Kansan, Illinoian, possibly Iowan, and early and late Wisconsin.

Pre-Illinoian till has been distinguished in various parts of the State. The ~~This~~ exact correlation of all exposures of this pre-Illinoian drift ~~known~~ with the Kansan is still in doubt. It seems probable that the Galesburg quadrangle and ~~the~~ Monmouth also was partially, if not entirely, covered by the Kansan ~~and the Illinoian~~ ice-sheet~~s~~. The ~~latter~~ Illinoian is known to have left a fairly thick mantle of drift and out-wash over the area. The presence of the Kansan is not so well established but it is thought that outwash materials from a pre-Illinoian ice-sheet have been found. (See ~~section~~ description on page 68).

Recent period

Degradation by streams, ground water, and temperature changes are the principal processes that have occurred in this area since glacial times. Leaching, solution, and transport of materials in suspension is going on constantly. As previously stated, some wind-blown dust is accumulating but the leaching is too rapid to allow it to collect in any considerable quantity as a true loess.

Chapter VI

Economic Geology

Introductory Statement

The most recent data on the mineral resources of the area including these ~~Galesburg~~ quadrangles was published for the year 1918.[1]

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1 Barrett, N. O., Mineral resources in Illinois in 1917 and 1918, Ill. State Geol. Surv. Bull. 38 pp. 25-112, 1922

Prior to 1925 there were no coal shipping mines in the Galesburg quadrangle. Statistics show a steady decline from 1905 to 1918 in the amount of coal produced in Knox County. Most of the mines included in the statistics, however, were located outside of ~~this~~ these quadrangles. As will be shown their has been some increase in the mining business within the past 10 years.

Clay Products

The manufacutre of clay products is one of the oldest industries in the Galesburg area.

The Purington Paving Brick Company (fig.) is the only plant in operation at the present time. This company manufactures vitrified paving brick as the main product. They also produce some face brick, hollow tile, and various types of drain tile. The total quantity and value of the production for 1918 is concealed in the report under "Other Counties." This was made necessary since it is the only manufacturer in the County. A fair estimate of the number of brick, tile, etc., produced for all purposes would be about 25,000 per year. The value fluctuates but would probably not exceed $5000.00.

The shale from which the Purington Paving Brick Company manufactures their brick is described under the Pennsylvanian system as the top bed of the Liverpool cyclothem, and has been called the Purington shale.

Insert drawing from my notes.

The shale is removed from a 45-foot bank (fig.) by steam shovel. The shale is fairly uniform throughout this cut, except that it grades laterally into a sandstone on the ~~north~~ east and ~~south~~ west sides of the pit. A central portion of the shale is rejected because it produced a glazed surface. It is a fatty shale and apparently runs high in alkalies, and alkali earths. The shale is overlain by a variable amount of glacial drift, loess, and soil. There is very little gravel in the drift. All but 4 or 5 feet of the loess is removed and this is ground in with the shale in the ratio of 1 part of loess to 2 parts of shale. This is claimed to give the proper mix for good face brick. No loess is used in making the vitrified brick for paving purposes.

The shale member is several feet thicker than the amount worked, but the lower portion is too sandy for present purposes ~~to be used~~. It became necessary to raise the working level 5 feet as the excavation proceeded eastward because of the increasing sand content of the lower portion.

An analysis of the shale shows: .

	Percent
SiO_2	58.48
Al_2O_3	
Fe_2O_3	29.41
FeO	
CaO	1.62
MgO	Trace
Organic matter and water............	7.20
Alkalies................................	not estimated
Loss and undetermined...............	3.29
	100.00

(Analysis furnished by ~~[illegible]~~ the company, R. A. Phillips, Supt., analyst unknown).

The Purington shale occurs over most of the quadrangle. An accurate estimate of reserve supply of this material is impossible however, because of the rapid variation in the character of the rock. Many places in the area other than the site chosen appear to have a shale of equal quality. South and east of the present quarry toward and in the vicinity of Knoxville the shale is thought to have a dependable brick-making quality. Plate ? shows areas where the Purington is known to exceed 15 feet in thickness. The upper part of Ham Creek is also a promising area. The sandy part of the Purington is in the lower part when present but exact amount cannot be foretold. The Abingdon Brick Co. formerly used this same shale, but the firm ceased manufacture in 1923.

The Abingdon Sanitary Manufacturing Company at Abingdon, produces considerable porcelain ware, but all of the raw materials used are imported.

Coal

(There is an accurate level on this shaft.)

Rock Island (No. 1) coal. The Galesburg Mining Company is the sole producer from this bed in the quadrangle. Their shaft was sunk early in 1925. (Fig.). The shaft is located on the north side of the Santa Fe R.R. in the center part of the SE¼, Sec. 16, Knox Twp. Their production is ~~small~~ about 1400 tons daily at present, ~~since they supply only local trade. During~~ The surface elevation at the shaft entry is 680(±)?. Coal No. 1 is 105 feet below the mouth of the shaft. In the upland part of this field No. 1 lies 242 feet below the surface.

The mine is served by a ~~the time of this investigation they were installing a~~ spur from the Santa Fe Railroad, and an excellent local truck trade is maintained. ~~At present they are producing less than 6000 short tons annually.~~

The coal is of good quality and is generally free from benches and partings in this area. Pyritic nodules, lenses, and seams are not common. The coal has an average thickness of about 52 inches at this mine. ~~It occurs 10 ft just below the surface~~. The final figures concerning the reserve supply of this vein in the area controlled by this company are not yet available, but the probable life of the mine at present production is thought to be around 10 or 12 years.

An analysis of the coal follows:

	As Received	Moisture free
Moisture....................	14.68	
Volatile matter............	36.48	42.75
Fixed carbon..............	41.61	48.78
Ash........................	7.23	8.47
Sulphur....................	4.74	5.55
Carbon dioxide............	.90	1.05
B.t.u......................	11,188	13,111

Unit coal, moisture, ash and sulphur free = 14,617 B.t.u.

(Analysis by the Dept. of Chemistry, Univ. of Illinois).

Colchester (No. 2) coal. The Colchester coal has been mined for many years by the drift method in numerous places over the quadrangle. No shipping mines have ever been operated, all of the coal removed being used locally. There are no reliable estimates available of the amount of coal that has been removed.

The Colchester coal is of fair quality. No analyses are known to have been made. It maintains an average thickness of 30 inches over approximately two-thirds of the area. The overburdem throughout this area averages less than 40 feet, and over considerable tracts the average thickness is less than 20 feet.

Stripping Possibilities of Coal No. 2.

In estimating the value of a given area for stripping purposes it is necessary to consider several factors other than the presence of a coal bed. The coal map (Plate ?) should be studied in connection with this discussion. The more important of these are (1) thickness and quality of the coal, (2) thickness and character of the overburden, (3) percentage of coal recoverable by stripping, (4) transportation and market, and (5) the value of the land to be stripped.

(1) Forty-eight inches of coal is a commonly accepted minimum for profitable commercial stripping operations. Coal of less thickness may be suitable under favorable circumstances, such as easily accessible markets and high demand for coal of the quality produced. The area in these quadrangles is very favorably situated as regards transportation and markets, but coal No. 2 never reaches 4 feet in thickness. Coal No. 5 offers greater possibility of stripping and will be described later.

(2) In some areas, the ratio of the thickness of overburden to the thickness of coal that can be profitably removed is 3 to 1. Elsewhere, where the coal is thick and of high quality, it is considered practicable to attempt 12 to 1. On this basis coal No. 2 cannot be profitably stripped on a large scale. Coal No. 5 will support several small scale operations and will be described later.

