GEOLOGY AND GEOGRAPHY

Chairman: HENRY H. GRAY
Indiana Geological Survey, 611 N. Walnut Grove, Bloomington, Indiana 47405

Chairman-Elect: AKHTAR HUSAIN SIDDIQI
Professor of Geology, Indiana State University, Terre Haute, Indiana 47809

ABSTRACTS

Pennsylvanian Oil and Gas Occurrences in Sullivan County, Indiana. SCOT ADAMS, DAMES and MOORE, Cincinnati, Ohio 45203 and GUNNAR KULLERUD, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907.——Data obtained from geophysical logs and petroleum, coal, and water well drillers' logs were examined to determine which Pennsylvanian stratigraphic horizons or intervals are associated with oil and gas.

Most electric logs gave no significant indications of petroleum content. Some gas zones were represented strongly in association with conductive formation fluids over Silurian reef structures. Long lateral resistivity logs defined gas zones well under these conditions. Resistivity logs with a 64 inch spacing demonstrated some response in these zones. Because of infiltration of drilling fluids, 16 inch logs failed to detect gas zones well.

Above the horizon of the Seelyville Coal, 384 records indicated a strong affiliation of oil and gas occurrences with coal seams coupled with black shales. This type of association is more common than are associations of the thicker clastic sediment intervals with oil and gas. Clastic units between the Houchin Creek and Survant horizons and between the Colchester and Seelyville horizons demonstrated a higher rate of occurrence of oil and gas than other clastic units above the Seelyville Coal. This is attributed to the larger maximum grain size and better sorting of sands in these particular intervals.

No mappable horizons were detected within the Pennsylvanian sediments below the Seelyville Coal seam. Therefore these sediments were referenced with respect to their distances below the Seelyville Coal. One hundred and ninety of these petroleum occurrences were plotted on a frequency histogram with 10 foot class intervals. No significant zones of increased petroleum accumulation were indicated. Beneath the Seelyville coal petroleum fluids were frequently found in sand horizons adjacent to black shales.

Some gas occurrences, as thick as 20 feet, were indicated on electric resistivity logs within areas of maximum Pennsylvanian structural closure over Silurian reefs. Drillers' logs indicate multiple horizon occurrences of gas and oil over these structures. Pennsylvanian structures, resulting from the influence of Mississippian unconformity bedrock highs, did not appear to exert an influence upon the location of oil and gas occurrences. Accumulations were as common over Mississippian unconformity valleys as over unconformity ridges.

Past production intervals are thin and discontinuous. Permeability appears to be limited by overall clay richness of the sediments, owing to a fluvialy dominated delta depositional influence. The distribution of occurrences appears to be somewhat random. Future prospects for significant Pennsylvanian oil and gas production are adverse. Some potential exists for domestic or farm gas supplies. Six occurrences of gas in Pleistocene sediments were noted.

Computer Generated Stereograms. ROBERT F. BLAKELY, Indiana Geological Survey, Bloomington, Indiana 47405.——Points located in space by X,Y,Z coordinates can be plotted in two dimensions using the relations $X_p = X\sin(A) + y\cos(A)$ and $Y_p = Z\cos(B) - (X\cos(A) + Y\sin(A))\sin(B)$. A is the angle between the X axis and the line of sight and B is the angle between the X-Y plane and that line. Using these expressions, points may be plotted or connected to draw three dimensional objects as viewed from any direction. By viewing the same subject from two slightly different directions, stereo pairs may be plotted. Hidden lines in stereograms are beneficial in rendering the object transparent and transmitting information about the image.

Correlation and Nomenclature of Middle Ordovician Stratigraphic Units in Indiana. JOHN B. DROSTE and TALAL F. ABDULKAREEM, Indiana University, Bloomington, Indiana 47405 and JOHN B. PATTON, Indiana University and Indiana Geological Survey, Bloomington, Indiana 47405.——Stratigraphic units of the Champlainian Series defined through surface exposures ranging from the flanks of the Ozark Mountains to the upper Mississippi Valley have traceable physical continuity into the subsurface in Indiana, where they are bounded below by the Knox Dolomite and above by the Trenton Limestone and its equivalents.

The Everton Dolomite, bounded above and below by significant unconformities, and the oldest unit of this series, is recognized only in the subsurface of southwesternmost Indiana. The Ancell Group, superjacent to the Everton Dolomite and of Chazyan and early Blackriverian age, consists of the St. Peter Sandstone and two formations with which it is in facies relationship, the Dutchtown Formation below and the Joachim Dolomite above. All or parts of the Ancell Group are found throughout the subsurface of Indiana. The Dutchtown correlates with rocks called Wells Creek in Ohio and Kentucky, and the Joachim correlates with three informally named members in the lower part of the Black River Limestone of southwestern Ohio.

The Black River Group of Indiana consists of two formations, the Pecatonica Formation below and the Plattin Formation above, that are recognized throughout the subsurface of Indiana. The Pecatonica is traceable into western Kentucky (where the same name is used), but it is uncertain that it continues very far east of the Indiana-Ohio boundary.

The Kolarik Mastodon Site. GARY D. ELLIS, Indiana Division of Historic Preservation and Archaeology, Indianapolis, Indiana 46204.——In August of 1980 the Indiana State Museum excavated, under the direction of the author, a late Pleistocene Mastodon (Mammut americanum) death site near Ora, Starke County, Indiana. In addition to the Mastodon remains, a nearly complete Caribou (Rangifer sp.) antler was recovered from associated context. The excellent state of floral and faunal preservation and the undisturbed site contexts provide an encapsulation of early post-Wisconsin life in northern Indiana. Unique on-site and laboratory bone conservation measures and the application of an innovative freeze-dry bone preservation procedure for the mega-faunal assemblage permitted an efficient and cost effective data recovery program.

