ground coal mines have significantly advanced during the past two decades. This has been the result of mining under more difficult conditions such as depth, geologic disturbances, vicinity of mined-out areas or gas and oil wells, methane emission, and higher ground pressures. Furthermore, capital requirements and operating costs for mining projects have been increasing. The mine operators find it advantageous to know more about the geological environment of the reserves to minimize the risks of development. Pre-mining investigations can provide useful information for mine planning and design (equipment selection, layout of mine workings, estimation of mine productivity, and analysis of ground control problems).

Some data obtained can be utilized to improve feasibility studies and financial analysis. The writers have been actively engaged in pre-mining investigations for coal reserves in the Illinois basin for about seven years. This paper describes geological, geotechnical, and hydrological investigations which can be conducted during the exploration drilling phase to obtain meaningful data for mine planning and design. The emphasis of the paper is on room-and-pillar coal mining.

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Akron Dolomite Oil and Gas Production, Chautauqua County, New York

The Upper Silurian Akron Dolomite in western New York has become the focus of exploratory drilling, with the recent discovery of significant volumes of both gas and oil. Depth through the productive zone is commonly less than 3,000 ft (900 m) ad unofficial reports indicate natural production over 10 mmcfgd and at least 500 barrels of high-gravity crude oil per day per well.

Productive wells have been erratic, but at least eight and as many as twelve discoveries have been drilled to date, all located within a narrow northeast-southwest trend spanning the county. Low-angle reserve faulting appears to be the trapping mechanism, with concomitant fracture enhancement of permeability. The haphazard distribution of productive wells within the trend suggests the need for both faulting and intense fracturing in order to create a viable reservoir. The fairway may extend northeastward into Cattaraugus and Erie Counties, New York. Detailed geological and geophysical work is necessary to pinpoint specific prospects. It is predicted that the play will have substantial impact on proven oil and gas reserves in New York State.

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Provenance Study of Upper Freeport (Pennsylvanian: Allegheny Group) and Mahoning (Pennsylvanian: Conemaugh Group) Sandstones in Eastern Ohio

Deposition of the complex sedimentary facies in the Allegheny basin exhibits a change in the dominant source of sediment influx from north to southeast through Pennsylvanian time. Lobate deltas entered eastern Ohio from both the rising Appalachian Mountains to the east and southeast and from the Canadian shield to the north. Confusion exists regarding the limits of the respective deltas. The present study is an attempt to define the limits of these sedimentary domains for a small portion of the basin in space and time. Samples of the upper Freeport (Upper Desmoinesian) and Mahoning (Lower Missourian) sandstones were collected along their western outcrop through eastern Ohio from Summit to Gallia Counties along a north-south transect. Thin sections were point-counted and analyses of the data made to determine whether the individual samples had their source in the high-grade metamorphic and igneous crystalline basement of the Canadian shield, or among the sedimentary and low-grade metamorphic rocks of the Appalachians. Determination of the source of the samples allows delineation of the boundary between respective delta lobes.

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Variability in Btu, Ash, and Sulfur Content of Northeastern Ohio Peat Deposits

Northeastern Ohio contains over 24,460 acres (9,898 ha.) of peatlands, some of which combine relatively low ash and sulfur with Btu values comparable to those of Ohio coal. This combination of properties makes these deposits a potential local fuel source.

Eighteen bogs developed in nine different substrate units were sampled to determine the range of within-bog and between-bog variability with respect to Btu, ash, and sulfur content. The substrate units are based on glacial and soil maps of the area. Two bogs were sampled from within each substrate unit. For each unit, one bog was sampled laterally at two localities at a depth of 6.5 ft (2 m), and a second bog was sampled vertically at one locality at depths of 6.5 and 20 ft (2 and 6 m). A total of 36 samples was collected and analyzed for Btu, ash, and sulfur.

The data show a strong negative correlation between ash and Btu. Ash content can explain 99.2% of the Btu values in the peat samples and can be used to predict Btu values to within ± 200 Btus. There are statistically significant differences in Btu, ash, and sulfur content in samples from different substrate units. Bogs in the substrate units, which included the Kent-Lavery Drift end moraine and kame facies, are generally high in Btu and low in ash and sulfur. An attempt was made to identify the combination of variables present locally in the nine substrate units which best explained their Btu content. Stepwise multilinear regression analysis of these variables shows that mean annual precipitation and drainage area explain 72% of the variation in the peat Btu values.

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Geologic Prediction of Shale Roof Rashing

Summertime rashing of coal mine roof shales can be deleterious to mine operation by restricting ventilation, impeding access, and posing other safety hazards. A two-year field monitoring program, coupled with laboratory investigations of shale behavior under various humidities, was aimed at defining causes and methods of prediction of shale roof deterioration.

Both strong and weak shales may exhibit deterioration in mines. It appears, on the basis of both laboratory and field investigations, that some weak shales, such as the "soapstone" above the Pittsburgh seam, may undergo very large swelling strains under high humidities. Some of this is recovered during wintertime drying, but the result is general loosening and disaggregation of the rock mass, which falls in small or medium-size chunks. By contrast, a more competent shale that exhibits less swelling strain (such as the roof of the Harrisburg [No. 5] seam in the Illinois basin) may still develop high compressive stresses and fail, by buckling or shear, into medium or large slabs. Further monitoring, both in the lab and underground, is needed to enable confident predictions of roof deterioration for all shales.