(3) An acre-foot of coal in the ground weighs about 1,770 short tons. A loss of only five per cent is obtainable under exceptionally favorable circumstances but 90 per cent recovery is a safer factor for the calculation of reserves.

(5) It is thought that the value of most of the land available for stripping would exceed that of the coal recovered where coal No. 2 is concerned. Where coal No. 5 is concerned this is not necessarily true.

Coal No. 5.

As will be seen on the coal map coal No. 5 is much more limited in areal extent than No. 2. The ① small area in Henderson Township, the ② area along Middle & Court Creeks, the ③ area west of Knoxville and the ④ area south and east of Abingdon are the chief localities of interest.

Areas ③ and ④ look especially favorable for further prospecting. The area south of Abingdon is especially promising because the coal has an almost certain thickness in excess of 3½ feet ~~over~~ under more than a section of land, and the cover rarely, if ever, will exceed 25 feet This will include no resistant heavy rock of any appreciable thickness.

The area west of Knoxville is larger than that south of Abingdon but the burden runs a little thicker reach 42 feet in a place or two and the coal varies from 2 feet to 4 feet within the region indicated as underlain by No. 5.

Cautions: Outside of the proven areas of No. 5 coal in Knox and Galesburg townships it is especially wise to proceed with caution. Exact information is lacking to tell exactly how far west this coal extends. The limits drawn on the coal map are estimates based upon limited data in a few instances. They are believed to be accurate within ½ mile.

It is known that a rather definitely defined escarpment or cuesta extends nearly north and south beneath the glacial deposits from northeast of Galesburg to south of Abingdon. This ridge is located as accurately as possible on the bed rock surface map. This escarpment undoubtedly contains No. 5 coal in places in Galesburg township. No one can say just where all the old pre-glacial valleys cut this rock ridge; therefore no one can say just where coal No. 5 has been removed and where it has not. At any rate it is deemed safe to recommend the 2 areas ③ and ④ above for further prospecting and investigation.

It is estimated that the reserves of Colchester coal in the Galesburg quadrangle is approximately 420,552,000 short tons. This estimate is based upon an average of 30 inches of coal over an area of 165 square miles with 90 per cent recovery by the stripping method of mining. After allowing for townsites this figure should probably be reduced 25 per cent. Nothing like this amount can ever be recovered until the coal supply situation becomes very acute. (Insert page 102a here)

Water Supply

All of the water for domestic use in these quadrangles is obtained from deep wells. The Chicago, Burlington, and Quincy Railroad however, obtains its water supply from a reservoir known as Lake Bracken, south of Galesburg. The Atchison, Topeka & Santa Fe R.R. obtains its water from Lake Storey in Henderson Township 3 miles north of Galesburg.

There are many subsurface horizons which supply water to the wells, but only four of these are important. The important ones are as follows:

(1) Dresbach or "Potsdam" sandstone of Upper Cambrian age. It occurs at an average depth of about 1400 feet below sea-level in this area, or about 2200 feet below the surface.

(2) St. Peter sandstone of Middle Ordovician age. The depth of this horizon below the surface varies between 1000 and 1200 feet. The upper surface of the St. Peter sandstone is 300 to 400 feet below sea-level.

(3) Water-bearing strata occur at various horizons within the Pennsylvanian rocks. Depths of approximately 80 feet below the surface are common for shallow

wells. The figure varies considerably for different localities over the area, reaching a maximum of 150 feet in the east central part of the Galesburg quadrangle and the adjoining part of the Monmouth area.

(4) Water is obtained from various horizons within the Pleistocene. The depths range from 15 to 115 feet below the surface.

In general, the best water comes from the greatest depth. The St. Peter sandstone however, furnishes nearly as high grade water as the Dresbach sandstone.

Analyses of water from the so-called "Potsdam" well at Galesburg, 2305 feet deep, and from a well drilled into the St. Peter sandstone in the same city, 1245 feet deep, are given below for comparisons.

(Hypothetical combinations from determinations made)

	"Potsdam" Well		St. Peter Well[1]	
	Parts per million	Grains per gallon	Parts per million	Grains per gallon
KNO_3	2.9	.17	~~3.6~~	~~.21~~
$NaNO_3$			3.6	.21
KCl	28.6	1.67		
NaCl	257.7	15.07	255.4	14.83
Na_2SO_4	490.7	28.70	927.2	53.60
Na_2CO_3	27.4	1.60	~~3.8~~	~~.33~~
$(NH_4)_2SO_4$			3.8	.33
$(NH_4)_2CO_3$	2.4	.14	~~203.1~~	~~11.77~~
$MgSO_4$			203.1	11.77

The quantity of water available in either of these formations is not known, of course, but the water level in the St. Peter sandstone is known to have lowered within the past 10 years. There has been a remarkable increase in the demand for water in that length of time. Almost the entire population of Galesburg, Abingdon and Knoxville formerly depended upon water from the St. Peter sandstone for their supply. Within recent years Galesburg has drilled two wells into the Dresbach (Potsdam) and now only uses the St. Peter in emergencies. Abingdon and Knoxville have each drilled a well into the Dresbach. Logs of these wells will be found at the back of this report. ~~With the exception of one, the "Potsdam" well, all the city water of Galesburg comes from this sandstone~~.

The city of Galesburg is now using about 1½ million gallons of water per day, an average of about 58 gallons per capita. A part of this is consumed by industrial plants. The "Potsdam" well yields 890 gallons by weight per minute, one St. Peter well yields 315 gallons per minute, and another 694 gallons. ~~The~~ Two St. Peter wells are pumped some daily to maintain mechanical efficiency. ~~alternately, and~~ The "Potsdam" wells ~~is~~ are in constant use. The surplus water is stored in a city reservoir.

Soils

The latest, detailed report upon the soils of this area was published in 1913 by the University of Illinois Agricultural Experiment Station as Soil Report No. 6. This report discusses the soils of Knox County as a unit. Soil Report No. ? published in 19 , covered Mercer County.

The soils are divided into three classes as follows:

(1) Upland prairie soils, rich in organic matter. These were originally covered with wild prairie grasses, the partially decayed roots of which have

been the source of much of the organic matter. The flat prairie land contains the higher amount of this constituent because the grasses and roots grew more luxuriantly there and the higher moisture content largely preserved them from decay. This soil in these areas is largely a loessal soil, and is generally very fertile.

(2) Upland timber soils, including those belts along stream courses over which forests once extended. These soils contain much less organic matter than the upland prairie soils because the large roots of dead trees and the surface accumulation of leaves, twigs, and fallen trees were burned by forest fires or suffered almost complete decay. Leaching is active upon the slopes and much of the organic material has been removed by the streams. This soil type is the so-called "white" soil of farmers.

(3) Swamp and bottom lands, which include flood plains along streams and some small swampy areas.

These quadrangles contain all three classes of soils but the first is by far the most important, including more than 65 per cent of the area.

(Insert Sand and Gravel)

Oil and Gas possibilities

None of the deep wells in this quadrangle struck oil or gas. They were, however, for the most part, drilled rather far off of the main structures favorable to oil accumulation. See Plate ~~III~~ ? and the structure descriptions in Chapter IV.

There are, at least, two possible oil producing horizons in this quadrangle.

(1) The Hoing sand which is thought to be a lenticular sand occurring at the base

Sand and Gravel

The Galesburg map area apparently holds little promise of commercial quantities of either sand or gravel. There are a few ~~areas~~ localities however that will bear investigation.

A small gravel pit ~~has been~~ was opened some years ago ~~on~~ the north side of the Santa Fe R.R. in the NE1/4, SW1/4, Sec. 13 T. 11 N., R. 2 E., (Knox Twp.) and has been ~~intermittently~~ intermittently worked since 1925. The gravel removed had to be screened and was quite variable in character, being in general too high in clay.

