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GEOLOGY AND MINERAL RESOURCES OF ADAMS COUNTY

by

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The present is the key to the past. This doctrine is the basis for all geological study. By observing present forces and processes and their effects upon the earth we can reconstruct the historical events which preceded them.

In this brief article we shall travel back into time and retrace the events which have left their stamp on Adams County.

The geological story of Adams County falls naturally into four great chapters:

1. The formation and beveling of the crystalline basement.
2. The formation of the bedrock layers.
3. The "lost interval" of erosion.
4. The Ice Age.

The Formation and Beveling of the Crystalline Basement.

The crystalline or "granite" basement on which the bedrock layers were laid down comes to the surface in the St. Francis Mountains of Missouri and in the region surrounding Lake Superior. In Illinois only a half dozen wells have penetrated to "the granite," none of them in Adams County.

Some of the basement rocks were once sandstone or shales--others cooled from the molten state as they poured out upon the surface as lava, or solidified deep underground as intrusive masses under great pressure. These ancient rock masses were then twisted and shattered in great mountain-making movements that had their roots deep within the earth's crust. Finally erosion, working through an immense span of geological time, wore the mountains down to a nearly flat plain.

The formation of the basement foundation consumed three-fourths of all geologic time during two Eras (Archaeozoic and Proterozoic) classed together as "Pre-Cambrian." (See figure 1.)

The Formation of the Bedrock Layers.

The Cambrian sea was the first to bring preservable kinds of life to the region and marks the beginning of a long period of time (the Paleozoic Era) when Illinois was beneath the seas that invaded the continent's interior. It was during this Era that the layers of bedrock limestone, shale, and sandstone were laid down as sediment on the bottom of the sea.

Late in the Paleozoic Era, during the Pennsylvanian Period, layers of coal were also formed, presumably in great swamps close to sea level. The coal-bearing strata once extended across all of Adams County, but in the western half of the county they were all worn away during the long period of erosion that marks the "lost interval" in Illinois.

The "Lost Interval" of Erosion.

After the coal-forming period, over 200 million years ago, the seas withdrew. There is no evidence that any part of Illinois was inundated again until Upper Cretaceous Time. Instead, the region was raised moderately above sea level, and streams and weathering agencies set to work stripping away the rocks, layer by layer. The debris of this erosion process was carried off to lower regions to be deposited as new sediment that would some day harden into rock strata. This cycle of deposition and erosion and redeposition has been going on throughout geologic time and is still goin on all about us. Thus through the time of the dinosaurs and through the time of all the strange and primitive mammals that followed, we have no record of the nature of life here in Illinois. We only know that erosion laid bare the Mississippian limestones and shales in western Adams County that once were buried beneath the coal strata, and that streams cut deep valleys into the bedrock.

The Ice Age.

Beginning about a million years ago and ending about 5,000 years ago, climatic conditions permitted the accumulation of four great ice masses near the poles. These gigantic ice masses moved as continental glaciers down into our present temperate zone. Climate during the "Ice Age" fluctuated so that mild intervals

of hundreds of thousands of years in duration intervened between stages of glacial advance.

The Pleistocene or Ice Age is divided accordingly into four major advances of glacial ice: the Nebraskan, Kansan, Illinoian, and Wisconsinan stages. Of these, only the Kansan and Illinoian are known to have invaded Adams County, although it is presumed that the first or Nebraskan Glacier also entered the county. The last, or Wisconsinan, glaciation did not extend this far southwest, but the waters from its melting indirectly contributed loess that is so vital a factor in the fertility of the soils of the area.

Topography and Pleistocene Deposits

A glance at a topographic map of Adams County reveals two strikingly different features. The broad, flat bottom land of the Mississippi River flood plain is sharply delineated by the closely spaced contours marking the bluffs on either side of the valley. The rest of the county is a flat, to undulatory, highly dissected upland consisting of material deposited by the glaciers (till) and wind-blown loess (silt). The numerous incisions were cut by tributaries to the Illinois and Mississippi Rivers. In places, these streams have cut their valleys completely through the unconsolidated glacial debris into the bedrock below. This upland covers a large part of western Illinois and is called the Galesburg Plain.

