GEOLOGY AND GEOGRAPHY

Chairman: BENJAMIN MOULTON, Butler University

WILLIAM J. WAYNE, Indiana University, was elected chairman for 1955

ABSTRACTS

Origin and Development of Caverns in the Beech Creek Limestone in Indiana. PRESTON MCGRAIN[1] and ORVILLE L. BANDY.[2]—Caverns developed in the Beech Creek limestone of Indiana strikingly reflect the physical characteristics of this formation. The main passages are joint controlled; they are narrow, tall, and turn frequently at abrupt angles. Side passages at intersecting right angles are common.

These caverns are in youthful stage of development. Streams course the main arteries at all seasons. Decorative dripstone and flowstone formations are rare. Rockfalls and collapse features are also rare except where the surface cover is thin.

The outcrop of the Beech Creek limestone, from the Ohio River northward for more than 90 miles, forms the most important spring-bearing horizon of any of the Chester formations. Locally openings have been enlarged until they reach cavernous proportions. Four caves, located in Greene, Martin, and Orange Counties, were mapped and studied in detail.

The Cypress formation, which overlies the Beech Creek limestone, is characteristically a thick, massive, jointed, and porous sandstone which collects precipitation, runoff, and subsurface waters. In the highly dissected Crawford Upland physiographic region, where major drainage lines have cut through these Chester formations, waters move freely in the Cypress sandstone until they reach the massive Beech Creek limestone, where downward percolating waters are concentrated in streams along the pronounced joint planes and bedding planes. The upper strata of the subjacent Elwren are characteristically gray shale or siltstone. Here the downward movement of water is obstructed, and it then moves laterally to the surface. The origin and development of Bear, Ray's, and Tow Caves can be explained in this manner. Enlargement is still continuing. Modification due to collapse and diversion of surface waters through sinkholes is minor.

The initial openings in the American Bottoms cavern system were formed in the same manner. Enlargement has taken place, and is taking place, as a result of the invasion of waters from Bridge Creek.

Three Dimension Maps in Color. BERNARD H. SCHOCKEL, Valparaiso University.—There is need for progress in the production of three-dimension, bona fide maps in color.

It has been established that they cannot be based successfully upon arrangement of color hues, or upon arrangement of color vividness.

---

1. Kentucky Geological Survey.
2. University of Southern California.

Quantitative precision has long been achieved by the use of bands of color hues to portray the contour spaces. Now, in addition, the third dimension can be achieved in such maps by the use of high lights and shadows, and by use of direction of stroke. Thereby all slopes are portrayed in three dimensions, i.e., by the use of color bands, high lights and shadows, and by direction of stroke.

Examples of such quantitatively precise, three-dimension, bona fide maps in color are the maps of Spring Mill State Park, and of the Navajo Country, by the author.

A Study of Population Trends in Pike County, Indiana. LOWELL I. DILLON, Indiana University.—Pike County, Indiana, suffered a loss of population every decade since 1900 except for the 1930-1940 period. Preliminary investigations show that this was a regional response until the 1940 census, as population graphs of the neighboring counties are rather similar up to that date. From 1940 to 1950, however, the decline seems more local, since surrounding counties made slight or substantial gains, whereas Pike had a twelve per cent loss.

The general area losses appear to reflect farm mechanization, inability of farmers on sub-marginal land to compete with those of more favored areas, loss of soil fertility due to erosion and strip coal mining, the change from shaft to strip coal mining, and the rural to urban trend associated with industrialization.

During the 1940-1950 decade, the most important reason for the dissimilarity between Pike and its neighbor counties seems to be lack of local industrialization. In 1947, Pike had less industry than any other southern Indiana county except Brown and Switzerland. Probably the second major reason was a locational one. Pike County is farther from Evansville than are Gibson and Warrick Counties, and thus less favorably located for commuting to this major southern Indiana industrial center.