So far as known, no other pits have been worked in this map area. The glacial drift is generally thicker over the northeast corner of the map however and the areas in the northern tier of sections in Knox Township and those in adjoining parts of Sparta Township offer the best conditions for prospecting for gravel and possibly for sand too although no sand deposits are as known.

Coarse sand of unknown quantity

occurs along the south wall of Pig Creek. This sand is of Pleistocene age and is loosely cemented into a poorly indurated grit.

The morainic remnants shown on the areal map (Plate —) in the extreme southeast corner may be favorable for gravel and sand prospecting although no deposits have been seen. In the west central part of Sec. 14 of Chestnut Township, just east of the Galesburg map, a considerable quantity of cemented gravel occurs in the stream bed beneath an old terrace remnant. This gravel may represent wash from the morainic remnant to the northwest.

Considerable quantity of brown sand occurs ~~in~~ the southeast corner of the Monmouth quadrangle. One deposit of commercial proportions occurs in a small ravine north of the east-west road in the NE 1/4, Sec. 19, T. 9 N., R. 1 W., (Berwick Twp. Another, and perhaps larger, deposit of glacial sand occurs along the south steep cut bank of Cedar Creek in the ~~northwest 1/4 NW 1/4~~, NE 1/4 NW 1/4, Sec. 20 of Berwick Township.

A sieve analysis of these sands follows
(Obtain from Lamar, to be sampled by him.)

(A physical description of the sand should follow here. It had not been studied under the microscope.) Recommendations will follow.

of the Niagaran dolomite. This is the producing sand in the Colman-Plymouth field in McDonough County, just southwest of Knox County. The Hoing sand has not been definitely identified from deep well cuttings in this area. This fact, however, does not preclude its presence in other localities. (2) The Platteville-Galean dolomite is overlain by the Maquoketa shale and may contain oil.

Gas in the glacial drift. Small quantities of natural gas have been found in the northern part of the quadrangle in the digging of shallow wells. The gas usually occurs in pockets or lenses of sand in the glacial drift. At the Purington Paving Brick Company plant in Court Creek valley shallow wells encountered water with large quantities of hydrogen sulfide. The water is reported also to have ~~also~~ had a high temperature.

In most cases of this sort the gases were probably derived from the decomposition of organic matter buried in the glacial drift. This natural gas has no connection with the accumulation of oil or gas in the underlying strata. The quantity of gas to be expected from this source is small. In a few cases enough gas is obtained from the drift to supply the needs of one or two families.

Gas accumulations in the glacial drift should not be confused with true oil seeps or gas escapages from solid rocks. Gas in glacial drift gives no indication of the presence of oil or gas in the deeper strata.

In 1930 Ellison Brothers of Knoxville drilled two holes in search for oil on a structure called Haw Creek Dome by the writer in 1927(1), and recommended by me for further prospecting. Hole No. 1 was in the NE 1/4 of the NW 1/4 Sec. 31, Knox Township. It was drilled to a depth of 1152 feet stopping in the St. Peter sandstone. This hole was far off to the north on the structure as then recommended and outlined. Hole No. 2 was drilled to 834 feet into what was considered the Trenton limestone. It was located in the NW 1/4 of the NE 1/4 of Sec. 36 Galesburg Township. A good show of high grade oil was reported at 470 feet in hole No. 2.

The Haw Creek structure and others in this Galesburg quadrangle were mapped on the basis of what was interpreted as coal No. 2. Later work proved that a few outcrops of No. 5 coal had been called No. 2. Recalculation then removed all of the domal structures from the area with exception of the Haw Creek Dome. This

(1) Poor, R.S. - Ill. Petrol. No. 9. 1927

structure appears now to be an anticline with a southeasterly plunge and ~~the~~ closure is lacking on the northwest. Further prospecting should be proceeded by advice for proper location on the structure.

31. Brooks Street (Bradley No. 2) well, SE. corner Brooks Street and Churchill Avenue (564 E. Brooks St.) Galesburg, Knox County, Illinois,[31] SW. 1/4 NW. 1/4 sec. 14, T. 11 N., R. 1 E. (Galesburg Twp.)

Altitude 782.75 feet.

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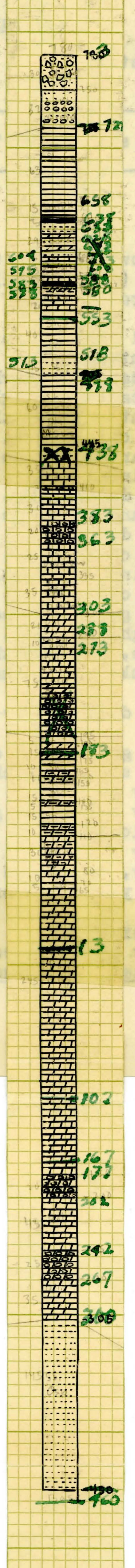
[31] Record derived from samples studied by T. E. Savage.

	Thickness Feet	Depth Feet	(783)
Recent and Pleistocene systems			
Clay, yellow to gray, with small pebbles, (glacial till)	30	30	753
Sand and gravel	32	62	721
Pennsylvanian system			
Carbondale (?) and Pottsville formations			
Shale, light gray	63	125	658
Shale, calcareous, dark gray	15	140	
Shale, calcareous, light gray	5	145	
Shale, light gray, with coal fragments	5	150	
Sandstone, calcareous, gray, fine grained	5	155	628
Sandstone and dolomite, calcareous, reddish, fine grained	5	160	
Sandstone, dark shale, and coal	3	163	620
Sandstone and dolomite, calcareous, reddish gray and dark	7	170	613
Sandstone, calcareous, gray to dark gray, fine grained and shale, gray	5	175	608
Sandstone, calcareous, fine grained, gray	4	179	
Limestone, gray and reddish, with fine sand	3	182	601
Shale, slightly sandy, gray and dark, and limestone, gray, with some fine sand	6	188	595
Shale, black, with limestone, white and dark	7	195	588
Limestone, dark "blue rock" and "Cap rock" of miners	5	200	
Coal No. 1	3	203	580
Underclay, gray, with coal	2	205	578
Limestone, shaly, black, and shale, black	25	230	553
Shale, gray to brown	5	235	
Shale, gray and light gray	15	250	533
Shale, yellowish-gray	5	255	
Shale, gray	10	265	
Shale, gray, with fine sand	5	270	513
Sandstone, yellowish-brown, fine grained	15	285	498
Mississippian system			
Sweetland Creek formation			
Shale, gray to slate-colored, containing *Sporangites huronense*	30	315	

31

Knox
Brooks
St well
Galesburg



Bradley No. 2 well - p. 2

(468)

Shale, gray and greenish-gray, containing *Sporangites huronense*	10	325	
Shale, gray to drab, containing many *Sporangites huronense*	20	345	438
Devonian system			
Cedar Valley and Wapsipinicon formations			
Limestone, light and dark gray, crystalline,	55	400	383
Limestone, dark gray, crystalline, and some chert	20	420	
Limestone, bluish-gray, gray, and light gray, fine grained	60	480	303
Silurian system			
Niagaran series			
Dolomite, gray, coarsely crystalline	15	495	
Shale, sandy, greenish-gray, with dolomite	15	510	273
Dolomite, light gray, crystalline, with shale, sandy, greenish-gray	90	600	183
Ordovician system			
Maquoketa series			
Shale, dolomitic, and dolomite, shaly, brownish-gray	170	770	13
Mohawkian series			
~~Dolomite, gray, with few shale fragments~~	~~40~~	~~[illegible]~~	
Galena and Platteville formations			
Dolomite, light gray, medium crystalline	120	890	-107
Dolomite, gray, crystalline, with some chert	60	950	-167
Dolomite, gray, crystalline	10	960	-177
Dolomite, gray, crystalline, with white chert	25	985	-202
Dolomite, gray, crystalline	40	1025	-242
Dolomite, gray, crystalline, with white chert	25	1050	-267
Dolomite, gray, crystalline	33	1083	-300
St. Peter formation			
Sandstone, clean, rounded, fine to medium grains	160	1243	-460

32. Artificial Ice Plant well, along South Street, between Seminary and Chambers Streets, Galesburg, Knox County, Illinois.[32/] NW. corner of SW. 1/4 NW. 1/4 sec. 14, T. 11 N., R. 1 E. (Galesburg Twp.)

