pane concentrations were separated into regional and anomalous values and contoured along with values of C_3/C_1. Analytical techniques developed to discriminate gas-prone areas from oil-prone areas confirmed the oil-prone nature of this field.

Geochemical anomalies were interpreted in the context of surface fracture distributions and areas of good production. Geochemical anomalies correspond with areas of optimal production from fractured reservoirs having mostly a north-northeast orientation. For this area a predominantly vertical leakage path from reservoir to surface is inferred. Geochemical prospecting using probes can identify oil versus gas-prone areas and can suggest which among many fracture directions are most likely to contain petroleum concentrations.

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Arsenic Concentration Variability and Inorganic Affinity for Selected Coal Beds of Central Appalachian Basin

The mean arsenic concentration on a whole-coal basis, for 613 complete channel samples representing 34 coal beds from the central Appalachian basin, is 14.0 ppm (standard deviation, s.d. = 14.9). An F-test for variance equality and the appropriate t-test on the means can separate stratigraphic units into three categories: (1) Kanawha Formation, which has a mean of 5.04 ppm; (2) New River, Pocahontas, and Monongahela Formations, which have means of 10.1, 10.9, and 12.4 ppm, respectively; and (3) Allegheny Formation, which has a mean of 18.1 ppm.

Data from 40 complete channel samples of the Upper Freeport coal bed (Allegheny Formation) were used for statistical evaluations (F- and t-tests as applied in the stratigraphic comparison) of the regional (western Pennsylvania) versus local (within mine) arsenic variation. The arsenic concentration and variation in whole-coal samples are greater on a regional scale (mean = 40.8 ppm, s.d. = 30.6, n = 21) than on a local scale (mean = 23.8 ppm, s.d. = 18.7, n = 19).

Nine channel samples of the Upper Freeport coal bed were subjected to a 21-part size-gravity washability study. A mean of 86 wt. % of the coal floated at a specific gravity of 1.6. The mean arsenic concentration (6.05 ppm) in this float recovery is 55% less than the mean arsenic concentration in the unprocessed samples (14.3 ppm). The mean arsenic concentration in the remaining 14 wt. % of the coal was 123 ppm. The float-sink analysis verified an inorganic affinity of arsenic and indicated that arsenic is associated with pyritic sulfur in the Upper Freeport coal bed. Three samples with a mean arsenic concentration of 4.20 ppm had a mean of 36.4% reduction of pyritic sulfur, while 6 samples with a mean arsenic concentration of 19.3 ppm had a mean of 63.8% reduction of pyritic sulfur. Concentrations of arsenic in complete channel samples above some threshold, approximately 10 ppm for these samples, appears to be associated with removable pyrite.

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The Mid-Atlantic Mesozoic Paleoshelf Edge: Carbonate Buildup or Reef?

An Atlantic Mesozoic paleoshelf-edge reef has been inferred from seismic profiles and Scotian Shelf petroleum exploration. The hypothetical reef forms a discontinuous offshore linear trend from Florida to Nova Scotia.

Data from recent Mid-Atlantic deep-water exploration drilling reveal the local nature of the paleoshelf-edge rim. Lower Cretaceous limestone was encountered at anticipated depths. Visual examination of drill cores and petrographic analysis of core thin sections show bioclastic grainstone, packstone, wackestone, floatstone, and rudstone, as well as a small amount of possible boundstone.

The bioclasts are mostly rounded, coarse sand and have thick or thin rinds. The abundant varieties of bioclasts include sponge, coral, echinoderm, bryozoan, bivalve, and algae fragments, with foraminifera, ostracods, calpionellids, and tubiphytes. Some intervals contain large (several centimeters), lobate stromatoporoids, which may be reefal framework elements.

I conclude that some intervals represent carbonate debris buildups and others represent reefal bioherms. Bioclastic debris intervals may result from in-place destruction of fragile calcareous reefal biota.

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Pennsylvania Anthracite Mining Industry: A Past—and a Future?

The anthracite region in north-central Pennsylvania was one of the earliest areas of coal mining in the United States. Anthracite was used by blacksmiths in Wilkes-Barre as early as 1769, and by 1808, coal was in demand for home heating and industrial markets. Anthracite production reached a peak of 99.6 million short tons in 1917, but has declined to only 4 million short tons in 1983. Reasons for the decline, during a time when energy demand has generally been increasing, include availability of cheaper fuels, unreliability of anthracite supply, labor-intensive mining, difficulty in mechanization of mines because of geologic conditions, depletion of the more accessible coal beds, and cost of correcting environmental problems.

Many energy analysts believe that the Pennsylvania anthracite industry is facing extinction. The remaining reserves are, however, extensive; a 1984 study funded by the U.S. Bureau of Mines estimated 19 billion tons of anthracite resources, including a reserve base of approximately 7 billion tons. The cost of anthracite leaving the preparation plant is at least 50% higher than that of bituminous coal mined in the East. However, the anthracite region is closer to major eastern markets, so transportation costs are less for anthracite. Because anthracite has a low sulfur value, the costly scrubber equipment required at power plants using higher sulfur bituminous coal usually is not necessary for anthracite-fired plants. Most mining research has been directed toward the bituminous coal industry in the past; similar research is needed in the anthracite industry to develop mechanized, high-productivity mining methods and to improve economic competitiveness.

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Microcomputers in Earth Science

Earth scientists and engineers are well advised to consider their long-term repetitive needs for computer support before making a heavy financial commitment in computer hardware. Powerful work stations can now be designed around a personal computer (PC) or microcomputer.

Success with microcomputers results from development of VLSI (very large-scale integrated) circuits and the 5¼-in. diskette (floppy) drive. The latter allows computers with limited memory to swap data rapidly and economically between memory and a storage diskette. Microcomputers benefit from advances in electronic technology and are approaching capabilities of mainframe processors. Equally important to the success of these hardware improvements is the acceptance of common operating systems between machines assembled by different manufacturers and the implementation of compilers for major computer languages. Accompanying compiler development is the development of more powerful, multi-tasking, multi-user operating systems.

Examples of powerful PC and super-micro systems that are of particular interest to those working in the earth sciences and mineral resource assessment will be presented, as well as improved peripheral equipment such as graphic printers, communication modems, digitizers, and specific software programs.

Such developments in hardware and software, which offer improved speed and responsiveness, are the real keys to improved productivity when microcomputers are used. They permit better management and analysis of data, more meaningful formatting of information, greater alternatives for problem-solving, and with a well-designed system, time and money saved.

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The Richlands Channel—Part of an Early Pennsylvanian Depocenter in East-Central Appalachian Basin

Investigations of Lower Pennsylvanian coal-bearing rocks for the central Appalachian basin analysis program have delineated a broad sinuous channel extending for 30 mi northwestward from Richlands, Virginia.