the prolific oil-producing Marchand sandstones of the Anadarko basin has continued unabated for many years. In view of this, inductive inference and multiple working hypotheses were used to account for all proposed environments. The upper Marchand sandstones (Pennsylvanian-Missourian) are formed best in the Northeast and East Binger fields of Caddo County, Oklahoma. Primary pay is from three sand zones (Marchand "A," "B," and "C") at depths of approximately 10,000 ft (3,000 m).

The upper Marchand sandstones are indicated by geometric and internal features to be part of a clastic, shallow-marine, tidal-dominated system. This system is characterized by coastal-intertidal flats drained by tidal channels in conjunction with basinward subtidal rhythmic sand ridges and depressions. Up to 80 ft (24 m) of Marchand sandstone probably reworked from sediments derived from the Wichita and/or Ouachita uplifts was distributed by tidal currents into erosional depressions commonly associated with subtidal sand ridges. Shelfward, intertidal flats principally drained by a series of tidal channels repeatedly prograded and receded during the upper Marchand interval.

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Distribution of Bitumens and Kerogen in Shale Clast

The mechanism of petroleum migration is not fully understood. One approach has been to study areas between rocks with source character and those with reservoir character. Published studies have been restricted to profiles across the bedding but the ease of movement of hydrocarbons along and across the bedding may be very different. Gradients for bitumens and kerogen both along and across shale bedding have been established by analyzing a shale clast encased in a sand matrix, where the distribution of bitumens is not controlled by the distribution of kerogen and shows evidence of bitumen movement through the clast. The amount and composition of the bitumens and their distribution suggest that the clast has been contaminated by movement of material into the shale from the surrounding medium, and that the movement of hydrocarbons occurs preferentially along the shale bedding. The composition of the material moving into the clast is not the same as the bulk composition of the contaminant but shows a preferential enrichment in normal paraffins, particularly those of shorter chain length.

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Mobile Basin-Shelf Border in Northeast Oklahoma During Desmoinesian Cyclic Sedimentation

Desmoinesian coal cycles and marine limestone bank episodes in northeastern Oklahoma are related to the mobility of the basin-shelf border area. This mobility may reflect the northward passage of a long-term crustal wave generated either by the Carboniferous convergence of the North American and African plates and/or the intense activity along the orogenic arcs comprising the now buried Llanoria complex in the northern Gulf of Mexico area. The shelf-edge carbonate banks (Wapanucka Limestone), located along the Choctaw fault in Early Pennsylvanian time, had moved 80 mi (128 km) north to Tulsa County by Middle Pennsylvanian (Marmaton) time and then another 80 mi (128 km) north to southern Kansas by Late Pennsylvanian time. Other tectonic and corresponding stratigraphic elements also show a broad northward shift. These include an isostatic compensated couplet between basinal foredeep and orogenic arc (zeugogeosyncline of Kay), a usually subsiding paleobathymetric axis and the southward-tilting slope and shelf of the craton border area. Complicating this simple picture is the overprint of eustatic rise and fall of sea level perhaps caused by waxing and waning of Gondwana glaciers that persisted throughout much of the Late Carboniferous.

Rising sea level on the northern shelf was marked by coals and limestones giving way to gray to black organic clay shales; and later, stagnant to lowering sea level was marked by progradational delta and associated silty to sandy deposits and finally a deep soil profile. Together these constitute typical cyclothems which are numerous throughout the shelf areas in northeast Oklahoma and adjoining states. These include some of the more productive Oklahoma oil and gas sandstones such as the Cleveland, Skinner, Red Fork, Bartlesville, and Booch.

The thicker basinal deposits of the southern Arkoma basin also contain some coals, but sandstones rather than shale or limestone commonly overlie such coals, perhaps owing to the greater ruggedness and tectonism of its source area in the east and south.

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Exploration for Pennsylvanian Sandstones, South-Central Kansas

To determine the presence, or conditions leading to the presence, of uraniferous host rocks in the Pennsylvanian subsurface strata of south-central Kansas, rocks in the Sedgwick basin were studied as part of a much larger investigation involving four 2° quadrangles. Investigation also extended into Oklahoma for purposes of correlation.

The area long has been one of active exploration for oil and gas and much of the subsurface information is drawn from well logs. Most of the surface Pennsylvanian outcrops have been studied for several years. The designation "sandstone" herein is used in its broadest sense, and may include any of the coarser clastic sediments because the impure, arkosic or graywacke-type sandstones may be more favorable host rocks, and the granularity may vary from very coarse to fine, in the latter case from cementation of original porosity. The most favorable environments for deposition are terrigenous and fluvial, shoreline, and nearshore deltaic; the cyclothemic deposits so characteristic of the Kansas Pennsylvanian should be most likely host rocks. The problem in part is one of stratigraphic correlation because the Kansas border was usually close to the hinge line, or shelf-to-basin transition, resulting in numerous facies changes. The presence of uraniferous deposits should probably be complementary with those in which hydrocarbons may occur.