Altitude 784.53 feet.

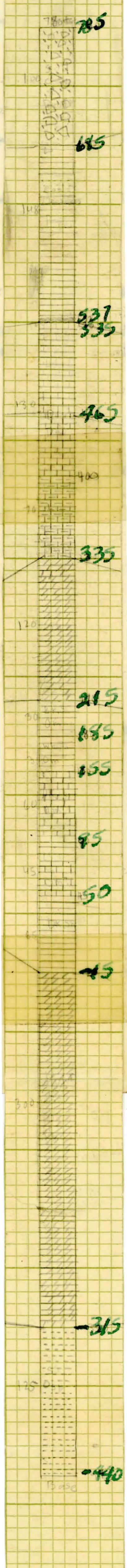
32/ Driller's record.

	Thickness Feet	Depth Feet	785
Recent and Pleistocene systems			
Soil, clay, and facial drift	100	100	685
Pennsylvanian system			
Carbondale (?) and Pottsville formations			
"Coal measures" (Shale, sandstone, etc.)	148	248	537
Coal	2	250	535
Mississippian system			
Sweetland Creek formation			
Shale and limestone	70	320	465
Devonian system			
Cedar Valley and Wapsipinicon formations			
Limestone and chert	130	450	335
Silurian system			
Niagaran series			
Limestone	120	570	215
Ordovician system			
Maquoketa series			
Shale, brownish	30	600	185
Shale, whitish	30	630	155
Limestone, dark	60	690	95
Limestone and shale	45	735	50
Shale, dark gray	65	800	-15
Mohawkian series			
Galena and Platteville formations			
Limestone	300	1100	-315
St. Peter formation			
Sandstone	125	1125	-440

75

(10) 32

Knox
Galesburg
Artificial
Ice
Co
Well



33. <u>Well (Bradley No. 1) behind Central Fire Station, Galesburg, Knox County, Illinois,[33] NW. 1/4 NE. 1/4 NE. 1/4 sec. 15, T. 11 N., R. 1 E. (Galesburg Twp.)</u>

Altitude 772.78 feet.

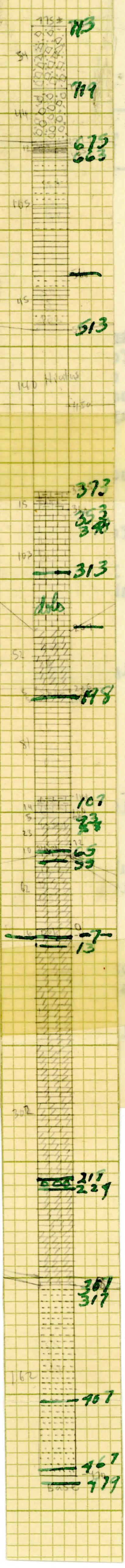
33/ Record derived from samples studied by T. E. Savage.

		Thickness Feet	Depth Feet	(773)
Recent and Pleistocene systems				
Till, pebbly and sandy	at		54	719
Sand	at		96	
Sand and gravel	at		98	675
Pennsylvanian system				
~~Carbondale (?) and Pottsville formations~~				
Carbondale (?) and Pottsville formations				
Coal, and shale, black, sandy	at		110	663
Shale, gray, with fine sand	at		215	
Shale and fine sand, gray	at		260	513
Mississippian system				
Sweetland Creek formation				
No record (may include some Devonian limestone)		140	400	373
Devonian system				
Cedar Valley and Wapsipinicon formations				
Limestone, gray, shaly		20	420	353
Limestone, gray, with a little sand		5	425	348
Limestone, light brownish-gray, fine-grained		35	460	313
Silurian system				
Niagaran series				
Limestone, dolomitic, light gray, subcrystalline		65	525	248
Dolomite, light gray		50	575	198
Ordovician system				
Maquoketa series				
Shale, greenish-gray		34	609	164
Shale, light gray		57	666	107
Limestone, shaly, dolomitic, subcrystalline		14	680	93
Shale, gray		5	685	88
Limestone, dolomitic, subcrystalline		6	691	82
Limestone, partly dolomitic, gray and drab		17	708	65
Shale, calcareous, gray		10	718	55
Mohawkian series				
Galena and Platteville formations				
Limestone, ~~gray, to~~ dolomitic, gray to drab, fine grained		62	780	-07
Dolomite, gray, crystalline		6	786	-13

33

~~45~~

Knox
Galesburg.
City well



(-13)

Limestone, dolomitic, gray	206	992	-219
Limestone, dolomitic, with some chert	5	997	-224
Limestone, dolomitic, gray	83	1080	-307
Glenwood (?) formation			
Limestone, dolomitic, gray, with some sand	10	1090	-317
St. Peter formation			
Sandstone, clean rounded grains	90	1180	-407
Sandstone, with gray dolomitic cement	60	1240	-467
Sandstone, clean rounded quartz grains	12	1252	-479

34/

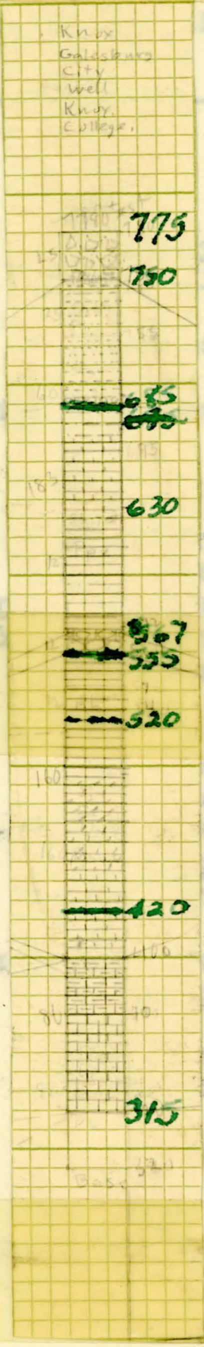
34. Well on Knox College Campus, Galesburg, Knox County, Illinois
SW. 1/4 NE. 1/4 sec. 15, T. 11 N., R. 1 E. (Galesburg Twp.)

Altitude 775 feet, estimated from Galesburg quadrangle topographic map.

34/ Record derived from samples studied by H. M. Dubois, T. E. Savage, and L. E. Workman.

