

micritized skeletal debris are the dominant particles. Peloids are abundant in the middle of the formation. The Alsen represents slightly deeper water and less current activity than the equivalent upper Becraft.

Port Ewen lithologies include irregular and nodular, silty, skeletal wackestones and packstones, silty, peloidal packstones, and interbedded shale. Ostracodes, bryozoans, brachiopods, and micritized skeletal grains represent the sparse fauna. Bioturbation is ubiquitous: *Chondrites*, *Planolites*, and *Zoophycos* lebensspuren are common. The Port Ewen formation records the deepest, least-oxygenated environment in the Helderberg Group.

EFRAMIAN, M., AMAX Coal Co., Indianapolis, IN

#### Cost of Adverse Geologic Conditions on Coal Production

This paper explores the cost attributed to mining of coal under adverse geologic conditions, in order to derive the costs that the geologic conditions generate. Both surface and underground models will be developed for ideal mining conditions. The two models will represent a reference point to which all costs are related. The underground model will consider such factors as roof and floor conditions, the effect of faults, and split coal. The surface model will include the effects of total overburden, hydrogeology, total thickness, and structure. These items of geologic information will be compared with geology of ideal mining conditions to determine the cost differential resulting from adverse conditions.

FRECH, KENNETH R., and ARTHUR E. BURFORD, Univ. Akron, Akron, OH

#### Aspects of Porosity Development in a Tight Sandstone, "Clinton" of Eastern Ohio

The Silurian "Clinton" sandstone of the Appalachian basin has long been a favored target for oil and gas exploration. Though most wells are of modest production, success ratios have been excellent. Porosities generally range from nil to as much as 10%, and permeabilities commonly range from less than 0.1 md to 1.0 md and more.

Detailed study of three cores from northeast Ohio by visual, petrographic, X-ray diffraction, cathodoluminescence, scanning electron microscopy, and electron microprobe analysis, shows that present porosity is essentially secondary in nature, and intergranular porosity shows significant modification and reduction by authigenic minerals. Pressure solution is suggested as moderate and fracture porosity is limited and, where present, is commonly healed by quartz and calcite overgrowths. Porosity appears to have developed and modified through successive stages. It appears to have progressed initially from dissolution of early calcite cement and local detrital clay matrix. Authigenic potassium feldspar rims formed on detrital potassium feldspar cores. Subsequently, ubiquitous quartz overgrowths, authigenic iron chlorite, and illite reduced porosity. Dissolution of the authigenic rims and detrital potassium feldspar cores also occurred. Some late-stage(?) calcite and phyllosilicate cements, and differential patches of anhydrite cement, further reduced porosity.

FURMAN, J. J., and JOHN R. SEFTON, Eastern Technical Center, Office of Surface Mining, Pittsburgh, PA

#### Geologic Information Requirements of Surface Mining Control and Reclamation Act of 1977 (PL 95-87)

The geologic information requirements of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) and the promulgating regulations are summarized. The basis and purpose of these

requirements and their relationship to the protection of water resources are explored. Specifically, with the geologic and related information acquired, mining and reclamation operations can be designed to preclude or mitigate the generation of acid mine drainage, and to maintain, restore, or perhaps even improve groundwater resources in proximity to and at the mine site. A hypothetical case study illustrates the substance of these requirements.

GEISER, PETER, Univ. Connecticut, Storrs, CT, and TERRY ENGELDER,\* Lamont-Doherty Geol. Observatory of Columbia Univ., Palisades, NY

#### Distribution of Layer-Parallel Shortening Fabrics in Appalachian Foreland of New York and Pennsylvania: Evidence for Two Non-Coaxial Phases of Alleghany Orogeny

A structural interpretation of a part of the central and northern Appalachian foreland, uses the correlation of mechanical twinning, solution cleavage, crenulation cleavage, pencils, joints, and deformed fossils. Such a correlation suggests that within the central Appalachians, the Alleghanian orogeny consists of two major phases: a deformation possibly as old as Pennsylvanian, herein called the Lackawanna phase, and a second deformation, termed the Main phase, which is Permian or younger in age.

The Lackawanna phase affects mainly the eastern parts of the foreland, such as the Hudson River Valley and Pocono Plateau, while the Main phase affects most of the Valley and Ridge and Alleghany Plateau. The Lackawanna phase is interpreted as the product of strike-slip motion possibly between the Avalon microcontinent and North America. The Main phase may record the final convergence of Africa against North America and its accreted microcontinents.

GILL, BRADLEY R., DAVID L. COPLEY, and ARTHUR E. OWEN, Berea Oil & Gas Corp., Buffalo, NY

#### Natural Gas Reserves as a Function of Reservoir Quality in Medina Group, Chautauqua County, New York

The Lower Silurian Medina Group is a deltaic sequence composed of interbedded sandstones, siltstones, and shales, and is the primary target for natural gas in western New York. Chautauqua is the westernmost county in the state, and the most actively drilled for Medina gas. While the Medina Group underlies all of the county and is generally considered productive of natural gas, there is a wide disparity in the production results that cannot be attributed to structural control.

A sufficient number of wells have been drilled to allow comparison of production history and reservoir quality as determined from geophysical logs. Contouring of these data shows a preferential accumulation of natural gas along linear trends that correspond to zones of enhanced reservoir quality. These trends may have a primary origin related to deposition within a complex deltaic sequence or a secondary origin of diagenetic or tectonic nature. The apparent presence of definable productive trends in the Medina suggests their extension into undeveloped areas, where they would constitute a viable exploration objective.

GUINNESS E. A., and R. E. ARVIDSON, McDonnell Center for the Space Sciences, Washington Univ., St. Louis, MO

#### Use of Digital Potential Field, Geologic, and Remote Sensing Data in Studies of Structure of the Mid-Continent

A great deal of digital potential field, geologic, and remote sensing data exists for the Mid-Continent region of the United States. These data sets are fundamental to the understanding of the