BENSON, D. JOE, Univ. Alabama, University, AL, B. L. BEARDEN, State Oil and Gas, Board, University, AL, and E. A. MANCINI, Univ. Alabama, and State Oil and Gas Board, University, AL

Porosity/Depth Relations in Smackover Formation, Southwest Alabama

In recent years a number of models have been developed relating porosity to depth of burial in carbonates. These models illustrate a progressive decrease in porosity as burial depth increases, with porosity values decreasing to less than 10% at depths below 10,000-12,000 ft (3,000-3,700 m).

To test the applicability of these general models to carbonates in southwest Alabama, porosity values of the Jurassic Smackover Formation were tabulated from 40 wells. These wells included both productive and nonproductive wells at depths of 10,500-19,750 ft (3,200-6,020 m). Although the data show trends similar to those predicted by the general models, the Smackover in southwest Alabama possesses significantly more porosity at depth.

Limestones show a very apparent decrease in porosity with increased depth of burial. Below 13,000 ft (3,900 m), limestones typically have porosities less than 10%. Dolomites, on the other hand, do not show any significant trends between porosity and burial depth, possessing porosities of more than 20% at depths in excess of 18,500 ft.

Petrographic analysis indicates that abnormally high porosities at depth in the Smackover of southwest Alabama can be related to favorable shallow diagenesis and the existence of significant amounts of mesogenetic secondary porosity which is related to migration of basinal brines and hydrocarbon maturation and migration.

These data indicate that significant amounts of porosity can exist at depths in excess of 15.000 ft (4,500 m) and that care must be exercised when applying general porosity/depth curves to specific areas.

BENSON, RICHARD N., and ROBERT G. DOYLE, Delaware Geol. Survey, Univ. Delaware, Newark, DE

Inner Margin of Baltimore Canyon Trough: Future Exploration Play

A structure contour map derived from interpretation of offshore seismic reflection profiles and onshore well control shows the configuration of the pre-Mesozoic age (crystalline) basement of the inner margin of the Baltimore Canyon trough (coastal plain and near offshore) from the Long Island platform to Cape Hatteras. Major structural features are north-south aligned grabens and half-grabens (rift basins) that contain probable Triassic-Jurassic age continental and lacustrine sedimentary rocks that were truncated and later onlapped by the sedimentary fill of the Baltimore Canyon trough. Other fault structures appear to be associated with the hinge zone of the Baltimore Canyon trough and its landward structural sag called the Chesapeake-Delaware embayment.

Many of the structural features of the basement are at depths shallow enough (< 20,000-25,000 ft, 6,100-7,500 m) to be tested by drilling. Closely spaced seismic-reflection profiling would be required to provide detail for locating petroleum prospects. Likely petroleum source beds are the lacustrine shales of the rift basins and, farther offshore, the more deeply buried organic carbon-rich shales in the sedimentary fill of the Baltimore Canyon trough. Potential structural-stratigraphic traps might be found within the rift basins. Petroleum prospects in the overlying section might include drape over basement highs, pinch-outs against basement, and growth fault structures controlled by basement faults.

BETHKE, CRAIG M., Univ. Illinois, Urbana, IL, J. D. PRUITT, ARCO Oil and Gas Co., Dallas, TX, and MARY H. BARROWS, Illinois State Geol. Survey, Champaign, IL

Petrographic, Geochemical, and Paleohydrologic Evidence of Nature of Petroleum Migration in Illinois Basin

Detailed studies of the petrography and geochemistry of petroleum source rocks, the geochemistry of petroleum accumulations, and the paleohydrology of the Illinois basin suggest an episode of long-range migration of Devonian-sourced petroleum during a period of regional groundwater flow.

Petrographic analyses of samples of the New Albany Shale group (Devonian/Mississippian) were used to define lateral and vertical variation in composition and thermal maturity of organic matter within the basin. These data delineate likely New Albany Shale group petroleum source areas.

GC, GCMS, and carbon isotopic analyses of thermally mature New Albany Shale in southeastern Illinois and Silurian-reservoired petroleum samples from central Illinois were used in making oil-oil and oil-source rock correlations. These correlations indicate long-range lateral and downward cross-stratigraphic net migration.

Compaction-driven and elevation head-driven ground-water flows within the basin were numerically modeled using available stratigraphic, structural, and hydrologic data. Calculations based on compaction-driven flow show the possibility of down-stratigraphic migration. Compaction-driven flow, however, cannot explain the amount of lateral transport inferred. Regional ground-water flow due to the uplift of the Pascola arch could explain the long-range lateral migration.

Calculations of the effects of advective heat transport by elevation head-driven flow agree with estimates of temperatures made from fluid inclusions in basin mineralization.

BHATTACHARYYA, AJIT, Rensselaer Polytechnic Inst., Troy, NY (present address: Jadavpur Univ., Calcutta, India), and GERALD M. FRIEDMAN,* Rensselaer Polytechnic Inst., Troy, NY

Experimental Compaction of Ooids under Deep-Burial Diagenetic Temperatures and Pressures

Modern ooid sand particles were experimentally compacted at temperatures of 150° and 200°C (302° and 392°F) and at pressures varying between 824 and 1,565 kg/cm^2 (11,700-22,250 psi) consistent with pressures caused by 3.5-6.5 km (11,000-21,000 ft) of overburden. Bulk volume reductions of 21-26% under the above experimental conditions were more substantial than usually considered reasonable.

Particle breakage and deformed particle contacts developed that are comparable to those reported for similar lithologic characteristics from the rock record.

Pressure solution can be produced successfully on compaction in ooid sand particles. This demonstrates that initial pore-volume reduction through mechanical grain adjustments and ultimate pressure solution are the major processes in the diagenetic evolution of limestones. This appears to solve the problem of mass balance. Additionally, ooids were noted to have been plastically deformed, giving rise to longitudinal and concavo-convex contacts.

BIGGERS, BARBARA, Texas Tech Univ., Lubbock, Texas

Reef to Back-Reef Microfacies and Diagenesis of Permian (Guadalupian) Tansill-Capitan Transition, Dark Canyon, Guadalupe Mountains, New Mexico

In Dark Canyon, the transition from Capitan reef facies to Tansill back-reef facies occurs across a distance of 150 m (500 ft). Detailed 3-dimensional sampling of the transition reveals facies based on biota content and textural changes. Also revealed are postdepositional modifications owing to diagenesis.

Three microfacies (A, B, and C), defined by the presence of a few diagnostic biota, occur between the Capitan reef and Tansill back-reef deposits. Several constituent biota occur throughout the zone, including calcareous sponges, gastropods, ostracods, problematic *Tubiphytes,* and foraminifera. Grading from Tansill shelf deposits to the Capitan reef, the facies are: (1) Tansill sensu stricto: dasyclad alga *Mizzia,* large gastropods, and brachiopods; (2) facies A; massive colonies of *Collenia,* bivalves, and red alga *Parachaetetes;* (3) facies B: large gastropods, bivalves, brachiopods, and bryozoans; (4) facies C: heads of *Archaeolithoporella,* and *Mizzia;* (5) Capitan reef: *Archaeolithoporella,* crinoids, and *Mizzia.* the reef proper is an algal boundstone, while back-reef facies are packstones-grainstones.

Submarine cements that have been modified diagenetically are dominant. The majority of the biota has been micritized. Large voids are filled by fibrous aragonite which has been replaced by botryoidal radial fibrous calcite. Many reef and near-reef limestones are extremely recrystallized. Back-reef areas have undergone several stages of dolomitization, whereas the actual reef is limestone. Some anhydrite moldic porosity is occluded