	Thickness Feet	Depth Feet	(775)
Pleistocene system			
Clay, with some sand, slightly calcareous, brownish-yellow to grayish-yellow	10	10	765
Clay, slightly sandy, calcareous, yellowish-drab and blue	5	15	760
Clay, less sandy than preceding, light drab	10	25	750
Sand and gravel	65	90	685
Pennsylvanian system			
Carbondale (?) and Pottsville formations			
Shale, light gray, pyritic	15	105	670
Shale, slightly calcareous, light gray	40	145	630
Shale, gray, with some very fine sand grains, micaceous and carbonaceous with coal	63	208	567
Mississippian system			
Chert, gray, (conglomerate)	12	220	555
Hannibal or Sweetland Creek formation			
Shale, light bluish-gray or drab, contains _Sporangites huronense_	10	230	545
Shale, light gray with dark laminae	25	255	520
Sweetland Creek formation			
Shale, dark bluish-gray and drab, contains _Sporangites huronense_	100	355	420
Devonian system			
Cedar Valley and Wapsipinicon formations			
Limestone, light gray, fine grained, dolomitic, argillaceous	105	460	315

84



Knox
Galesburg
City
Well
Knox
College.
775
750
630
567
555
520
420
315

35. City Well No. 3, 420 feet southeast of intersection of Main and Henderson Streets, Galesburg, Knox County, Illinois.[35/] NW. corner sec. 15, T. 11 N., R. 1 E. (Galesburg Twp.)

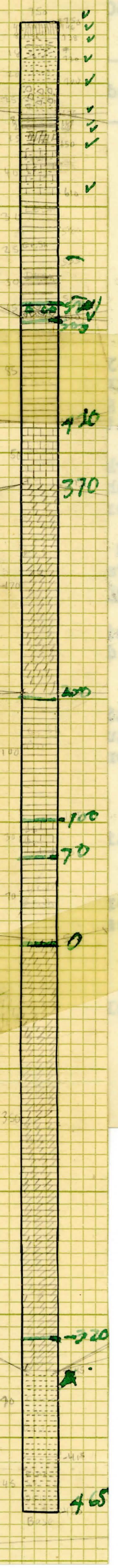
Altitude approximately 750 feet.

35/ Record derived from samples studied by J. A. Udden.

	Thickness Feet	Depth Feet	alt 750
Recent and Pleistocene systems			
Loam, black	4	4	746
Loess	8	12	738
Sand, clayey	18	30	720
Sand	20	50	700
Sand and gravel	25	75	675
Pennsylvanian system			
Shale, dark	8	83	667
Shale, black, coaly, with shaly coal	2	85	665
Underclay, light gray	15	100	650
Limestone, sandy, gray	40	140	610
Shale, grayish-white	35	175	575
Shale, gray	25	200	550
Shale, clayey, dark	30	230	520
Shale, light bluish gray, with white chert, (conglomerate)	15	245	505
Mississippian system			
Sweetland Creek formation			
Shale, brownish-gray, containing abundant *Sporangites huronense*	85	330	420
Devonian system			
Cedar Valley and Wapsipinicon formations			
Limestone, shaly, dolomitic, gray	50	380	370
Silurian system			
Niagaran series			
Limestone, dolomitic, white, coarse crystalline texture (may include some Devonian limestone)	170	550	200
Ordovician system			
Maquoketa series			
Shale, gray	100	650	100
Limestone, dolomitic, gray, fine grained	30	680	70
Shale, gray	70	750	0
Mohawkian series			
Galena and Platteville formations			
Limestone (thickness wrong in log)	320	1070	-320
St. Peter formation			
Sandstone	30	1100	-350
Sandstone, coarse, clean quartz grains	70	1170	-420
Sandstone, fine, clean quartz grains	45	1215	-465

35

Knox City well No. 3 Galesburg

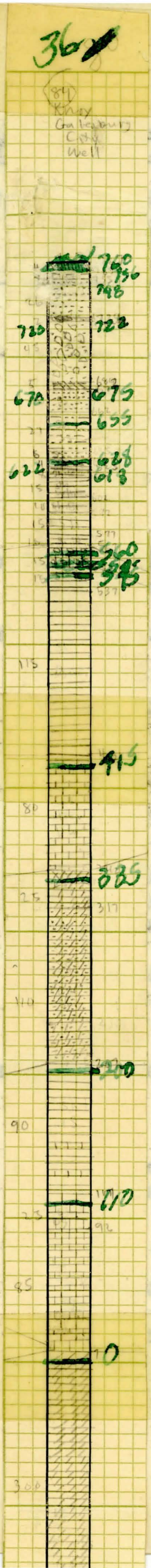


36. City artesian well No. 1, Galesburg, Knox County, Illinois, NE. corner sec. 16, T. 11 N., R. 1 E. (Galesburg Twp.)

Altitude approximately 760 feet, estimated from Galesburg quadrangle topographic map.

36/
Driller's record.

	Thickness Feet	Depth Feet	(760
Recent and Pleistocene systems			
Topsoil, black	4	4	756
Clay, blue	8	12	748
Sand, fine	13	25	735
Sand	13	38	722
Coal (fragment in glacial drift)	2	40	720
Sand and gravel, coarse	45	85	675
Pennsylvanian system			
Carbondale (?) and Pottsville formations			
Underclay	5	90	670
Sandstone	15	105	655
Shale, mixed with sand	27	132	628
Sandstone	6	138	
Underclay	4	142	
Shale, black	8	150	610
Shale, white	15	165	
Shale, brown	10	175	585
~~Shale, brown~~	~~15~~	~~190~~	
"Soapstone" (shale)	15	190	570
"Soapstone" (shale), black	10	200	
Limestone and chert (basal conglomerate)	15	215	545
Mississippian system			
Sweetland Creek formations			
"Slate" (shale)	15	230	530
Shale, yellow	115	345	415
Devonian system			
Cedar Valley and Wapsipinicon formations			
Limestone	80	425	335
Silurian system			
Niagaran series			
Limestone, white	25	450	310
Sandstone (dolomite?)	110	560	200
Ordovician system			
~~Maquoketa formation~~			
Maquoketa formation			
Shale and limestone	90	650	110
Limestone	25	675	85
Limestone, black	85	760	0
Galena and Platteville formations			
Limestone	300	1060	-300
St. Peter formation			
Sandstone	166	1226	-466


36
84
Knox
Galesburg
City
Well
760
756
748
720
722
675
670
655
628
622
618
560
415
335
200
110
10

74. Purington Paving Brick Co. well, East Galesburg, Knox County, Ill.
NW. ¼ SW. ¼ sec. 17, T. 11 N., R. 2 E.
Altitude 710 feet, estimated from topographic map, Galesburg quadrangle.

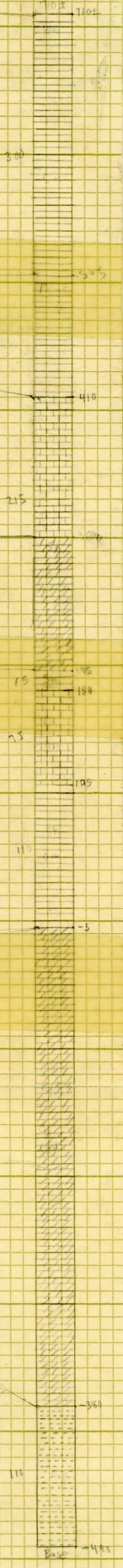
Authority# J. P. Miller Co. Drillers.

	Thickness Feet	Depth Feet
Pleistocene and Recent systems		
Not recorded, may be absent		
Pennsylvanian system		
Carbondale and Pottsville formations		
Record states shale 300 feet, estimated Pennsylvanian	205	205
Mississippian system		
Sweetland Creek formation		
Estimated in 300 feet shale above	95	300
Devonian ######## system		
Cedar Valley and Wapsipinicon formations		
Record states limestone 215 feet, estimated Devonian	110	410
Silurian system		
Lockport formation		
Estimated in 213 feet limestone above	105	515
Ordovician system		
Maquoketa formation		
Shale	15	530
Limestone	75	605
Shale	110	715
Galena and Platteville formations		
Limestone (and Dolomite)	375	1090
St. Peter formation		
Sandstone	109	1199

74

(12)

Knox
Purington
Paving
Brick Co.
East
Galesburg



85. City Well, Kirkwood, Warren County, Ill./ SE. ¼ SE. ¼ sec. 9, T. 10 N., R. 3 W. Altitude 742 feet, estimated from topographic map, Monmouth quadrangle.

