proposed. The proximal cycle consists of coarse pebbly biosparites, commonly showing the characteristics of grain flows, passing up into cross-bedded, fine-grained biosparites, which then are overlain by micrite and calcareous shales. Calcareous shales occur interbedded throughout the cycle. This cycle is interpreted as having been deposited in bypass channels on slopes around the Middle Ordovician islands or shoals. The distal cycle consists of poorly washed biosparite passing up into interbedded micrite and calcareous clay, and is interpreted as being deposited near the base of the slope or in the adjacent basin.

Both types of cycles have hardgrounds on their coarser units, indicating long periods of nondeposition and/or erosion after deposition.

A close analogy can be made, both in microfacies and depositional environment, with the Holocene Arabian shelf of the Persian Gulf. Furthermore, both have similar tectonic situations—carbonate shelves on ancient shields undergoing collision with a magmatic arc.

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Facies and Depositional Environments of Energy Shale Member (Carbondale Formation, Pennsylvanian), Southwestern Jefferson County, Illinois

The Energy Shale directly overlies the Herrin (No. 6) Coal Member in southwestern Jefferson County. Five facies of the Energy are recognized in the study area. The depositional environment is interpreted as a large quiet-water bay into which periodic influxes of coarse-grained sediments from the nearby Walshville channel were deposited as crevasse splays. The bay-fill deposits include a nonmarine and a brackish-marine facies; the latter has higher sulfur and boron contents and a sparse marine fauna. Both bay-fill facies are faintly laminated gray shales, and both grade laterally into and underlie deposits of the distal portion of crevasse splays. The distal splay facies is dominantly siltstone with lenticular bedding. The proximal splay facies grade laterally into and are interbedded with the distal splay deposits, and are divided into a channel facies (characteristically a well-sorted sandstone that contains microcross-bedding, clay drapes, contorted bedding, and a shale clast lag-deposit) and an interchannel facies (characterized by massive and flaser-bedded sandstones). Sulfur and boron content of the proximal and distal splay deposits is considerably less than that of the brackish-marine bay deposits, suggesting a nonmarine origin. Energy Shale facies have a direct influence on the sulfur content of the underlying Herrin (No. 6) Coal. In areas where thick (> 20 ft, 6 m) nonmarine bay-fill deposits overlie the coal, the sulfur content of the coal is less than 1%. Where the coal is overlain by thick proximal splay deposits, the sulfur content is 2 to 3%. This increase in sulfur content is attributed to downward percolation of sulfate-rich marine waters of a later transgression through the permeable sandstone. Where the coal is overlain by thin brackish-marine Energy or by the Anna Shale, the sulfur content averages 4 to 5%.

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Inorganic Geochemistry of Illinois Basin Coals

Chemical and mineralogical compositions of more than 100 samples of Illinois basin coals have been examined from an existing data base. Multivariate statistical analysis of the data shows that variation of many trace elements is related to mineral impurities in coal, including pyrite, clay minerals, calcite, sphalerite, and quartz. Organic sulfur, germanium, and boron are associated primarily with organic matter. The high sulfur content in most Illinois basin coal results from seawater permeation immediately following peat deposition. Low-sulfur coal ($< 2.5\%$ total sulfur) occurs in restricted areas where the coal is overlain by a thick fluvial gray shale (such as the Energy Shale Member that overlies the Herrin Coal Member). The gray shale, which predates marine transgression, acted as an impermeable barrier that effectively reduced infiltration of seawater into the peat. The interpretation is consistent with sulfur-isotopic data indicating that bacterially reduced sulfate is a principal source of sulfur enrichment. High-sulfur coal is significantly enriched in molybdenum, boron, mercury, uranium, iron, and thallium relative to low-sulfur coal. Seawater is a possible source of the high molybdenum, boron, mercury, and uranium contents in high-sulfur coal. Concentrations of iron and thallium in seawater are very low, suggesting that these two elements were probably derived from a terrigenous source and transported to the swamp by rivers. Positive correlation between sulfur and all these trace elements in Illinois basin coal indicates that their variations are also related to the postdepositional sedimentary environment.

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Geology of Principal Australia Coals and Coal Basins: A Review

Bituminous or subbituminous coals are known from nearly all parts of Australia. Those of greatest economic importance today are found in the Permian and Triassic Bowen and Galilee basins of Queensland and the Sydney-Bowen basin of New South Wales, with some coalfields of lesser significance in the Clarence-Moreton basin in Queensland and New South Wales. The lesser known fields also include the Permian Collie coalfield and Perth (Permian-Cretaceous) and Canning (Permian-Triassic) basins of Western Australia; the Bonaparte basin (Permian), mostly offshore in the Darwin area of Northern Territory and Western Australia; the shallow Permian coals of the large Arckaringa basin, and the smaller Triassic-Jurassic Leigh Creek basin in South Australia; the Early Cretaceous of the Gippsland basin, Victoria; and the Permian and Triassic coals of the Tasmania basin, particularly the Fingal area. Structural, sedimentary, and paleobiologic features of the coal-bearing strata and regional trends of various coal characteristics of some of the principal economic or geologically interesting basins and coals are reviewed and illustrated. These include the Hail Creek syncline, Goonyella, Peak Downs, German Creek, Blackwater, Baralaba, Tolmeis and Moura Mines of the Bowen basin of Queensland and the unique Blair Athol mine at the far western edge of Bowen basin. In New South Wales these include the Hunter Valley area Singleton Coal Measures represented by the Foyebrook-Liddell Seam and Ravensworth mines; the Newcastle area; the Ulan Seam of the Goulburn Valley area; the western shelf area and Sydney-Wollongong region represented by the Illawarra (Permian) Coal Measures which are overlain by the thick Triassic Narrabean Series, Hawksbury Sandstone, and Wianamatta Group. A paleobiologic analysis of the thick brown coal sequences in the Yallourn, Latrobe Valley, and Bacchus Marsh areas of Victoria, and the significance of tectonics in the development of these great coal swamps will be reviewed.

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Illinois Mined-Out Coal Areas—Map and Data System

The Illinois State Geological Survey has completed a digitized file of outlines and locations of all known abandoned mines in Illinois (more than 5,500) and a computerized file of mining methods, mining conditions, geological conditions, and historical and geographical data for each mine site. The files were compiled in response to increasing requests for such information from public and private agencies involved in urban planning, coal resource evaluations, and mine subsidence investigations.

The mine outlines were digitized from original mine maps and/or microfilm copies of the maps. ILLIMAP, an Illinois State Geological Survey-designed computer-based mapping system, was modified to manipulate the digitized data. Maps generated by this system show mine outlines, portal locations, and index number assigned to each mine.

The end products of this project will be a comprehensive Illinois coal-mine data file and two sets of mined-out-area maps, one set consisting of overlays for the U.S. Geological Survey topographic map series in the coal areas, the other of county base maps. Mine index numbers on the maps will be used to retrieve information from the coal-mine data file. Overlays will be housed at Illinois Abandoned Mined Land Reclamation Council offices.

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Sauk Sedimentation Patterns in Indiana and Adjacent States

The Sauk Sequence in Indiana and adjacent states is composed of two supergroups in mutual facies relationship, the Potsdam below and the Knox above. The Potsdam Supergroup contains, in ascending order, predominantly siliciclastic rocks that include the Mount Simon Sandstone,