MACPHERSON, JOHN D., E. NIGH, and ALUN WHITTAKER, Exploration Logging, Inc., Sacramento, CA

Estimation of Sediment Compaction Profiles Using Combination of Real-Time Drilling Response Modeling and Direct Porosity Measurements

The detection of overpressured formations at the wellsite has been limited in the past to empirical rate-of-penetration normalization equations (e.g., "d" exponent). These equations are limited to specific bit types and require much interpretation by well site geologists, particularly in wildcat areas.

A new, theoretically based method of evaluating overpressures handles several bit types independently (milltooth, insert, Stratapax, and diamond), and the output (drilling porosity) is calibrated to true formation porosity through the use of pulsed nuclear magnetic resonance techniques on drill cuttings.

Extended output from the method produces the following: online formation porosity curves, formation permeability, formation pressures (pore, overburden, fracture), bulk rock properties (e.g., Poisson's ratio, using a compressibility model that observes the change in porosity with incremental overburden pressure), and formation and bottom-hole temperatures. The method frees the geologist to interpret the output as the well is drilled. Several examples describe the interpretive significance of the output. For example, a pseudosonic log generated by the model shows excellent correlation with wire-line sonic measurements in consolidated formations; on certain wells the maximum value attained by the formation pore pressure is controlled by the overlying fracture gradient (hence, an on-line fracture gradient allows prediction of the maximum pore pressures likely to be encountered).

MAGARITZ, MORDECKAI, Weizmann Inst. Science, Rehovot, Israel, and Univ. Oregon, Eugene, OR, and YEHEZKEEL DRUCKMAN, Geol. Survey Israel, Jerusalem, Israel

Carbon Isotope Composition of an Upper Triassic Evaporite Section in Israel: Evidence for Meteoric Water Influx

Upper Triassic (Upper Carnian) extensive evaporites occur in shallow-water basins that are surrounded by supratidal dolomites. The evaporites consist of laminated and nodular anhydrites (gypsum in outcrop) interlayered with dolomitic mudstones and, rarely, with algal or oolitic grainstones. The evaporitic section reaches a thickness of about 180 m (590 ft), whereas the surrounding dolomitic facies amount to 80–100 m (260–330 ft).

Systematic $\delta^{13}C$ profiles of the carbonates of the entire Triassic section in an outcrop and two boreholes revealed an extreme ^{13}C depletion in the evaporitic section (the Mohilla Formation) in both the basins and highs, relative to the lower parts of the Triassic section in all three investigated sections. The $\delta^{13}C$ values range from −2 ‰ to −14 ‰ in the Mohilla sections, whereas in the lower parts of the section the $\delta^{13}C$ values range from +1 ‰ to −5 ‰.

The systematic repetition of $\delta^{13}C$-depleted rocks in different basinal sections as well as from dolomitic highs, rules out the possibility of post-depositional diagenetic changes in the $\delta^{13}C$ composition.

Alternatively, one may assume changes in the $\delta^{13}C$ composition of the Upper Carnian Tethys ocean. However, such low values are not plausible to reflect the oceanic $\delta^{13}C$ composition. It is therefore proposed to relate the $\delta^{13}C$ values to an influx of fresh continental water floating upon the dense evaporated brine. Such a periodic influx of continental water is also compatible with the repetitive alternation of evaporites and carbonates within the Mohilla Formation.

MANCINI, ERNEST A., ROBERT M. MINK, and BENNETT L. BEARDEN, State Oil and Gas Board of Alabama, University, AL

Upper Jurassic Norphlet Formation—New Frontier for Hydrocarbon Prospecting in the Central and Eastern Gulf of Mexico Regions

Since the discovery of oil in 1967 from the Smackover Formation at Toxey field, Choctaw County, Alabama, and of condensate in 1968 from the Norphlet Formation at Flomaton field, Escambia County, Alabama, the Upper Jurassic has become the primary exploration target in southwestern Alabama. Following those initial discoveries, 39 Upper Jurassic fields have been established in Alabama, but only in 4 of these has the Norphlet produced hydrocarbons. The discovery of productive Norphlet gas sandstones in 1979 at the Lower Mobile Bay-Mary Ann field, offshore Alabama, has demonstrated the potential of the Norphlet in the central and eastern Gulf of Mexico regions. All 4 wells drilled to test the Norphlet in Mobile Bay have been successful gas wells, and have tested between 10.5 and 19.4 mmcf per day. Although drilling is to depths exceeding 20,000 ft (6,100 m) subsea, the projected gas reserves justify continued exploration.

