highs are parallel with portions of major tectonic features such as the Eastern Kentucky syncline. Overall, though, the association of north-south–trending rank highs with tectonic expression is not as marked as that with the anomaly associated with the Kentucky River faults. It is possible that the rank trends are related to basement features with subdued surface expression. Rank generally increases with depth, and regional trends observed in one coal are also seen in overlying and underlying coals.

The cause of the regional southeastward increase in rank is likely to be the combined influence of greater depth of burial and proximity to late Paleozoic orogenic activity. The anomalous trends could be due to increased depth of burial, but are more likely to have resulted from tectonic activity along faults and basement discontinuities. The thermal disturbances necessary to increase the coal rank need not have been great, perhaps on the order of 10-20°C (18-36°F) above the metamorphic temperatures of the lower rank coals.

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Reactivation of Landslides by Surface Subsidence from Longwall Mining

Subsidence research by the U.S. Bureau of Mines has identified and documented the occurrence of landslides over a longwall mining area in the Dunkard basin. Most of these landslides occurred in masses of slumped hummocky soil generally associated with limestone and claystone beds of the Washington and Greene Formations. Identification and characterization of this phenomenon are needed to model accurately the future effect of subsidence-related surface damage to postmining land use.

Mining by longwall methods has been observed to produce a gradual surface subsidence profile of up to 60% of the thickness of the mined coal bed. The gradual subsidence of panels averaging 600 × 5,000 ft (180 × 1,525 m) can cause reactivation of older landslide deposits by decreasing the support to the landslide toe area. Examination of surficial features over a longwall mining area comprised of nine panels has led to the identification of several reactivated landslides. The two largest landslides occurred above a thin sandstone member with several associated springs. The largest landslides ranged from 100 to 300 ft (30 to 90 m) in length and from 100 to 200 ft (30 to 60 m) in width. Maximum scarp-slope displacements were approximately 7 ft (2 m). Less significant mass wasting was also observed over the longwall panels. Identification of landslides was accomplished through examination of premining aerial photographs and geologic field investigation. Characterization of reactivated zones was achieved through evaluation of current aerial 2-ft (0.6-m) surface contour map and field surveys. Recognition of problem areas will make civic and mining personnel aware of the landslide potential so that damage in such areas can be minimized.

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Depositional Environment and Reservoir Characteristics of Upper Devonian Kane Sandstone in Central Western Pennsylvania

Interpretative mapping techniques provide the basis for an environmental analysis of the Upper Devonian Kane sandstone in part of central western Pennsylvania.

Stratigraphically, the Kane sandstone is defined as the basal marine sandstone unit of the Upper Devonian Bradford Group. It represents the initial stages of clastic influx accommodated by the prograding Catskill delta complex. In eastern parts of the Appalachian Plateau, it most commonly exhibits an elongate lenticular geometry with long axes oriented normal to subnormal to regional strike.

The study area spans the three-county junction of Cambria, Clearfield, and Indiana Counties, where the Kane sandstone has been the target of intense drilling activity. Kane completions in this area are characterized by high initial potentials (up to 20 MMCFGD) and correspondingly high recoverable gas reserves.

Gross interval isopachs (G.S.S. and G.I.S.), net sand isopachs, sand percentage, and structure contour maps show that Kane sediments were emplaced as part of a small-scale submarine-fan environment, with a long axis trending west-northwest.

A complex suite of subenvironments ranges from submarine channel (proximal) to a radiating complex of small channels at the fan apex, which become broad flat channels and sheetlike sands in a downfan direction. These environments ultimately give way to distal mud facies away from the fan area.

Gross interval isopachs of the lower third of the Bradford Group interval show that increased thicknesses of sediment were emplaced along an inferred structural boundary trending west-northwest. This boundary very nearly coincides with a zone of cross strike structural discontinuity observed in the Valley and Ridge province.

The interpretations used in this analysis provide useful methods for evaluating future Devonian reservoirs.

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Subsurface Geology of Medina Group (Lower Silurian) and Clinton Group (Lower to Upper Silurian) of New York

The depositional environments and geologic history of the Medina Group (Lower Silurian) and the Clinton Group (Lower to Upper Silurian) of New York have been interpreted from a regional subsurface study using approximately 250 gamma-ray logs and 125 sample logs. A sequence of paleogeographic maps illustrate the geologic history and depositional environments associated with this predominately clastic, rock sequence.

Seven principal depositional environments are recognized on the basis of subsurface sedimentary facies. These environments are: (1) transgressive clastic shoreline, (2) stationary clastic shoreline, (3) progradational clastic shoreline, (4) shallow marine nearshore to deltaic, (5) transgressive shallow marine clastic shelf, (6) transgressive shallow marine carbonate shelf, (7) progradational shallow marine clastic-carbonate shelf. Subenvironments recognized within the stationary clastic shoreline include beach, bay, barrier, and open-marine.

The Silurian clastic rocks were deposited during an overall marine transgression that was interrupted by three major progradational phases. The orogenic episodes represented by these progradational phases steadily decreased in intensity. The sediment influx during the first progradational phase was large enough to produce a deltaic system that extended throughout New York. During the second progradational phase, the sediment influx was small relative to the first event, and subsidence probably increased from loading of the Grimsby sediments. The deltaic system that developed during this time was restricted to east-central New York. The final progradational phase represents an even smaller influx of terrigenous material; only a linear clastic shoreline developed in eastern New York. This phase marks the last major influx of terrigenous clastic sediments until Devonian time.

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Subsurface Stratigraphy of Medina Group (Lower Silurian), Clinton Group (Lower to Upper Silurian), and Lockport Group (Upper Silurian) of New York

A network of ten regional cross sections across New York reveals the detailed subsurface stratigraphy of the Medina Group (Lower Silurian), Clinton Group (Lower to Upper Silurian), and Lockport Group (Upper Silurian). Both gamma-ray logs and sample logs were used to correlate from outcrop to subcrop and well to well throughout the subsurface of New York. Approximately 250 well logs and 125 sample logs were incorporated into this study.

The study indicates that the Medina Group can be subdivided into the Whirlpool, Power Glen, and Grimsby Formations. The Clinton Group is subdivided into 16 formations. In the west, the Clinton Group includes the Thorold, Reynales, Irondequoit, and Rochester Formations. In central and eastern New York, this group is subdivided into the Oneida, Bear Creek, Kodak, Sodus, Wolcott, Otsquaqo, Willowvale, Sauquoit, Williamson, Irondequoit, Dawes, and Heidimer Formations. Two formations are recognized in the Lockport Group: the Sconondoa and Ilion Formations.

In addition to the stratigraphy, the cross sections also display the