The topographic differences between the Galesburg Plain and the Mississippi River flood plain are distinctly shown on the Quincy and Liberty topographic maps. (These maps may be purchased from the Illinois State Geological Survey or the United States Geological Survey, Washington 25, D. C., for 30 cents each. The U. S. Geological Survey also will send, upon request, a descriptive folder about topographic maps and a folder illustrating topographic map symbols.)

There are two caves and many sink holes which have developed in the jointed limestone south of Quincy giving the terrain a pitted surface. The circular depressions developed by solution of limestone produced what is called Karst topography.

Most of Illinois is covered with a mantle of glacial till (boulders, sand,

and clay in an unsorted mixture) to depths ranging from a few feet to more than 400 feet. The till is responsible for the level plains of Illinois and is the parent of much of the fertile soil.

The Nebraskan Glacier is believed to have invaded Adams County, but no deposits of this age have been found. Kansan glacial deposits are found in western Adams County and Illinoian till covers the eastern and central portion of the county. The westernmost limit of the Illinoian Glacier is marked by the Payson Moraine, a low ridge trending in a north-south direction, just skirting near the eastern edge of Quincy. The Kansan till occurs as a blanket deposit at the surface in the western part of the county and beneath the Illinoian till in the central and eastern parts.

After the retreat of the Illinoian Glacier, glacial deposits were subjected to weathering and an extensive soil was developed during the Sangamonian Interglacial Stage. Later, the Sangamon soil was buried beneath two successive sheets of wind-blown dust called loess. Loess is a fine silt that was blown by strong winds from the valley bottoms of the Mississippi and Illinois Rivers. Its origin is related to seasonal fluctuations during the glacial stages, especially the last or Wisconsinan. During the summer, the valleys were flooded with melt water from the glacier. In winter, when little melting occurred and the summer floods subsided, the sand and silt in the valleys ~~was~~ were exposed and dried and strong winds spread the fine material over adjacent uplands. Most of the loess in Adams County is related to the last, or Wisconsinan Glacier.

Bedrock

Over about three-fourths of Illinois, the Pennsylvanian or Coal Measures rocks are closest to the surface. A thin veneer of Pennsylvanian age rocks, largely shale, sandstone, and thin limestones, occurs in eastern Adams County. These strata contain several thin coal beds of which the Colchester No. 2 Coal is the most important in terms of reserves. The No. 2 Coal ranges up to 26 inches in thickness.

Pennsylvania rocks are unlike older rocks in Illinois since they consist of many different types, with coal the most outstanding. In Illinois, coals are commonly

overlain by black sheety shale ("roof slate") followed by limestone with marine fossils. The limestone is usually overlain by gray shale, also containing marine fossils.

Beneath the coal there is an underclay, in turn sometimes underlain by an underclay limestone or shale, then sandstone. This type of rhythmic succesion of different kinds of strata is repeated in much the same sequence some 50 times where the Pennsylvanian rocks are thickest. Each rhythmic succession of Pennsylvanian rocks is called a cyclothem. In Adams County, where deposition was slow and intermittent at the margin of the basin, cyclothems are generally incomplete.

The many different rock types in the Pennsylvanian System indicate many rapid changes of environment which took place repeatedly. At that time rivers were bringing sediments from the north and east, possibly as far away as the present Atlantic coast and the region south of Hudson Bay. The ~~Mid-West~~ Midwest was subject to frequent marine invasions as the land rose or sank, or the sea level raised or lowered.

