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ABSTRACTS

Landfills in Marion County—A Revisit. Konrad J. Banaszak and Theodore K. Greeman, U.S. Geological Survey, 6023 Guion Road, Indianapolis, Indiana 46254.——Seven landfills studied in the early 1970s were revisited in the fall of 1983. Four of the fills are in coarse sediments of the White River glaciofluvial channel and three are on the Tipton Till Plain. A map of lineaments was prepared from aerial photographs. There is no apparent relation between those features and the hydrology of the fills, probably because many wells are lost and four fills are in coarse material. Of the 82 wells drilled to study the three fills in till, 38 remain. Ground-water mounds were present at all three. At one fill, the specific conductance of water in most shallow wells ranged from 1,200 to 10,000 micromhos per centimeter (umhos/cm), and in a deep (162-foot) well specific conductance increased from an average of 760 umhos/cm in the 1970s to 4,450 umhos/cm in 1983. Of the 93 wells drilled to study the four fills in glaciofluvial material, 57 remain. In 1983, no data could be collected at one fill. Of the remaining fills, one had no gradient change; flow was toward the river with extremely slight vertical gradients. The second fill had no gradient change; flow was away from the river with downward vertical gradients. The gradient at the third fill had great change. In the 1970s, the shallow system flowed toward the river with a horizontal gradient of 0.001 and deep system was almost flat. In 1983, the direction of shallow and deep flow was away from the river with a horizontal gradient of 0.0025. These results confirm the advantages of continuous monitoring and the unpredictability of changes in flow direction and gradient.

Compression Strength Testing of the Springfield Coal, Coal V, Pike County, Indiana. K.C. Kuo and T.R. West, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907.——Coal pillars are left intact in underground mines to support the opening. Typically square or rectangular in shape, their purpose is to provide safety and continued mining while preventing surface subsidence. The optimum design maximizes coal extraction as well.

Coal strength can be determined by in-situ tests, (time consuming and expensive) or through laboratory testing. In the lab, different sized, cube-shaped specimens are tested in uniaxial compression. Research on Appalachian coals has shown that strength of cubes decreases with increasing size until a value equal to the pillar strength is obtained.

In this research, specimens of the Springfield Coal (Coal V) were collected from an operating open pit mine, Pike County, Indiana. Cut from the working face immediately behind the loading shovel, they were stored in sealed styrofoam coolers to

prevent moisture loss. Cracks occur in coal specimens during drying. Storage is in a humidity chamber prior to sample preparation and for prepared samples until testing.

Specimens are cut dry using a horizontal band saw with a tungsten carbide blade. After rough cutting, cubes are ground smooth using sand paper and a surface grinder to assure the loading surfaces are parallel. Cubes are prepared so that loading will be perpendicular to the bedding planes. Coal strength data for the Illinois Basin coals will be provided in this research.

Interpretation of Glacial Geology and Groundwater Problems in East-central Indiana using Improved Compilations of Water Well Driller's Records. ALAN C. SAMUELSON, Department of Geology, Ball State University, Muncie, Indiana 47306.——Recently published USGS compilations of water well driller's records in East Central Indiana have proven to be superior to previously published general compilations. The data were compiled for computer simulations of regional groundwater conditions, but have been valuable in interpretation of landuse, site specific groundwater, and geologic problems involving glacial stratigraphy. The new compilations show depth and lateral extent of sand and gravel horizons. The improved maps display four to six sand and gravel horizons per county and show distribution by elevation and thickness of each horizon. A number of examples are presented to demonstrate data reliability as confirmed by subsequent tests and the resulting evaluations of geologic, engineering, and groundwater resource problems. Specific aquifer horizons have been correlated with outcrop and outwash soil exposures. Locations of important groundwater seepage into stream baseflow can be identified.

Three-dimensional Patterns of Biotite Composition within the Cloudy Pass Batholith, Washington. J.R. SANS AND C.D. POTTER, Department of Geology, Ball State University, Muncie, Indiana 47306.——The Cloudy Pass batholith is a small epizonal pluton of Miocene age. Since the batholith straddles the Cascade Crest, it has been deeply dissected by glacial erosion so that specimens could be collected over an area 14.88 by 15.26 kilometers with a vertical range of 1.54 kilometers.

The ten chemical elements most abundant in biotite (Na, Mg, Al, Si, Cl, K, Ca, Ti, Mn, total Fe) were determined by electron microprobe. Ferrous iron was determined by decomposition in a teflon bomb followed by titration of excess standard potassium dichromate with standard ferrous ammonium sulfate.

The compositional variations of biotite were studied on the following five different scales extending over nine orders of magnitude (micrometers to kilometers): (1) within a single biotite grain, (2) between grains in a single thin section, (3) between sections from the same rock specimen, (4) between specimens from the same outcrop and, (5) over the entire accessible volume of the batholith (about 350 cubic kilometers).

At the scale of a single biotite grain, three cations (Na, K and Mn) exhibit essentially no zoning, five cations (Mg, Al, Si, Ca, and Fe) show weak zoning, and one cation (Ti) shows strong zoning. At the three intermediate scales, specimens from the center of the pluton show a significant range of biotite composition, especially in the Fe/(Fe + Mg) cation ratio. Specimens from the margins and roof show a peculiar bimodal distribution of biotite compositions. On the scale of the entire batholith, Fe/(Fe + Mg), Mn, total Fe, and ferrous Fe decrease with elevation, whereas Mg, Cl, and ferric iron increase. All the above features of biotite are interpreted as due to subtle resetting of composition by hydrothermal activity during the cooling history.

Geology and Geomorphic History of the Garrison Chapel Cave System, Monroe County, Indiana. WILLIAM L. WILSON AND DONALD W. ASH, Department of Geography and

Geology, Indiana State University, Terre Haute, Indiana 47809.——The Garrison Chapel Cave System, in western Monroe County, Indiana, is composed of three hydrologically connected caves named Grotto, Shaft and Salamander. All three convey the same drainage westward from portions of the karsted Cave Creek and Garrison Chapel Valley watersheds. The cave stream resurges along the eastern side of Coon Hollow and is tributary to Richland Creek via Little Richland Creek. Up to four cavern levels are present in some portions of the system. Similar size, elevation, and fluvial sediments have led some authors to suggest that the Main Passage in Salamander Cave, the Big Room in Shaft, and the Main Passage in Grotto Cave were at one time integrated parts of the same large truck drainage net. Recent stratigraphic measurements and level surveys show that the passages are not related. Upper levels are accordant with bedding, are generally strike-oriented, have low gradients, and have sequences of mostly silty fluvial sediment that rise to, or near to, the passage ceiling, except where re-excavated by free surface streams. The lowest level contains an active stream, is dip-oriented, has a gradient steeper than the local dip, consequently downcutting at least 35 feet through the stratigraphic section. The relationship between cave passages and their geologic setting suggests a history of initial progressively westward and stratigraphically lower development of strike-oriented, phreatic passages that occurred perhaps in response to base level lowering. Meander scars that rise along the cave wall while passing downstream, indicate conduits may have developed by upcutting to reach equilibrium with base level (paragenesis). At some places, the older, upper levels have collapsed into the stream (lowest) level. Some cave streams appear to have fortuitously intersected older passages and now follow the passages along certain reaches of the stream. Thick, paragenetic sediment has been partially excavated by modern streams that may be downcutting to reach equilibrium with base levels that were greatly lowered by deep stage entrenchment of surface streams associated with drainage rearrangements of the Teays and Ohio rivers during Pleistocene glaciation.