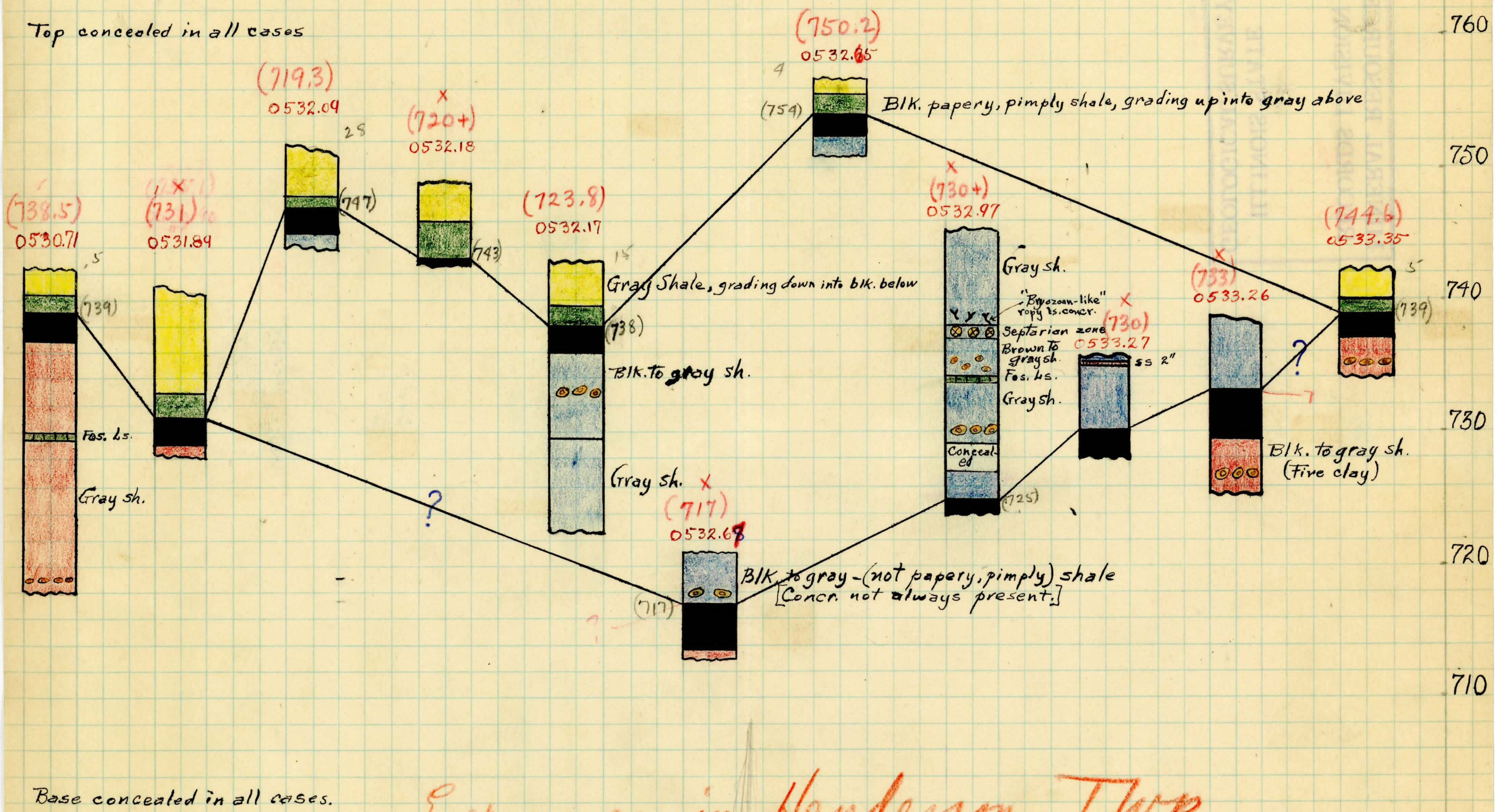
/ Authority O. P. Colegrove, who was drilling for T. W. Moore. Descriptive terms used in record are in many cases inaccurate.

	Thickness Feet	Depth Feet
Pleistocene and Recent systems		
Loam, subsoil and clay	63	63
Mississippian system		
Burlington formation		
Limestone	57	120
Record states "White flint, grained 196 feet" estimated cherty limestone, Burlington	47	167
Hannibal and Sweetland Creek formations (?)		
Shale, estimated in "white flint 196 feet" above	149	316
Record states "Granite, very hard to drill 22 feet; This may be crystalline or cherty limestone , perhaps in lower part of Hannibal formation	22	338
Record states "Sandstone 370 feet" estimated Sweetland Creek formation	94	432
Devonian system		
Cedar Valley and Wapsipinicon formations		
Limestone, estimated in "sandstone 370 feet" above	95	527
Silurian system		
Lockport formation		
Dolomite, estimated in "sandstone 370 feet" above	45	572
Ordovician system		
Maquoketa formation		
Shale and dolomite, estimated in "sandstone 370 feet" above	136	708
Galena formation		
Record states " Stone, yellowish gray, hard, flinty in nature", probably dolomite	59	767

86. Prairie Pipe Line ### Company Water well, Ponemah, Warren County, Ill.
NW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 35, T. 10 N., R. 3 W.
Altitude 725 feet, estimated from topographic map, Monmouth quadrangle.

Authority C. R. Pendarvis, Media, Ill.

	Thickness Feet	Depth Feet
Pleistocene and Recent systems		
Soil	4	4
Clay	3	7
Pennsylvanian system		
Pottsville formation		
Shale	11	18
Sand, yellow	27	45
Mississippian system		
Burlington formation		
Limestone	115	160
Hannibal and Sweetland Creek formations		
Shale	257	417
Devonian system		
Cedar Valley and Wapsipinicon formations		
Limestone	90	507
Shale	1	508
Silurian system		
Lockport formation		
Record shows "Sandstone 17 feet", probably porous dolomite	17	525
Limestone	17	542
Ordovician system		
Maquoketa formation		
Shale, light	51	593
Shale, brown	47	640
Limestone, brown	32	672
Shale	55	727
Galena and Platteville formations		
Record shows "Sand, brown 159 feet", probably porous dolomite	159	886