Current Applications of Interactive Geographic Data Bases and Land Data Systems. GLENN MONTGOMERY, Mid-States Engineering Company, Inc., Indianapolis, Indiana.——A major problem concerning most natural resource and land planning problems involves the comprehensive and often complex task of compiling, accessing and managing information. Frequently, massive and seemingly

unrelated data must be analyzed to spot problems and highlight possible planning solutions. Within the last two years major technological advances in the field of interactive computer graphics are providing resource planners with advance tools for the storage, retrieval, manipulation and re-combination of planning data from virtually any source document. Meshing emerging interactive graphics with the concept of a geographic database and linked graphic (map) and non-graphic (record) files, planners and resource managers are now realizing new levels of analytical flexibility and research productivity.

Mid-States Engineering, an Indianapolis based consulting engineering firm, specializing in land planning, photogrammetric engineering and related services, recently installed the first of a new generation of interactive computer graphics systems. Utilizing the unusual capabilities of this system, this paper briefly reviews conceptual planning, design, organization and construction of digital graphic databases; digitization from existing maps or photogrammetric compilation, and the creation of new maps from coordinate geometric data. Several local environmental inventory and analysis applications will be reviewed.

Identification of the Twocreekan Substage in Indiana. ALLAN F. SCHNEIDER, University of Wisconsin-Parkside, Kenosha, Wisconsin 53141, and MARK RESHKIN, Indiana University-Northwest, Gary, Indiana 46408.——The Twocreekan Substage of the Wisconsinan Stage of glaciation is generally regarded as an important time-stratigraphic unit in the late Quaternary glacial chronology of the Midwest. Botanical (palynological) evidence for the Twocreekan interstade in Indiana was recognized many years ago in pollen diagrams by Frey (northern Indiana) and Engelhardt (central Indiana). Geological (stratigraphic) evidence for its identification has not been previously reported, however, partly because ice deposits of immediate pre-Twocreekan (late Woodfordian or Port Huron) age and immediate post-Twocreekan (Valderan or Greatlakean) age are not present in Indiana, as they are farther north. Furthermore, recognition of the Twocreekan interval has not been indicated by radiometric dates.

A previously unreported ^{14}C date of 11,815 ± 640 yrs. B.P. (IU-67) on wood from a thin organic horizon near the base of a 6-meter section of lacustrine sediments in northern Lake County thus represents the first positive geologic identification of the Twocreekan Substage in Indiana. The identification is strengthened by two post-Twocreekan radiocarbon dates, also not previously reported, of 10,890 ± 560 yrs. (IU-69) and 9,100 ± 640 yrs (IU-68) on wood specimens from organic horizons higher in the stratigraphic section at the same locality. The Twocreekan assignment is further supported by the fact that the dated layer overlies calcareous clayey till that is either Tinley or Lake Border till and thus can be no younger than the Glenwood II state of glacial Lake Chicago, which has been dated previously from independent evidence as about 12,000 to 12,600 radiocarbon years B.P.

A Study of Lake Chicago Calumet Beach Sediments. ALFRED T. SMITH and PERRY E. ZACK, Indiana University Northwest, Gary, Indiana 46408.——Three consecutive and distinct environments contributed to the formation of the Calumet Beach of glacial Lake Chicago in the Gary quadrangle of Indiana. A low lake-level period that occurred between two equally high lake-levels resulted in the deposition of a peat layer between two similar arrays of lacustrine beach sediments. This sequence of deposits provides a distinction between the Calumet lake stages in the lakeshore region.

Construction of an Apartment/Social Center Complex in Karst Terrain, Bloomington, Indiana. TERRY R. WEST, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907 and THOMAS KALLIO and DAVID WARDER, ATEC Associates, Inc.——Karstic terrain such as that found in Bloomington, Indiana requires careful consideration during design and construction. Disruption of subsurface drainage patterns and/or excessive loading of cavernous bedrock must be avoided, or significant damage to construction can occur.

To assess the construction feasibility of a three story apartment/social center complex on the north side of Bloomington, shallow surface-depressions were mapped and lithologic trends evaluated. Solutioning along primary and secondary joints in the thick-bedded, dense, biofragmented Harrodsburg Limestone and the overlying, several few feet of lower Salem Limestone (both Mississippian Age) was believed responsible for karstic conditions at the site. The vertical extent of these features was predicted to be limited to a zone above a sequence of interbedded shale (Elevation 760). Further, surface expression of sinkholes was thought to have developed from collapsed soil plugs settling into enlarged vertical pipes formed at the junction of joint sets.

Although sinkhole development is a slow, geologic process, which would not be expected to occur during the life of the structure, the potential for loss of foundation support from these pipes poses a construction threat. Actual conditions revealed by inspection of sinkholes during construction were generally consistent with the original interpretative study. Solutioning was found to be more strongly developed along primary joints, these trending slightly closer, (between N65° to 80°E) to the regional pattern (N81°E) than originally anticipated. Enlarged vertical openings were found at the junction of joint sets in several locations. However, local variations in lithologic composition, and to a lesser extent, solutioning along bedding planes, were also contributing factors warranting future interpretation.

The proposed method for treating karstic conditions within the limits of load bearing foundations of the main building and for other related structures, focused on maintaining subsurface drainage, structural support and soil moisture equilibrium. To accomplish this end, the soil was cleaned from each sinkhole on both the sides and bottom prior to backfilling with a layer several feet thick of large sized crushed stone. A reinforced concrete pad, with vertical drains was placed over the filled sinkhole and supported on the rock bench above the active solution pit. Crushed stone overlain by filter fabric was placed over the concrete pad to serve as a drainage filter. Finally, natural clay fill from the site was placed and compacted over the depressions as needed to establish the foundation grade.