4:00 A. R. BROWN: Horizontal Seismic Sections and Their Utility in Petroleum Exploration
4:30 J. A. WARD: Subunconformity Seismic Stratigraphic Exploration

Abstracts

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Computerized Process for Interpretation of Well Logs in Naturally Fractured Reservoirs

A computerized process is presented which allows the determination of primary and secondary porosities, and water saturation in the primary porosity, secondary porosity, and composite system, in naturally fractured reservoirs.

The process utilizes conventional well logs such as resistivity, density, neutron, and sonic.

The theoretical background behind the interpretation techniques is presented with examples of its application in the recompletion of an Austin Chalk well, and in the completion of fractured carbonate rocks in the Williston basin of Montana and in Canada.

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Arkoma Basin Model: Middle Ordovician Through Early Devonian

The Arkoma is a structural-sedimentary basin covering much of eastern Oklahoma and western Arkansas, and extending south to the Choctaw fault. (This report covers only the Oklahoma part of the basin.) In general the basin deepens and thickens toward the south, a pattern which was well developed by Simpson time (early Middle Ordovician), but which was sharply interrupted during Middle Ordovician (late Bromide) and not resumed until after Early Devonian. During this interregnum the sediments are represented largely by a succession of thin but widespread carbonate units separated by diastems and unconformities. This period began with an intertidal environment which extended over most of the basin (late Bromide; Fite), followed by a succession of widespread, shallow carbonate seas, generally with prolific faunas including many representatives of the sessile benthos, separated by times of uplift of varying intensity and duration. The only significant departure from this pattern is the Upper Ordovician Sylvan Shale, a calcareous mudstone and shale representing an environment which inhibited almost all of the sessile benthos, the only persistent organisms being graptolites and chitinozoans. Carbonate sedimentation was resumed following this shale episode, continuing to the end of the Early Devonian. This depositional model produced a body of sediments whose total thickness does not exceed 500 ft (152 m), and which neither individually nor collectively shows any directional thickening. Early Devonian deposition was followed by a prolonged period of uplift accompanied by extensive erosion and truncation. The region was then submerged by the advancing Chattanooga (Woodford) sea, and the pattern of southward subsidence and thickening again resumed.

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Transitional Desmoinesian to Missourian Cyclic Deposits on Opposite Shores of Arkoma Seaway

Distinctive differences between Late Desmoinesian to early Missourian cyclic deposits on opposite shores of the Pennsylvanian Arkoma seaway were noted during outcrop mapping in eastern Oklahoma.

The north shore deposits conform to the classical Mid-Continent Pennsylvanian cyclothem. A regressive blanket sandstone is succeeded in turn by underclay, coal, and carbonaceous shale, transgressive calcareous shale and/or limestone, black fissile shale with phosphate nodules, and, finally, gray shale with calcareous to sideritic inclusions that becomes upward increasingly silty to sandy.

The south shore deposits that border the Ouachita and Arbuckle uplifts in southeastern Oklahoma reveal a more symmetrical cycle than for the preceding. Both transgressive and regressive sandstones are present, and, although exceedingly lenticular, converge northward to enclose a fluviatile tongue of red beds and conglomeratic lenses. The subjacent and superjacent transgressive marine wedges contain fossiliferous gray to black shales. Limestones are usually thin and developed near tops and bottoms of shale sequences.

Seaway deposits are much more variable. High sea-level phase is characterized by subtidal gray shale with subordinate bioturbated siltstone to sandstone. A low sea-level phase commonly consists of intertonguing north and south shore deposits.

Effects of eustatic oscillations of sea level were imprinted on a episodically subsiding depositional trough. Many stratigraphic horizons that reflect sea-level reversals are useful for regional correlations. Application of this concept to the polycyclic Holdenville formation of Hughes County indicates its northward continuation as the Memorial shale and the overlying Jenks and Tulsa sandstones and associated shales of Tulsa County previously miscorrelated with the Seminole Formation. In the subsurface these sandstones become the oil productive Cleveland sandstones. These correlations are supported by fossil determinations.

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Uranium Mineralization in North-Central and Southwestern Oklahoma

At least three types of uranium occurrences are known in the study areas. In north-central Oklahoma (Enid 2 × 1° Quadrangle) several "red-bed" uranium-copper shows occur in the Oscar group and Wellington Formation. The mineralization is associated with plant debris and is confined to gray, fine-grained sandstone lenses within a red-bed sequence. The most reasonable source for the Cu and U are the red beds, with Cu and U released by subsurface breakdown of minerals. The maximum Cu and U concentrations are 2.95% and 125 ppm, respectively. In contrast, the "Kupferschiefer-type" copper deposits in southwestern Oklahoma (Creta and Mangum) contain only up to 12 ppm U.

In southwestern Oklahoma (Clinton 2 × 1° Quadrangle) carnotite and tyuyamunite occur in siltstones of the basal part of the Doxey formation. Although the origin of the mineralization is not entirely clear, the common association of uranium with the red-to-gray interfaces may reflect the location of primary ore at a redox interace, since uranium shows little tendency to migrate during oxidation of deposits containing appreciable vanadium. In addition, interpretation of approximately 700 ground-water analyses using the WATEQFC program yielded suggestions as to possible targets for further investigation in the Clinton Quadrangle.

The third type of uranium occurrence is associated with