That these conditions existed is evident from the nature of the sediments. Many of the shales, limestones, and ironstones above the coals contain marine fossils. The coals are believed to have formed in broad fresh-water marshes somewhat like the present Dismal Swamp of Virginia. Most of the sandstones, conglomerates, underclays, underclay limestones, and some shales probably accumulated in fresh-water environments such as river valleys, lagoons, lakes, or lowland plains. There is no area in the world today that has conditions exactly like those that existed during "Coal Measures" time.

The plants and trees that grew in "Coal Measures" time were luxuriant. In the jungle-like growths the plants most common were huge tree ferns that grew to a height of more than 50 feet and had fronds five or six feet long. Along with them were seed ferns, now extinct, giant scouring rushes, and large scale trees, which grew to heights of 100 feet or more.

Older than the Pennsylvanian rocks, and therefore underlying them, are the Mississippian rocks. These rocks are at the surface west of the Mississippian-Pennsylvanian boundary and form the high bluffs along the Mississippi River. In

southeastern Adams County, where McKee, Grindstone, and Fishhook Creeks join, a large "window" of Mississippian rocks has been exposed by erosion of the overlying Pennsylvanian strata.

Only Middle (Valmeyerian) and lower (Kinderhookian) Mississippian rocks are present in Adams County. The Upper Mississippian (Chesterian) strata were removed long ago by erosion.

The St. Louis Limestone, the Salem Limestone, the geode-bearing Warsaw Limestone and Shale, the Keokuk-Burlington Limestone, and the Kinderhook Shale and Limestone are the major Mississippian formations represented. The Burlington is generally well exposed in the bluffs, in quarries, and in creek banks and is abundantly fossiliferous.

Structure

Structure in rock strata is generally thought of in terms of folding and faulting of the originally horizontal rocks. The largest structural feature in Adams County is the Pittsfield-Hadley Anticline. This upwarp of the rock strata trends northwestward from Pike through Southeastern Adams County and thence into Missouri. The maximum rise is in Pike County where it forms an elongated dome. In western Adams County the fold splits into 3 zones. One zone continues into Missouri and the other two branch out to form the Western Adams County Monocline. A monocline is a fold having only one inclined side, the other side being horizontal.

The Fishhook Anticline lies just north of and trends parallel to the Pittsfield-Hadley Anticline. The Fishhook structure is only a local feature extending for approximately 7.5 miles. A terrace on the northeast flank of, and 250 feet lower than, the Fishhook Anticline is the site of oil accumulation in the newly discovered Kellerville and Siloam pools.

Mineral Resources

Coal.

Coal is mined in Adams County from the Colchester No. 2 Coal seam which is approximately 26 inches thick. The county produced a total of 120,893 tons of

coal with 37,620 tons strip mined in 1960. The 1960 production, valued at $150,856, was from one mine.

Oil and Gas.

The discovery of the Kellerville oil pool in Adams County and the Siloam field in Brown County has stimulated interest in the oil possibilities of western Illinois. The discovery of the Kellerville-Siloam fields has shown that minor structural oil traps exist in western Adams County but extensive drilling is usually required because the structures are small and discontinuous. The only natural gas field in Adams County is at Beverly.

Limestone.

Adams County is one of the leading producers of limestone among the 56 producing Illinois counties. The many outcrops of Mississippian limestone are the basis of the active stone industry and supply large reserves for future expansion.

The useability of a limestone depends upon many factors such as standards of purity and suitable physical properties. The Lower Burlington is greater than 95% calcium carbonate and is therefore desirable for use in the manufacture of lime and for the chemical industry. Some of the many uses of specially treated limestone include rubber and plastic fillers, animal feeds, ceramic glazes and bodyware, adhesives, linoleum and floor tile, phonograph records and water purification. This stone is also used for agricultural lime and road material.

Most of the quarries are underground galleries mined out of the river bluffs. The great thickness of overburden makes this the most practical method.

Sand and Gravel.