Norphlet petroleum traps in the region are principally combination traps involving favorable stratigraphy and salt anticlines (Copeland field), extensional fault traps associated with salt movement (Flomaton field), and faulted salt anticlines (Hatter's Pond and Lower Mobile Bay-Mary Ann fields). Reservoir rocks include marine, dune, and fluvial sandstone lithofacies. Sandstone porosity involves both primary intergranular and secondary dissolution and fracture. Smackover algal carbonate mudstone is probably the source for much of the Norphlet hydrocarbon, but downdip Norphlet marine shales may also be source rocks.

The central and eastern Gulf of Mexico regions should continue to be excellent areas to explore for hydrocarbons in the years ahead. Successful Norphlet petroleum prospecting in the area has involved the identification of favorable sandstone lithofacies and structural hydrocarbon traps by using geologic and geophysical methods. Future Norphlet discoveries will require the delineation of stratigraphic and structural/stratigraphic combination hydrocarbon traps using seismic-stratigraphic techniques.

MANCINI, ERNEST A., Geol. Survey Alabama, University, AL

Paleocene Lignite Deposits of Southwest Alabama

In southwest Alabama, lignite having economic potential occurs in the Oak Hill Member of the Naheola Formation. This middle Paleocene lignite generally consists of a single bed of 1–14 ft (0.5–4 m) in thickness and is the most extensive lignite in the southwest Alabama region. The Oak Hill lignite deposit accumulated in lower delta plain coastal marshes in interchannel areas behind a barrier system. The source area for the deltaic sediments was probably to the west and/or northwest of Choctaw County, Alabama. The lignite occurs in a clay-dominated sequence. Oak Hill interdistributary bay ripple-laminated clays are interbedded with ripple-laminated, crevasse splay sands generally less than 15 ft (5 m) thick. The glauconitic sands of the overlying Coal Bluff Marl Member of the Naheola Formation represent times of marine encroachment into the interchannel basin area.

Lignite having subeconomic value at present occurs in the upper part of the Tuscahoma Sand. This upper Paleocene lignite is irregular in its outcrop pattern and apparently is not represented over extensive areas. It is locally persistent with one or more beds less than 3 ft (1 m) thick. The Tuscahoma may contain up to 6 lignite seams that may exceed a total thickness of 5 ft (1.5 m). These lignite beds were deposited in lower delta-plain coastal marshes adjacent to high constructive deltaic bar finger sands. Tuscahoma marsh clays are interbedded with ripple-laminated and cross-bedded bar finger sands. The Tuscahoma Sand is overlain by the Bashi Marl Member of the Hatchetigbee Formation. The Bashi contains a diverse lower Eocene marine fossil assemblage.

MANDL, G., Koninklijke/Shell Exploratie en Produktie Laboratorium, Rijswijk, Netherlands

Rotating Parallel Faults—"Book Shelf" Mechanism

In various tectonic environments, simple shearing or extension of crustal parts has been accommodated by the rotation of parallel faults in an array. Because of its kinematic resemblance to the tilting of a row of books on a shelf, the tectonic process may be referred to as a "book shelf" mechanism. Its most important manifestations are cross-faulting between normal faults or parallel wrench faults, the extension of deltaic slope deposits, and all forms of tilted block tectonics.

The process is addressed from a geomechanical point of view to determine geological operating conditions and controlling parameters. Kinematically, one has to distinguish between two basic modes of the book shelf mechanism: the dilational mode, where rotating faults tend to open up and may become migration paths, and the domino style, where the