The Krebs Formation (Middle Pennsylvanian-Desmoinesian) forms the lower portion of the Cherokee Group in the Cherokee basin of southeastern Kansas. The Krebs Formation near its outcrop in Cherokee and Crawford Counties consists of 78% shale and mudstone, 18% sandstone and siltstone, 3% coal, and 1% limestone, comprising a total thickness of 120 to 220 ft (37 to 67 m). Integration of data from continuous cores, outcrops, and geophysical logs provides a detailed stratigraphic framework and facilitates interpretation of depositional environments. Coal beds and associated seat-rock units, some having an areal extent of several thousand square miles, provide excellent stratigraphic marker beds for correlation of discontinuous reservoir sandstones. Radioactive dark-gray shale units and argillaceous limestone units often overlie coal beds and may be equally widespread.

Net-sandstone isolith maps reveal the presence of a lobate deltaic complex in southwestern Missouri, characterized by both stacking and offset of major sandstone bodies. Coal beds commonly cap upward-coarsening, mud-dominated sequences consisting of dark-gray shale with occasional argillaceous limestones overlain by lenticular-bedded shale or wavy-bedded siltstones. This vertical transition of lithofacies is interpreted to result from the progradational infilling of large interdistributary bays. Coarsening-upward sandstone sequences—consisting of lenticular-bedded shale grading upward into wavy-bedded siltstone, flaser-bedded sandstone, and rippled or cross-bedded sandstone—represent distributary mouth-bar or crevasse-splay deposits. Fining-upward sequences—composed of a basal scour surface overlain by mud-clast conglomerates, large-scale cross-bedded sandstone, and rippled or flaser-bedded sandstone—are interpreted to be channel-fill or point-bar deposits.

HRYHOR, WILLIAM J., Hryhor Geophysical Ltd., Kelowna, B.C., Canada

Seismic Exploration for Pennsylvanian Granite Wash Reservoirs, Palo Duro Basin

A seismic reflection common-depth-point technique was designed specifically for the Palo Duro basin. The goal was to locate hydrocarbon traps in the Pennsylvanian granite wash. Success ratios using the designed techniques were approximately as follows: (1) to locate hydrocarbon-bearing features, approximately 25%; (2) to locate structures, approximately 50%; (3) to pinpoint development locations, approximately 75%.

The specific technique design is presented as it relates to: (a) density and layout of seismic lines; (b) spread lengths and configuration; (c) field parameters, e.g., geophone array and shot-hole depths; (d) data correction techniques, including weathering correction, choice of datum plane, and choice of datum velocity; (e) data processing requirements and quality control; and (f) interpretation of data, including depth conversion and well ties.

This paper covers the aforementioned topics with a minimum of advanced mathematics, and it poses questions for the advanced mathematician.

LYDAY, J. REED, Pioneer Production Corp., Denver, CO

Atokan (Pennsylvanian) Berlin Field: Anatomy of a Recycled Detrital Dolomite Reservoir, Deep Anadarko Basin, Oklahoma

Berlin gas field in Beckham County, Oklahoma, was discovered in 1977, and is the largest Atoka (Pennsylvanian) hydrocarbon accumulation in the Anadarko basin. It is an overpressured reservoir at a depth of 15,000 ft (4,572 m) and occupies a surface area of 41 mi^2 (106 km^2). The reservoir rock consists of recycled, detrital Arbuckle dolomite (Cambrian-Ordovician), and contains ultimate recoverable reserves of 242 to 362 bcf.

Arbuckle dolomite and limited exposures of Precambrian granite rocks were eroded from the Amarillo-Wichita Mountains in the Atokan and were deposited as a terrigenous, sandy dolomite clastic wedge adjacent to the uplift. In the late Atokan, the Elk City structure was uplifted and subaerially exposed in the vicinity of the northern limit of the dolomite clastic wedge. The detrital dolomite on the structure was concurrently eroded and recycled northward as a shallow marine fan delta. Subsequent recrystallization destroyed the detrital depositional texture and created the present intercrystalline porosity.

