GEOGRAPHY AND GEOLOGY

Chairman: Richard L. Powell, Department of Geosciences, Purdue University, Lafayette, Indiana 47907

Arthur Mirsky, Department of Geology, Indiana University, Indianapolis, Indiana 46202, was elected Chairman for 1973

ABSTRACTS

Origins of Wedge-like Soil Structures: Marion County, Indiana. J. V. Gardner, Department of Geography and Geology, Indiana State University, Terre Haute, Indiana 47809.——Outcrops of wedge-like soil structures, which may be confused with features originating in frost climates, were noted in Marion County, Indiana. These features are soil tongues (pendants) which penetrate downward into calcareous outwash. They are primarily a product of local solutioning unrelated to Pleistocene periglacial activity.

An Exposure of Pre-Wisconsinan Drift near Fort Wayne, Indiana[1]. M. C. Moore and N. K. Bleuer, Indiana Geological Survey, Bloomington, Indiana 47401.——The oldest unconsolidated materials yet identified in northern Indiana are exposed in the May Stone and Sand, Inc., Ardmore Road quarry (NE ¼, Sec. 29, T 30 N, R 12 E) at Fort Wayne. There, 5 feet of cobbly gravel are overlain by 4 feet of fine- to medium-grained, loamy sand which, when moist, is a gray to olive (5 Y hue) color. These units are further distinguished by their high content of angular chert and pebbles of other resistant lithologies and by their lack of shale or carbonate material (except in a rubble layer immediately above the limestone bedrock of Devonian age.) Some constituents of the heavy mineral suite from these sands and gravels have thick iron-oxide coatings, and the suite appears to be depleted in hornblende by an amount similar to that found in some Sangamonian soils. The high garnet-to-epidote ratio confirms an eastern or northeastern source for the allochthonous constituents. The content of mixed-layered clay minerals is higher in the old drift than it is in the overyling till.

This deposit of weathered, unconsolidated materials lies in a small upland bedrock valley and is preserved beneath either calcareous outwash or wood and snail-bearing till of the Trafalgar Formation (Wisconsinan, Tazewellian Substage). Because of its position directly above bedrock and beneath the otherwise oldest material in the area, because of its extremely weathered character, and because its composition suggests incorporation of bedrock residuum, we conclude that the deposit is pre-Wisconsinan in age.

---

[1] Publication authorized by the State Geologist, Indiana Geological Survey.

Major Constituents of Ash from Five Indiana Coals.[1] LOUIS V. MILLER and CARRIE F. FOLEY, Indiana Geological Survey, Bloomington, Indiana 47401.——Three channel coal samples from each of five major Indiana coal seams were collected, prepared, and ashed according to ASTM designation D 271-68 and D 2234-68. The lithium metaborate fusion method was chosen for the dissolution of the ash. Iron, silicon, aluminum, calcium, and magnesium were determined by atomic absorption spectrophotometry whereas sodium and potassium were determined by flame emission spectrophotometry. After calculation of the elements to the oxide form, the data indicate that as much as 95 per cent of the weight of the ash was composed of silica, alumina, and iron oxide. On the basis of the few number of samples analyzed, the various coal seams could not be identified by any major ash constituent. Totals for some of the samples were too high, which indicated a systematic error. More work will be needed to determine the suitability of the atomic absorption-lithium metaborate fusion method of analysis for coal ash.

[1] Published with permission of the State Geologist, Indiana Geological Survey.

The Stratigraphy of the Clays and Shales of Spencer County, Indiana[1]. MICHAEL C. CARPENTER and GEORGE S. AUSTIN, Indiana Geological Survey, Bloomington, Indiana 47401.——The Pennsylvanian Mansfield, Brazil, and Staunton Formations crop out in eastern and central Spencer County, Indiana, and dip westerly about 25 feet per mile. In the western part of the county they lie beneath younger Pennsylvanian formations and an overlying deep residual cover. The rocks within these older Pennsylvanian formations consist of shales, siltstones, mudstones, underclays, coals, sandstones, and limestones. The thicker coals, their subjacent underclays, and the marine limestones are the most reliable stratigraphic markers for correlation on a countywide basis. Most of the shale, mudstone, and sandstone beds, however, are discontinuous and can only be traced laterally from available surface exposures with great difficulty. About four drill holes per mile would be necessary to correlate these detrital rocks with any degree of certainty.

The shales overlying the Perth Limestone Member and underlying the underclay of the Buffaloville Coal Member and the Mariah Hill and St. Meinrad Coal Beds are the most laterally persistent of the argillaceous non-underclay units in the older Pennsylvanian formations. In addition, an underclay and thick shale that occur below a thin coalbed, roughly 35 feet below the top of the Buffaloville Coal Member and at the approximate stratigraphic position of the Upper Block Coal Member, can be traced for approximately 5 miles.

[1] Published with permission of the State Geologist, Indiana Geological Survey.

Drainage Patterns and Stream Classification in a Neotectonic Region. NEIL V. WEBER, Department of Earth Sciences, Indiana University at South Bend, South Bend, Indiana 46615.——Drainage patterns have long been used by geomorphologists in their attempts to interpret the

geological structure and the nature of underlying strata. Most previous work on the relation between drainage patterns, geologic structure, and bedrock lithology pertains to regions which have been quiescent during recent geologic history (*i.e.*, regions where weathering and erosion have etched out the resultant landforms).

This report focuses on a region that has been all but quiescent in recent geologic time. The southern portion of the Colorado Plateau (San Francisco Plateau, Arizona) was a highly active volcanic and tectonic region for the past several million years. Volcanic activity has been dated as recently as 1065 A.D. (Sunset Crater eruption). The landforms of this region are believed to be in their initial stage of development, with much of the drainage original upon the surface.