Exposures in Henderson Twp.
Galesburg Quad
R S Poor

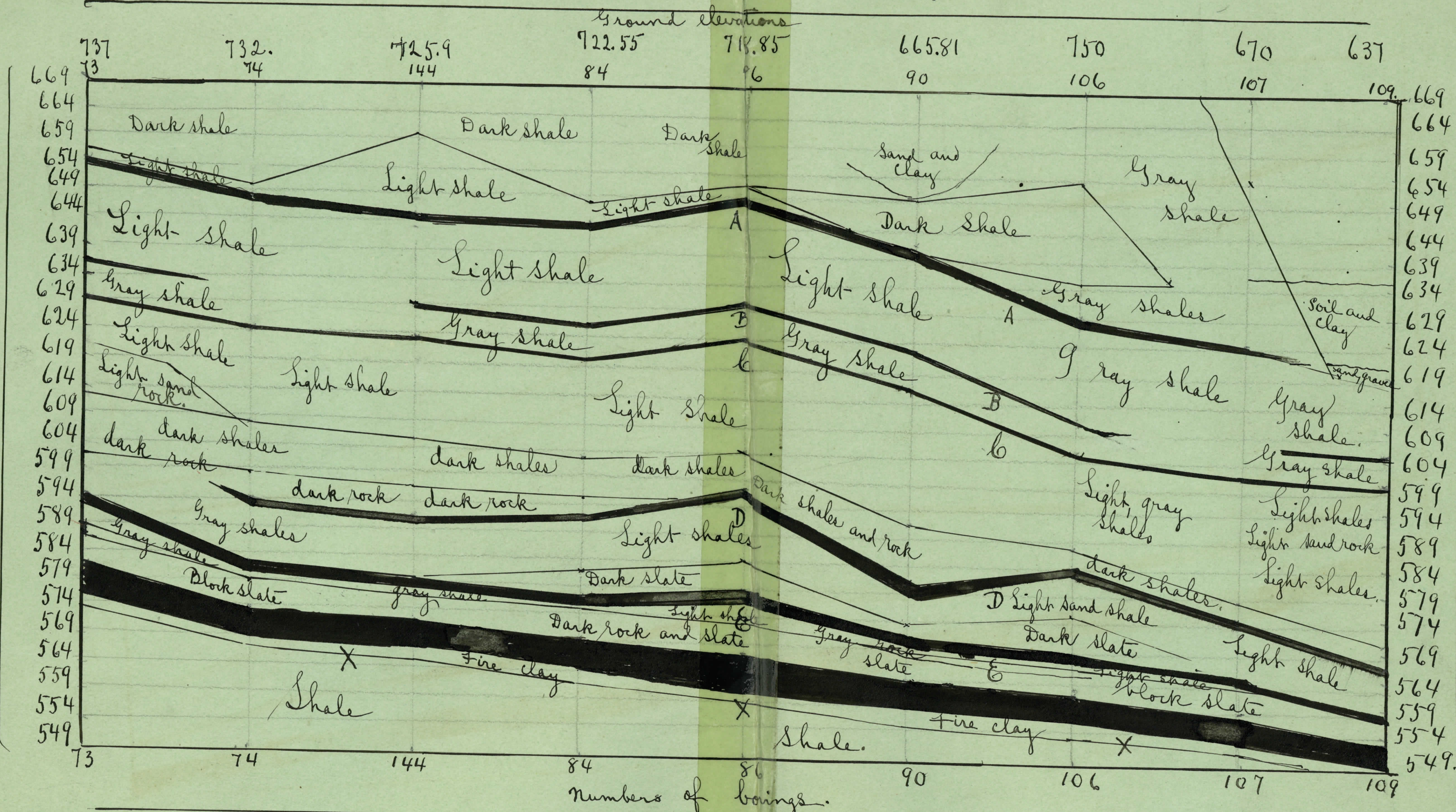
(735.1)
0530.90

near Lake Storey

5-16

Accompanies R. S. Poor Mss 244

Section from borings four miles east of Galesburg, Ill.

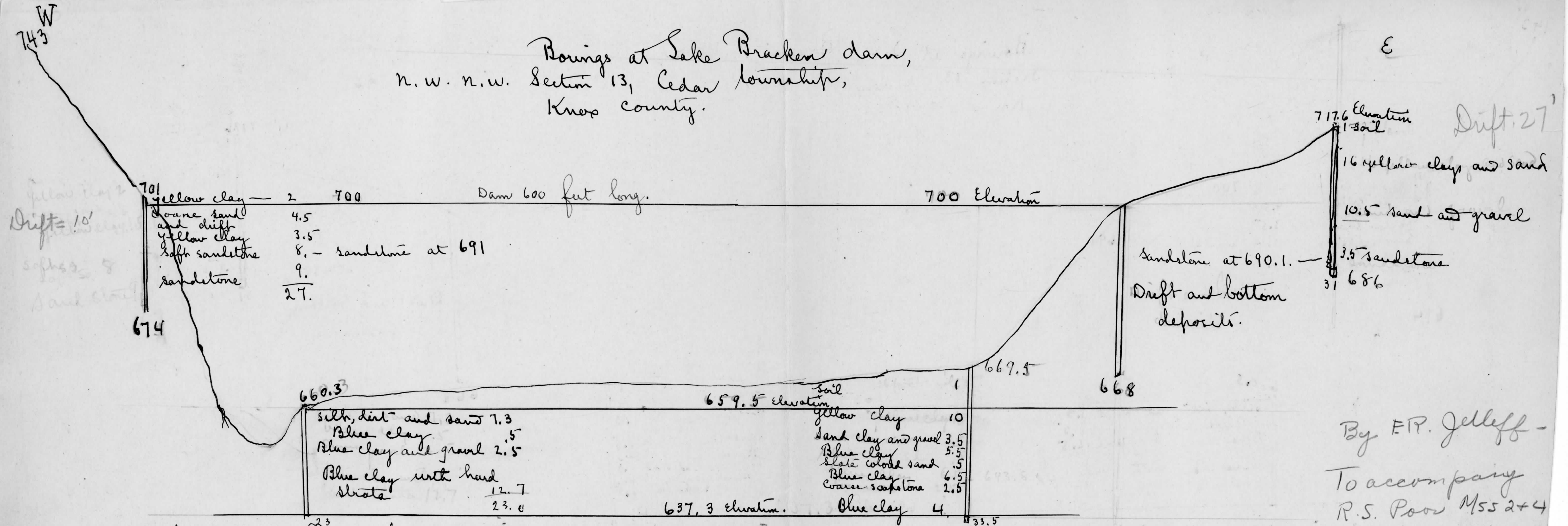


Distance East and West two miles; borings about one quarter mile apart. Elevation 5 feet for each quarter mile.

Fred R. Jelliff, Galesburg

Note → Draw on white paper, make lettering with heavier line

Borings at Lake Bracken dam, N.W. N.W. Section 13, Cedar township, Knox county.