Deposits of gravel and sand occur at scattered places in the uplands of Adams County. The floodplains of the tributary streams to the Mississippi and Illinois rivers contain some sand and gravel deposits which usually are composed largely of chert fragments concentrated from upland bedrock. The Mississippi River floodplain is underlain by sand and silt. Only two pits in the county reported production in 1961.

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Clay.

The clay resources of Adams County have not been developed but southeastern and northeastern portions of the county have substantial clay reserves for the future. The Purington Shale and the underclays below the Colchester No. 2 Coal have possible uses in structural clay products, flue liners, terra cotta, stoneware and pottery.

Note: To enable students to study and recognize the most common rocks and minerals encountered in Illinois, the Illinois State Geological Survey provides to Illinois schools a set of 35 typical rocks and minerals. The collection can be obtained upon request from teachers, free, except for a shipping charge of 65 cents. Samples of limestone, granite, shale, coal, clay, sandstone, petroleum, quartz, galena, and sphalerite are included in the set. Many schools have this rock collection, so please consult your school library and principal before ordering. Because of demand, the Survey can send only one set per school or one set per five hundred students.

Conservation of Mineral Resources

Mineral resources, unlike soils and forest, cannot be regenerated or replanted, and this makes it mandatory to avoid waste. True conservation of mineral resources, in addition to avoiding direct waste, must include efforts toward improvement in recovery, adaptation, and utilization. Such measures will extend the life of the reserves of high-quality minerals and make useable large quantities of minerals now considered inferior.

Improved recovery as a conservation measure is well illustrated by the use of waterflooding in worked-out or low producing oil fields. In primary production, natural pressure of gas or water upon the oil in the reservoir rock drives some of the oil to the surface. However, as this natural pressure declines, it is necessary to pump the oil. In former years when the quantity of oil produced did not justify the cost of pumping, wells, and in some cases entire fields, were shut down. One-third to one-half of the original oil remained underground.

In the late 30's it was discovered that restoring pressure in the worked

out pools would allow some of the remaining oil to be produced. Experiments and experience indicated that pressure could be restored by injecting water into the reservoir rock. Waterflooding is being used widely in Illinois and now accounts for over 65 percent of the state's oil production. Oil that otherwise would not be produced is being recovered through waterflooding.

Many large mineral deposits within the United States contain impurities or are of such low grade that without treatment they are of no commercial value. Procedures developed for upgrading and purifying such deposits greatly extend and increase the reserves of useable minerals. This, too, is a form of conservation. The cleaning of coal and the upgrading of iron ore are examples of improving the mineral product to meet industry's specifications.

Some minerals that do not meet market requirements when used alone can be blended with other higher quality minerals to produce useable products. In recent years, research at the Illinois State Geological Survey has demonstrated that certain Illinois coals which do not produce satisfactory coke when used alone can be blended with eastern coking coals to produce metallurgical coke meeting industry's specifications. This not only provides new markets for Illinois coals but also helps conserve and extend the life of the deposits of the more strongly coking coals of the nation.

Providing future mineral material for the growing population and industry will require new and continued research on minerals, their benefication and use.