Specific conclusions were as follows:

1) The streams within the study area could have developed in a number of ways; only through detailed analysis of individual streams and stream segments (*e.g.*, their slope and valley profile characteristics, their gradients, and their relative association with bedrocks outcrops and/or valley alluvium) can origins be defined.
2) Drainage pattern terminology should not be taken to infer the genetic history of streams and stream segments.
3) The problems encountered in the study of the association among diastrophism, volcanism, and drainage-line development in neotectonic areas are different from those of similar associations in areas which have been structurally inactive and subjected to weathering and erosion over extended periods of geologic time.

The Influence of Cap Rock on the Development of Slopes. DIANE H. BURNER, Department of Geography and Geology, Indiana State University, Terre Haute, Indiana 47809.——This study was an investigation of the possible influence of sandstone caprock on the development of slopes on two different sequences of flat-lying carbonate strata in southwestern Kentucky.

Four slope categories were studied: sandstone-capped Paint Creek limestone slopes; uncapped Paint Creek limestone slopes; sandstone-capped Renault limestone slopes; and uncapped Renault limestone slopes. One hundred randomly selected slopes were measured in each slope category. The mean and maximum slope values were established for each slope measured. Analysis of Variance and the *F* test were used to determine whether mean slopes in each sandstone-capped limestone slope category were significantly different from the mean slopes in the corresponding uncapped limestone slope category. The *F* test was also used to determine whether the maximum slopes in each sandstone-capped limestone slope category were significantly different from the maximum slopes in the corresponding uncapped carbonate slope category.

Analysis of Variance revealed that the mean and maximum sandstone-capped carbonate slopes were, respectively, significantly greater than the mean and maximum uncapped limestone slopes. The

analysis also showed that the magnitude of the mean and maximum slopes developed on sandstone-capped limestones was significantly influenced by the thickness and lithologic characteristics of the caprock. Finally, the test results suggested that the magnitude of the mean and maximum slopes developed on uncapped limestone was at least partly determined by the lithologic characteristic of the carbonate sequence.

A Study of the Floras in the Alleghenian and Conemaughian Series in Sullivan County, Indiana. RAYMOND N. PHEIFER and DAVID L. DILCHER, Department of Botany, Indiana University, Bloomington 47401.——Compressed remains of plants preserved in the shales overlying Indiana Coal No. 5, in the Dugger Formation, and No. 7, in the Shelburn Formation were collected from the Hawthorn and Dugger pits of the Peabody Coal Company. In the Hawthorn pit shale above both Coals No. 5 and No. 7 were sampled and in the Dugger pit fossils were collected only above the No. 7 Coal. Plant fossils were abundant and most frequently collected from the shale units 20-25 feet above the No. 5 coal and 0-3 feet above the No. 7 Coal. Several hundred specimens were collected to provide a sufficient sample to establish both the taxonomic affinities and relative abundance of the plant fossils at each locality. *Sigillaria cumulata* Weiss, *Linopteris muensteri* Potonie, and *Neuropteris rarinervis* Bunbury are unique to the shale above Coal No. 5. *Sigillaria cumulata* has not been described previously from the Illinois coal basin. Lycopods were common at all the localities. Above Coal No. 5 the Neuropterid ferns and Cordaites were more abundant than above Coal No. 7 and only a few Calamitean remains were found. Dispersed seeds of seed ferns were common above Coal No. 5. In a comparison of the two localities for No. 7 Coal it was noticed that Pecopterid and Sphenopterid fern foliage are more common at the Dugger pit while Mariopterid and Alethopterid seed fern foliage are more common at the Hawthorn pit. Neuropterids are conspicuously absent above the No. 7 Coal at the Dugger pit. As a result of this preliminary work the fossil plants common to the shales above Indiana Coals No. 5 and 7 are beginning to be characterized and the lateral variation of these fossils above Coal No. 7 understood.

NOTE

Symbolization and Computer Mapping. WILLIAM D. BROOKS, Department of Geography and Geology, Indiana State University, Terre Haute, Indiana 47809.——Premap decision making regarding the selection of screen tones and patterns is a difficult problem. The influence or perception of screen tones and patterns for final map appearance is not yet well enough understood to make objective decisions regarding line screen to increase per cent area inked. Choice of line screen to increase per cent area inked is done to enable the cartographer to infer increasing magnitude of data. Lighter tonal areas are generally associated with lesser magnitudes while darker tonal areas are associated with greater magnitudes.

The purpose of this research was to review the effectiveness of printer characters to create perceptible tonal changes. Printer characters used for area symbolization must function by classifying area and also to infer data ranking.

Computer maps produced by character printers compound the decision making for a number of reasons: 1) it is not possible to order objectively preferred printer characters according to per cent area inked; 2) if preferred characters are ordered subjectively, a problem arises due to character shape characteristics; 3) print characters do not fill the 1/10-inch by 1/6-inch rectangle allowed each print symbol (Because of this, excessive white background allows "noise" in the perceptors map image); and 4) a mechanical problem which arises because symbols are not overprinted in a consistent manner. An O and an asterisk do not always overprint correctly allowing an apparent reduction in per cent area inked.

In summary, incipient research regarding the effectiveness of printer characters to classify area and infer data ranking has isolated items needing controlled, rigorous research design. The most important is to rank objectively each individual preferred printer character and selected overprint assignments. I am presently engaged in assessing per cent area inked for each character. Further research is needed on all aspects of symbolization for computer maps. Increases in available machine-readable data and shortages of fully-trained personnel for manual production will result in an increase in the use of computer maps acceptable as a final product.