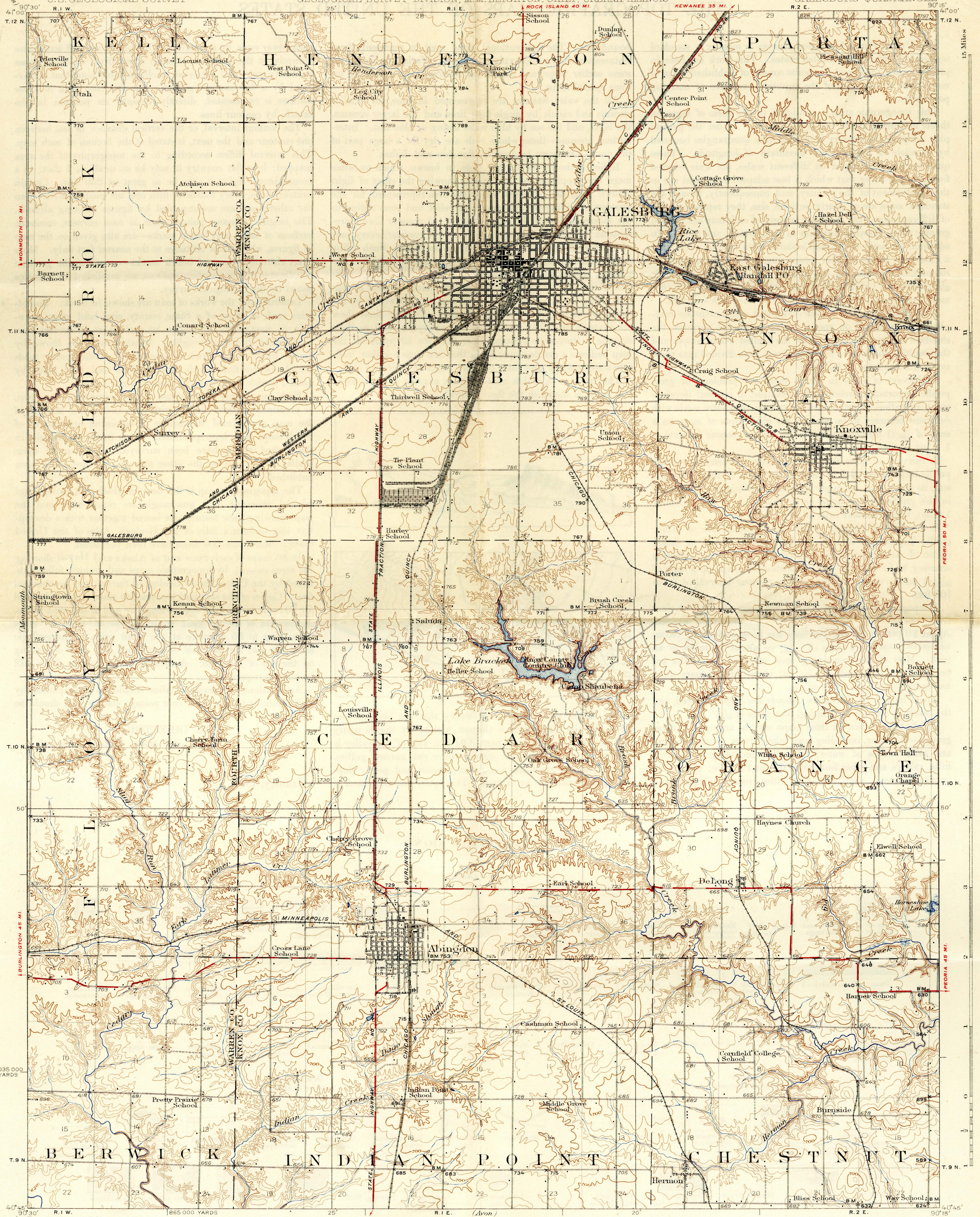
By F.R. Jelleff – To accompany R.S. Poor MSS 2+4 on the Galesburg quad.

In coming from Seminary Street diagonally across Section 10 and then through section 11 and to the dam in Section 13, Cedar township, Knox county, following the creek, five exposures of a micaceous sandstone with stem imprints were seen, and 23 ravines counted. Ironstone concretions, shale, slate and coal were noted on one of the main branches, all now concealed by water. Section ½ mile north of north end of reservoir, 209 feet deep, shows 6 veins of coal; one fourth mile still farther north shows 215 feet log with seven veins; still ¼ mile farther north shows log 170 feet with six veins. Log one mile East, 223 feet shows seven veins, one of which is a seam of four and a ~~half~~ sixth feet within 61 feet of surface. One fourth mile south of this last log, is another showing seven veins, with the lowest 4 feet; and still farther south another log gives seven veins. Coal was formerly mined in the hills surrounding Lake Bracken and there can still be seen in numerous places the friable sand shale, that lies above its 700 foot level.

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
A. M. SHELTON, DIRECTOR
GEOLOGICAL SURVEY DIVISION, M. M. LEIGHTON, CHIEF, URBANA ILLINOIS

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

ILLINOIS
GALESBURG QUADRANGLE



Topography by H. E. Simmons, W. S. Gehres, and J. T. Schultz
Control by U.S. Geological Survey and from railroad valuation surveys
Surveyed in 1924-1925

APPROXIMATE MEAN DECLINATION, 1925

Scale $\frac{1}{62500}$

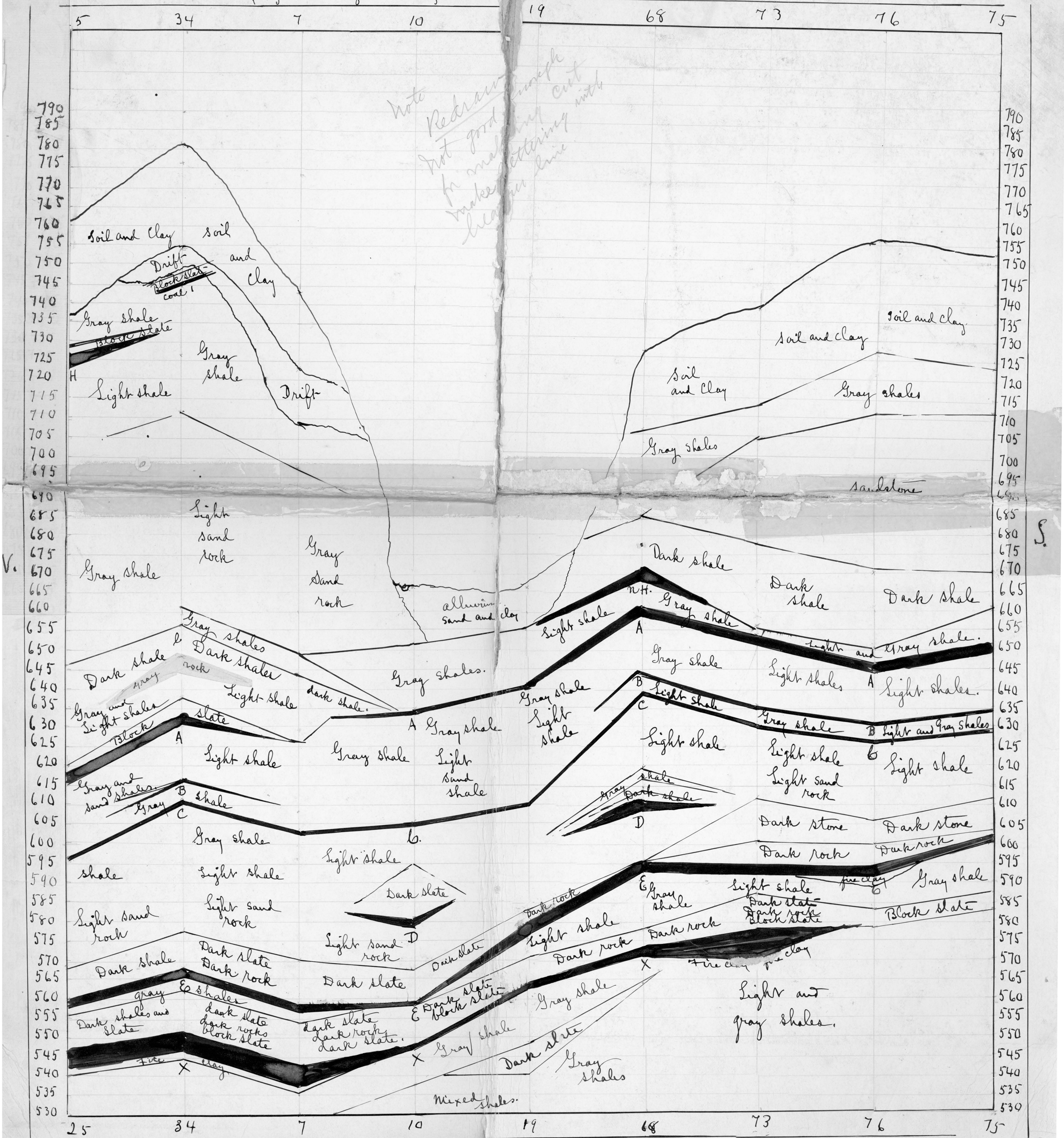
Contour interval 20 feet
Datum is mean sea level

Polyconic projection. North American datum
5000 yard grid based upon U.S. zone system, C

THROUGH ROUTES
SECONDARY ROUTES

GALESBURG, ILL.
Edition of 1927

Sections of eight borings extending north [illegible] south for two miles, East of Galesburg 4 miles.



Fred R. Jelliff