range from < 1 to 6%. Sulfur values are much higher for thin pyrite-rich units. Siderite nodules are common in Pennsylvanian shales, but little siderite is found in the New Albany. Dolomite, commonly ferroan, and calcite in a variety of forms are the dominant carbonates in the New Albany. Some Pennsylvanian shales may contain large fossils or mica flakes, but such coarse-grained features are uncommon in the New Albany Shale.

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Geothermal Gradients in Mississippi Embayment

A statistical analysis of bottom-hole temperatures from oil and gas wells in the northern Mississippi embayment suggests that the geothermal gradient below a depth of 1 km is low (22.2°C/km) and for the New Madrid seismic zone, it is even lower (15.7°C/km). These data support the tentative conclusion of Swanberg et al that ground-water convection is the source of near-surface heat in shallow water wells of the region. Research by Mitchell et al had suggested a high geothermal gradient in the crust and upper mantle beneath the New Madrid seismic zone as a plausible explanation for the lower than average compressional wave velocities observed there. Warmer than normal wells in the northern Mississippi embayment are scattered at random and may be attributed to random error in the data. Deep wells in the southern Mississippi embayment are substantially hotter than wells at a comparable depth farther north. The regional geothermal gradient below a depth of 1 km from northern Louisiana to central Mississippi is 26.9°C/km. From central Mississippi to central Alabama, the geothermal gradient (23.1°C/km) is comparable to that of the northern Mississippi embayment.

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Field Investigations in Arkansas Valley Seismic Swarm Area

Field and air photo investigation of the Arkansas Valley seismic swarm area in 1982 resulted in the detection of a northeast-trending lineament which dissects the swarm region and may be indicative of the fault which is the source of the recent seismicity. The linear coincides with the alignment of portions of several drainage systems along much of its length, and in other places it is defined by escarpments a few feet high. The possible relationship of the linear to local and regional structures and seismicity will be discussed. Additional features consisting of ground cracks, sinks, and a relatively fresh-appearing scarp in the vicinity of a known fault in the swarm area will also be discussed. This study was funded by the Arkansas Geologic Commission and the Geology Department of Southern Illinois University.

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Structural Relationships Between Cottage Grove and Shawneetown Fault Systems, Southeastern Illinois, as Inferred from Gravity Data

Gravity measurements, extensive field mapping, and drill hole data have been used to determine the structural relations between the Cottage Grove and Shawneetown fault systems of southeastern Illinois.

The Cottage Grove structure is an east-west-trending, right-lateral wrench fault which extends across southern Illinois. The Shawneetown fault is the western extension of the Rough Creek fault system of Kentucky and consists of several high-angle reverse and normal faults. Both fault systems are part of Heyl's 38th Parallel lineament; however, the relation between them has been obscured by Pleistocene lacustrine and fluvial sedimentation.

Over 400 new gravity stations, with approximate 0.5 km (0.3 mi) spacing, were occupied in eastern Saline and western Gallatin Counties. The data were reduced to the Bouguer values, contoured, and selected profiles were two-dimensionally modeled. The new data, in conjunction with coal mine, drill hole and field mapping data, suggest an eastward extension and bifurcation of the Cottage Grove system. The northern segment continues eastward, dying out just west of the north-south Wabash Valley fault system. The southern segment trends southeastward, possibly merging with the Shawneetown fault system in a complexly faulted zone.

The use of gravity data in conjunction with other structural information may provide a useful tool for defining structure obscured by unconsolidated deposits in southern Illinois and other parts of the Illinois basin.

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Correlation of Fractural Reservoir Productivity with Fracture Intersection Quadrants

Higher success rates for discovery of gas and oil in naturally fractured reservoirs can be achieved by correlating discoveries and productivities with fracture intersection quadrants. These fracture intersection quadrants are formed by the intersection of the two predominant fracture directions. Higher success rates in a particular quadrant appear to be related to greater fracture density resulting from the downdip extensions of the fractures in the stratigraphic zone of interest. Plunge of the intersection should be considered to insure that the drill hole penetrates the projected intersection within the stratigraphic zone of interest.

Observations in Kentucky have shown success rates can be improved three-fold when drilling in the most favorable quadrant as opposed to the least favorable quadrant, and when the drill hole is located a proper distance from the fault intersection to allow for the downdip projection to the zone of interest.

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Tectonic History of Mississippi Embayment and Surrounding Areas

Recently published U.S. Geological Survey gravity and magnetic maps constitute powerful tools for interpreting the tectonic nature and history of the northern part of the Mississippi embayment. Perhaps the most striking feature of the maps is a set of alternating, roughly coincident gravity and magnetic anomalies that bear northeastward and extend from the northwestern edge of the embayment to Alabama. Positive anomalies in this set are viewed, using the model of McKensie, as zones of stretching, thinning, and subsidence of the continental lithosphere. Gradients between positive and negative anomalies may mark the position of listric faults, which blocked out grabens and horsts within the basement rocks, forming a low-relief crustal mosaic.

This mosaic was jostled by the Ouachita collision during the Late Pennsylvanian. A horst on the northwestern flank of the embayment was pushed slightly northeastward and uplifted at its northeastern end to form the Pascola arch. Potential field maps provide no evidence that the Pascola arch connected the Ozark and Nashville domes. Older structures athwart the region trend of the mosaic, such as the Ste. Genevieve and Rough Creek faults, were reactivated as thrust faults up on their southern sides. In the Early Permian, alkalic dikes were intruded in the region of the Illinois Mineral District providing the earliest evidence of a lens of low velocity mantle rock beneath the embayment. Radiometric dates suggest alkalic igneous activity peaked in the Cretaceous.

In this scenario, the Reelfoot region evolved from a broad complex graben to a true rift during the late Paleozoic. Mesozoic igneous events and present seismicity suggest that the Reelfoot is not a dying rift; it is instead being born.

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Drowned Barrier Bar and Tidal Inlet Sequences in Buckner-Sesser-Valier Fields, Franklin County, Illinois

Nearly 400 electric logs, using spontaneous potential and resistivity curves, were analyzed in a study of the Aux Vases Formation in the Buckner-Sesser-Valier fields of Franklin County, Illinois. Subsurface mapping procedures incorporated data from core descriptions, scout tickets, and electric logs in constructing structure maps on marker beds directly above and below the formation, and isopachs of producing and nonproducing sandstones within the formation.

Three lithofacies were recognized in the Aux Vases Formation; in ascending order they are: Facies A, a thin, nonproductive calcareous