Geologic Control of Ground-water Occurrence in Western Marion County, Indiana. CLAUDE M. ROBERTS, U. S. Geological Survey.—Water-supply needs for both urban expansion and farm use have created ground-water problems in western Marion County, Indiana.

Thin, clayey glacial till of low permeability covers the shale bedrock of the area and locally contains shallow, thin lenses and streaks of water-bearing sand and gravel. Yields from the sands and gravels range widely from place to place; the water is usually of suitable quality. The shale retards the downward movement of water and serves to confine any water present in the limestone beneath. The dense limestone of the area is considered a poor aquifer; it yields water containing hydrogen sulfide.

At several localities, however, deep wells penetrating a limestone formation yield small quantities of water containing little or no hydrogen sulfide.

Interesting Aspects of the Conglomerate-Sandstone Phase of the Glacial Deposits of Tippecanoe County, Indiana. JOSEPH S. ROSENSHEIN, U. S. Geological Survey.—During a ground-water reconnaissance of Tippecanoe County, Ind., conglomerate and standstone were observed interbedded with unconsolidated glacial deposits. Outcrops of the consolidated deposits are present in the west, west-central, and northeast part of the

county. These cemented deposits are associated primarily with the Wabash River and Wildcat Creek drainage. Locally the material forms resistant terrace levels. Greater thicknesses of sandstone were found in the central part than in the northeast part of the county. Both the sandstone and conglomerate are crossbedded. The deposits are underlain and overlain by a gray-blue clay; in some areas they are underlain by a compact maroon till.

Calcium carbonate is the primary cementing agent. In many areas the degree of cementation varies in both the horizontal and vertical directions. The better sorted material is more effectively cemented.

Springs are present at the contact of rock and underlying gray-blue clay. Associated with the springs are deposits of calcareous tufa. In the past the cemented deposits must have been an aquifer of some consequence, with progressive erosion of the material by the Wabash River controlling the ground-water levels. Apparently cementation occurred either during late Wisconsin time or early Recent time.

A Method for Mapping Permeable Zones in Glacial Till. PORTER E. WARD, U. S. Geological Survey.—Well-inventory data, water-level fluctuations, and well characteristics are being used to map sand and gravel zones in the till plains of southern Indiana. The data indicating greater productivity of wells are taken to reveal the presence of the more productive aquifers and are used, with caution, as evidence of the shape and continuity of these aquifers. The method must be applied with an understanding of its limitations; however, it is very useful in reconnaissance studies where precise geologic and hydrologic data are rare or unobtainable.

Some Examples of Geologic Control of Ground-Water Quality in Northwestern Indiana. REUBEN J. VIG, U. S. Geological Survey.—Two conditions worthy of comment were observed during a ground-water study in northwestern Indiana. The first concerns hydrogen sulfide in water pumped from shallow limestone aquifers; the second, the effect of geologic structure upon ground-water quality.

Hydrogen sulfide is usually present in ground water where the New Albany shale caps limestone. The shale, which is known to contain pyrite and some organic material, could be a possible source of the gas. In some sections of the area, hydrogen sulfide is present also in ground water when limestone is directly in contact with the glacial drift. This limestone contains quantities of organic matter and has pyritic zones from which hydrogen sulfide could be derived in the presence of underground water. If the source of hydrogen sulfide is in the limestone, a shale barrier could serve as an effective trap for the gas.

Analyses of water from Ordovician aquifers show that the dissolved-solids content is considerably higher than that of water from Cambrian aquifers. This difference probably is the result of structural control. Cross sections based on logs of deep wells indicate that the St. Peter sandstone, the chief aquifer of Ordovician age, pinches out against the Kankakee arch, thus trapping the water. The Cambrian strata, however, are continuous across the arch.

