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

Abstracts

AGUILERA, ROBERTO, and LUIS A. ACEVEDO, Roberto Aguilera & Associates, Inc., Irving, TX

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.

AMSDEN, THOMAS W., Oklahoma Geol. Survey, Norman, OK

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.

BENNISON, ALLAN P., Geological Consultant, Tulsa, OK

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.

BLOCH, SALMAN, and KENNETH S. JOHNSON, Oklahoma Geol. Survey, Norman, OK

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

petroliferous areas. Of these, the Cement oil field has produced the only commercial uranium deposit in Oklahoma. Less well known is a small occurrence in Kiowa County (in the Hennessey group) where uranium is associated with pyrobitumen nodules. The nodules contain between 2,225 and 10,110 ppm U. Available field, microscopic, and geochemical evidence suggest that the pyrobitumens are secondary, i.e., alteration products of crude oil. Uranium was provided by ground water.

Petroliferous areas in Oklahoma hold the greatest potential for discovery of significant uranium mineralization. Oil-field brines can, in some places, be a useful tool in exploration for such minerlization. While high radium-226 concentrations in natural waters are not a specific indicator of subsurface uranium mineralization, relatively high ratios of Ra-226/Ra-228, Ra-226/Ba, Ra-223/Ra-228, and Ra-223/Ba in such waters from sedimentary terranes may better reflect the presence of uranium accumulations in the subsurface. Available analyses of several radioactive oil-field brines and springs from various parts of Oklahoma indicate that these waters do not meet the above criteria and are not, therefore, surface expressions of buried uranium mineralization.

BREWER, J. A., et al, Cornell Univ., Ithaca, NY

COCORP Deep Seismic Reflection Traverse Across Southern Oklahoma Aulacogen

COCORP deep seismic reflection profiles across the width of the southern Oklahoma aulacogen, from the Hardeman basin on the south, through the Wichita Mountains and Anadarko basin on the north, reveal basement deformation that necessitates major revision of ideas about the geologic history.

The profiles south of the Wichita Mountains show that the Precambrian crust is highly layered to depths of 10 to 13 km over an area at least 2,500 km^2, and probably much more. Judging by COCORP surveys elsewhere in the United States, such extensive Precambrian layering is very unusual. The layered crust can be interpreted as a large Proterozoic basin, probably filled mainly with clastic sediments and felsic volcanics since these lithologies are widespread in the Precambrian of the southern Mid-Continent region.

The layering is truncated on the south side of the Wichita Mountains, and under the mountains is either absent or only present in a highly altered form. The truncation is probably caused by Precambrian faults in conjunction with granitic intrusions. Pennsylvanian compression reactivated these faults.

The COCORP profiles across the northern flank of the Wichita Mountains and into Anadarko basin are in an early stage of processing, but preliminary results suggest that the Precambrian layering that is so distinctive south of the mountain does not extend beneath the Anadarko basin. Crystalline rocks of the Wichita Mountains appear to have thrust north along a moderately dipping fault, overlapping the basin by 8 to 9 km. The attitude of the fault at depth beneath the mountains is unclear at present.

Simple models for the southern Oklahoma area as an aulacogen must be revised to consider the complex Precambrian history revealed by the COCORP data.

BROWN, ALISTAIR R., Geophysical Service Inc., Dallas, TX

Horizontal Seismic Sections and Their Utility in Petroleum Exploration

Horizontal seismic sections are one type of product from a three-dimensional seismic survey. Three-dimensional surveys have been performed in every type of environment worldwide and have contributed to many exploration, appraisal and development successes.

Horizontal, or Seiscrop, sections display the spatial extent of subsurface features and are particularly valuable for direct mapping. Three dimensional data from several areas, including the Mid-Continent, will be used to demonstrate the utility of Seiscrop sections for structural mapping, and for the delineation of hydrocarbon flat spots, carbonate features, stream channels, and sand bars.

BROWN, W. G., Chevron U.S.A. Inc., Denver, CO

Washita Valley Fault System—A New Look at an Old Fault

With the application of plate tectonic concepts to southern Oklahoma, the structural style has more recently been characterized as a wrench fault system. In particular, the Washita Valley fault (WVF) is generally considered by many geologists to be a major left-lateral strike-slip fault with an offset of approximately 40 mi (64 km).

The map most commonly used to demonstrate this magnitude of lateral offset is the basal Oil Creek sand distribution map. The zero edge of the basal Oil Creek sand provides the necessary piercing point to judge lateral offset along the WVF. However, the published basal Oil Creek map depicts the present-day distribution of the sand which is the result of cumulative movements since the deposition of the basal Oil Creek sand. Individual orogenic episodes must be sorted to determine what contribution possible strike-slip movements have made toward the present-day basal Oil Creek sand distribution.

To unravel these various orogenic episodes a palinspastic restoration must be made. In such a sequential restoration, the last movement should be restored first or the known movements restored first to determine the unknown movements. In this presentation, the observable folds along the WVF have been "unfolded" and the known reverse faults have been restored to a pre-fault position. When this has been accomplished the partly restored basal Oil Creek sand map may be used to determine the amount of lateral offset on the WVF.

The resulting restoration indicates that the commonly quoted figure of 40 mi (64 km) of lateral offset is too large. Surface and subsurface data demonstrate that the crustal shortening represented by folds and reverse faults alone can account for the present-day basal Oil Creek sand distribution and thus very little strike-slip movement is needed along the Washita Valley fault system.

COMER, JOHN B., Univ. Tulsa, Tulsa, OK, and HENRY H. HINCH, Amoco Production Co., Tulsa, OK

Petrologic Factors Controlling Internal Migration and Expulsion of Petroleum from Source Rocks: Woodford-Chattanooga of Oklahoma and Arkansas

Upper Devonian-Lower Mississippian black shales are excellent oil source rocks throughout Oklahoma and much of western Arkansas. Black shales were deposited in shallow-water shelf or epeiric sea environments in the north and deep basins in the south (i.e., Arbuckle province). Silty black shale is more common in the north whereas silicified black shale in-