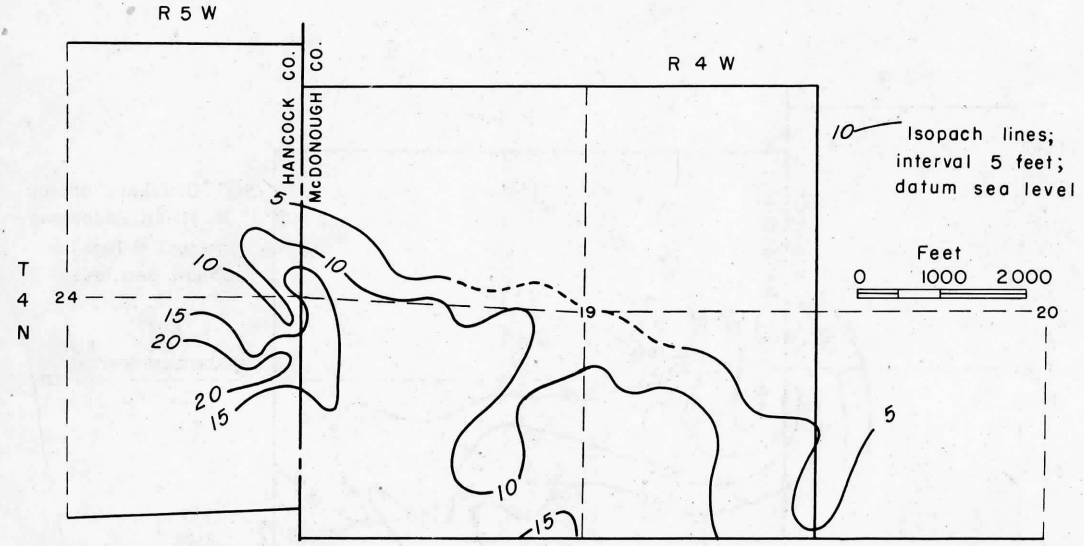

Fig. 6 - Isopach map of Hoing Sandstone, Plymouth pool, Hancock and McDonough Counties. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

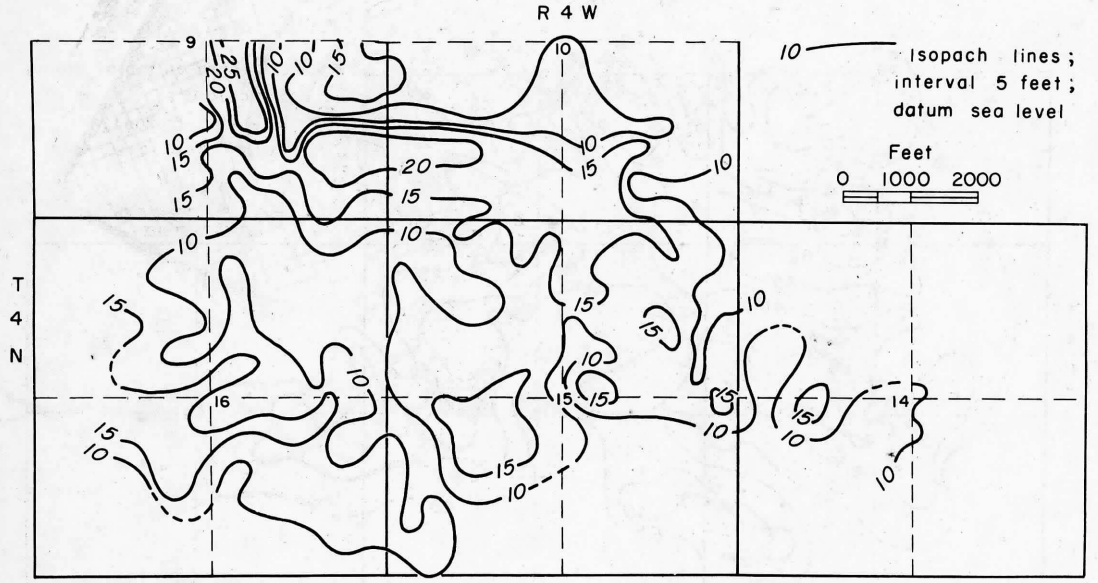

Fig. 7 - Isopach map of Hoing Sandstone, Colmar oil pool, McDonough County. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