Status of Rural Zoning in the United States—1954. J. E. BECHT, Indiana University.—A study of existing laws and attitudes concerning

"Rural Zoning" is especially timely in view of current problems that have arisen from severe droughts plaguing large sections of the United States and, to a lesser degree, because numerous areas have been adversely affected by the "economic recession" which began early in 1953. The purpose of the study is to provide an estimate of the effectiveness of any land-use programs which might be undertaken to alleviate rural economic distress and to maintain or to restore land values.

Effective state-wide "Rural Zoning Laws" have been adopted by less than one-fourth of the states. Many of the states which have the greatest need for "Rural Zoning" lack adequate laws to cope with their agricultural, grazing and forest land-use problems. Most "Rural Zoning" laws currently listed in the statutes were adopted and accepted during the years 1932-38. By 1932 sufficient pioneer work in Wisconsin, reports by federal committees and recommendations by state and county planning groups provided patterns of concrete corrective steps that could be followed to improve economic conditions in areas of limited physical resources. However, by 1938 the nation was sufficiently occupied with world affairs so that most problem areas were provided with stimuli which temporarily alleviated their financial plight. Consequently, interest in "Rural Zoning," other than for restrictions connected with highway, suburban and airport construction, has waned and it appears as though much costly and time-consuming re-education will be necessary before the general public will again recognize the need for sound zoning laws to govern uses of agricultural, grazing and forest problem-lands.

Locational Patterns of Wholesaling Within Metropolitan Centers. JACK C. RANSOME, Indiana University.—Wholesaling establishments are concentrated overwhelmingly in downtown districts of metropolitan centers. Brokers and sales offices prefer sites near the financial district where credit and communications facilities are best developed. Such wholesalers compete favorably with other users for office building space. Their location affords maximum convenience to clients.

Wholesalers with storage cling mostly to the edges of the retail shopping district and migrate with it. They occupy old retail or residential areas of low rent and with low pedestrian densities. Often they form a buffer zone between retailing and railroads or the waterfront. Symbiotic relationships are seen between retailing and wholesaling and light manufacturing and wholesaling. As a wholesaling district becomes known for a commodity line, like wholesalers are attracted and the resulting community tends to have considerable locational inertia.

Transportation facilities are hampered in downtown areas because of narrow streets, traffic congestion, and the lack of adequate off-street parking for trucks and customer automobiles. A slow decentralization of wholesaling is occurring in metropolitan centers. The movement is proceeding along rail sidings and highways which lead out from the city. Wholesaling in outlying areas is oriented chiefly to the carload receipt of goods, abundant operating space relatively free from congestion, lower taxes, and the suburban market beyond ten miles from the city center.

Planning groups must anticipate a greater need for wholesaling office

space in the metropolitan center, and should encourage cooperative warehouse and transportation facilities for outlying wholesalers.

Iron Deposits in Southwestern Indiana.[1] WAYNE M. BUNDY, Indiana Geological Survey.—Most of the iron deposits of Martin and Greene Counties are within the Mansfield formation (Lower Pennsylvanian), but small deposits also occur in the Beech Creek limestone (Upper Mississippian), Goethite, the major iron mineral, occurs as cementing material, concretions, bands along bedding planes, veins, irregular open space fillings, and plant replacements in sandstone and shale. Small replacement bodies of goethite commonly are present in limestone. Magnetite occurs as finely disseminated grains within the interior shells of concretions. Iron probably was precipitated in swamps and lagoons in early Pennsylvanian time. That iron was deposited in bogs is indicated by: (1) local occurrence, (2) relative abundance of associated plant fossils, (3) similarity of chemical analysis with other iron deposits known to be of bog origin, (4) presence of clay, similar in composition to underclay, and (5) abundance and probable syngenetic nature of the iron concretions. Widespread occurrence of shrinkage cracks and colloform texture suggests that iron was largely a colloidal precipitant. Electrolytes, micro-organisms, oxidation, and supersaturation may have been active in the precipitation of the iron.

---

1. Published by permission of the State Geologist.