The deep Elk City structure consists of an upthrust block bound by the late Atokan unconformity that is genetically associated with the Berlin fan delta. Present relief on the upthrust block and overlying anticlinal folds formed during post-Atokan growth of the structure.

Berlin field provides a model of a large, localized clastic deposit derived from uplift and erosion of a prominent structure, and it is an example of the potential for large detrital stratigraphic traps around the perimeters of prominent structures that contain crestal unconformities.

MERRIAM, D. F., S. B. LAMOREAUX, J. A. SILFER, and G. V. WOLF, Wichita State Univ., Wichita, KS

Upper Pennsylvanian Marine Algal Banks of Kansas: Comparison and Implications

Marine algal banks (mounds or buildups) present in the Shawnee Group (Upper Pennsylvanian) crop out in eastern Kansas. The youngest of about 20 banks known to occur in the section differ in shape and size but, in general, cause a local increase in thickness that is compensated by a decrease in thickness of the overlying shale. The phylloid algae, *Eugonophyllum* and *Epimastopora,* trapped and bound the carbonate mud in a role similar to the modern sea grass, *Thalassia,* in Florida Bay. The soft mudbanks created barriers to water circulation and fauna distribution. The Shawnee banks decrease in size, contain less algae and more micrite, and are more difficult to define with decreasing age. The Plattsmouth bank formed instantaneously by building on the "normal" lithology over a large area; the Ervine Creek bank started locally and spread laterally so it is funnel shaped; the Hartford bank is diffuse with the algae occurring in small curls instead of larger, flat blades. All three banks are capped with a layer of osagite/pellets/fusulinids. The Plattsmouth bank is topped with a crust of algal(?) material, and the Ervine Creek bank shows evidence of solution features, indicating possible subaerial exposure. Interpretation of the sequence is that the elongated banks were formed in shallow, warm water parallel to shore in a regressive environment until smothered by an influx of fine clastic material. Differences in size, shape, algae type and quantity, and postdepositional alterations result from subtle differences in setting and timing of development.

PEELER, JAMES A., Wichita State Univ., Wichita, KS

Reservoir Characterization Study of Mississippian "Chat" Reservoirs, South-Central Kansas

Mississippian "Chat" intervals in south-central Kansas have produced more than 20 million bbl of oil as of December 1983, but only 8-12% of estimated oil in place was produced. Generally, poor "Chat" production has been attributed to low API gravity and low-viscosity oils, producing from high-porosity, low-permeability in-situ chert intervals. Production is from Mississippian "Chat" residual, tripolitic, in-situ chert intervals and overlying Pennsylvanian Cherokee sands.

One reservoir initially classified as having low API gravity and low-viscosity oil is the Hardtner field in southern Barber County, Kansas, near the axis of Pratt anticline. Previous studies using structure, isopach, net-pay, and combinations of porosity and water saturation maps have had limited success in defining hydrocarbon migration paths or increasing reserves through drilling. Recent studies indicate that, by mapping the reservoir parameters of relative oil-water permeability, water- and oil-wet rock conditions, and phase-drive mechanism, producibility may be better estimated.

Reservoir core analysis and geophysical well logs indicate both water-wet and oil-wet rock conditions are present within 80-ac spacings. Further core analysis indicates pore-throat geometries are related to the dissolution of sponge spicules present in the cherts.

The present study uses variables of relative permeability, paleotopography, pore-throat tortuosity, and coordination numbers as input for multivariant vector-analytical algorithms (CABFAC-QMODE family of algorithms). Results of this and other "Chat" reservoir studies suggest a practical evaluation criteria for more effective exploitation drilling and increased efficiency in enhanced recovery programs.

PHILLIPS, ERIC H., Gulf Oil Exploration & Production Co.-U.S., Casper, WY

Gravity-Slide Thrusting and Folded Faults in Western Arbuckle Mountains, Oklahoma