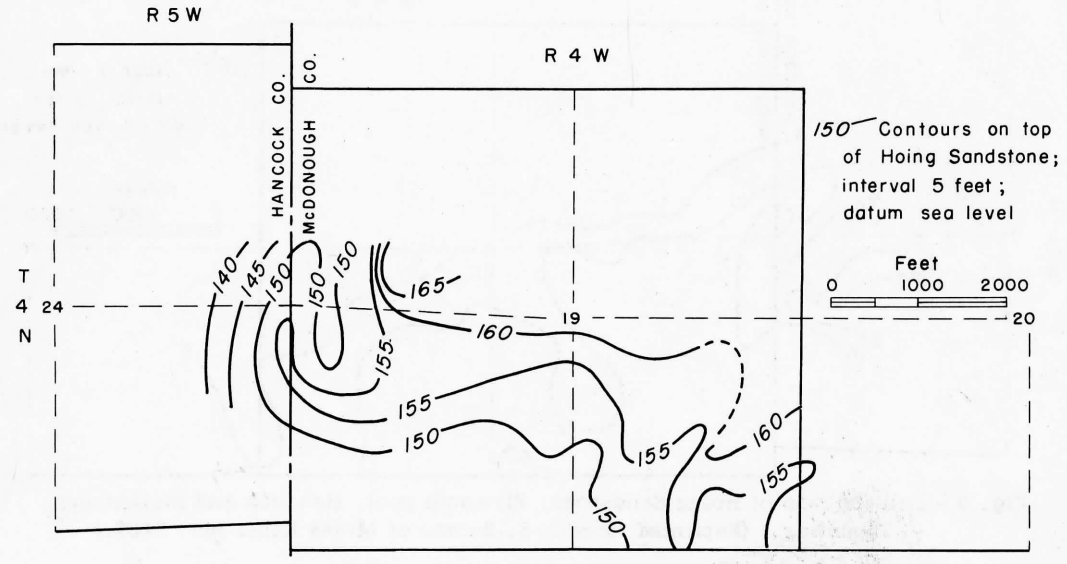

Fig. 8 - Structure map on the top of the Hoing Sandstone, Plymouth oil pool, Hancock and McDonough Counties. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

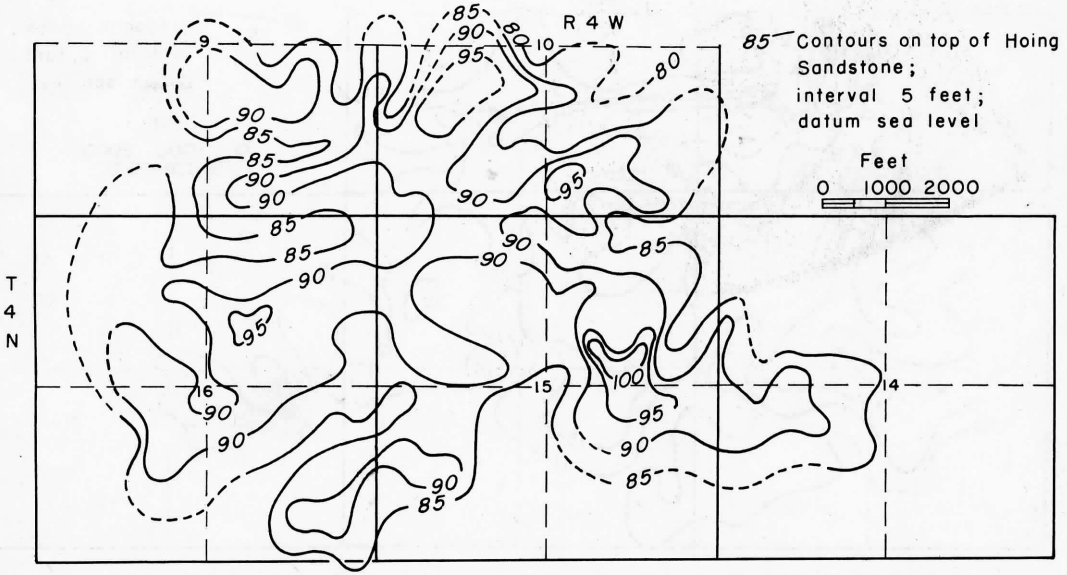

Fig. 9 - Structure map on the top of the Hoing Sandstone, Colmar oil pool, McDonough County. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)