PRECHT, WILLIAM F., Champlin Petrol. Co., Englewood, CO

Diagenesis of Coeymans (Lower Devonian) Patch Reefs, Northern Appalachian Basin

Fourteen Coeymans-age patch reefs and bioherms have been identified along the Silurian-Devonian outcrop belt in northeastern Pennsylvania, northwestern New Jersey, and central New York. Detailed petrographic analysis of samples from five reefs has led to development of a regional diagenetic model.

Diagenetic fabrics show evidence of near-surface conditions that developed in five successive stages. The reconstruction of the diagenetic history of the reefs is as follows: (1) lithologic development of the reef facies, (2) syndepositional infilling by detrital micrite in pores, fractures, and cavities to form geopetal structures, (3) early subaerial emergence in which minor amounts of calcite cement were precipitated in a freshwater vadose environment, (4) a regional transgression that briefly resubmerged the reefs, followed by subaerial exposure, which led to a mixing of fresh and marine pore waters resulting in localized development of silica cements and dolomite precipitation, and (5) continued subaerial exposure of the reefs where large-scale freshwater phreatic conditions resulted in total porosity occlusion by stable low-Mg calcite.

Stage 4 shows the most regional variation in fabrics and conditions. An abundance of various forms of silica has been described in the Coeymans reefs of central New York. These varied forms resulted from fluctuations in pH and salinity. Stage 5 is the most pervasive within the reefs studied. Common phreatic fabrics are syntaxial overgrowths on crinoidal grainstones, drusy calcite rims, and neomorphic spar with crystals coarsening and completely filling the central parts of all remaining pores.

The model developed in this study leads us to infer that Coeymans reefs found in the shallow subsurface would not be favorable hydrocarbon reservoirs. The possibility does exist that localized porosity development occurs in untested reefs within the deeper subsurface portions of the basin.

PROUTY, C. E., Michigan State Univ., East Lansing, MI

Trenton Exploration and Wrenching Tectonics—Michigan Basin and Environs

Hydrocarbon production in the Michigan basin occurs primarily from Silurian pinnacle reefs or Middle Ordovician and Middle Devonian linear, faulted, and dolomitized structures. The writer has previously proposed a wrenching model for the basin based on lineament (fault) patterns from Landsat imagery and outcrop fracture analyses ("ground truth"). The azimuths of existing linear producing fields, whether from Trenton-Black River or younger rocks, closely fit the shear model.

Analyses (x-ray diffraction) of numerous well samples from several producing fields show dolomite/calcite ratios of epigenetically formed dolomite (porous reservoir rock) channelways along vertical shear faults, shear folds, cross faults, cross folds, and stratigraphic permeable offshoots from the fault channelways of the wrenching model. The dolomitizing fluids probably entered the fault channelways from artesian waters from below. If so, basin form would be important to reservoir rock development in this system.

Geophysical exploration for the strike-slip shear faults in nearly horizontal rocks generally has proved elusive, even for accompanying shear folds where they have small amplitudes. The Trenton-Black River Albion-Scipio giant field is shear faulted but not shear folded. Geophysical search for other similar structures has been far from successful.

Thus, "model fitting" in many instances may be the most effective tool. It should be recognized that faults sensed by the reflected infrared of Landsat are open systems, at least near the surface. It is the "unseen" closed system components of the model for which one searches.

ROEN, JOHN B., U.S. Geol. Survey, Reston, VA

Geologic Framework and Hydrocarbon Evaluation of Devonian and Mississippian Black Shales in Appalachian Basin

The Paleozoic wedge of sedimentary rocks in the Appalachian basin is a repetitive cyclic rock sequence consisting mainly of three alternating rock types—siliciclastics, carbonates, and black shales rich in organic matter. Of the two black-shale sequences in the basin, the upper is the Devonian and Mississippian shales, which have attracted interest as a source of uranium, oil and gas, and pyrolytic oil. Recent geologic studies have defined their regional stratigraphy, distribution, and thickness. These studies have provided the necessary framework for resource evaluations and for geochemical characterizations, including analysis of the chemical structure of the kerogen by ^{13}C nuclear magnetic resonance (NMR). An eastward-thickening sequence of predominantly very fine to fine-grained rocks contains an aggregate thickness of dark shale (rich in organic matter) that ranges from about 15 ft (4.6 m) or less in the south-central part of the basin to about 500 ft (150 m) in the northeastern part of the basin. The average organic-carbon content for the black shales ranges from about 3% in the eastern part of the basin to about 10% in the western part. Regionally, the maturation of the shales increases eastward. Various studies suggest that the Devonian and Mississippian shales west of the Allegheny front have not exceeded the catagenic stage. The ^{13}C NMR determinations of aromaticity of kerogen from selected stratigraphic intervals suggest that a significant amount of the parent organic material was of terrestrial origin. This NMR work corroborates visual evidence such as the presence of coalified plant material and the known initial flourishing of vascular plants in Devonian time. Maturation of shale containing aromatic kerogen derived primarily from vascular plants generated mostly nonassociated "dry" natural gas. Therefore, the composition of the gas in the black shales, whether "wet" or "dry," appears to be more closely related to the kerogen type or degree of aromaticity than to the degree of thermal maturation. The Devonian and Mississippian black shales in the basin are estimated to contain 200-300 mmcf of gas. Recoverable-reserve estimates are highly variable because the source and reservoir rock are one and the same and because the exploitation conditions and techniques vary across the basin.

SCHWALB, HOWARD R., Illinois State Geol. Survey, Champaign, IL

Model for Tectonic Deformation of Eastern Stable Interior Crustal Rocks as Interpreted from Overlying Sediments

The Eastern stable interior is characterized by arches, domes, and synclinal basins usually covered by sedimentary layers dating back to the Cambrian. On the basis of data from outcrops and deep tests drilled into or through the sedimentary cover, activity in the underlying crustal (basement) rocks can be interpreted from many of the sedimentary tectonic features created by this movement. Geophysical studies of crustal rocks indicate that as much as 12 km (7.5 mi) of relief exists at their base and that there is layering within the crust. Since Precambrian time, new crust, probably supplied by a stationary hot spot in the asthenosphere as continental drift shifted the overlying plate, created uplift of features such as the La Salle anticlinal belt, while dense crustal layers subsided to create riftlike grabens. During periods of plate collision or very rapid drift, the mantle and crust were decoupled; this action produced an upward vector of thrust against downward crustal bulges, and arches and domes responded by uplift. Platewide unconformities developed during the decoupled movement of crust and mantle. The sedimentary rocks record the time and nature of the activity.

SEYLER, BEVERLY, Illinois State Geol. Survey, Champaign, IL, and MARK A. PEARCE, Gypsum Energy Management Co., Attica, NY

Environments of Deposition in Medina Group in Western New York

The basal Silurian Medina Group including the Whirlpool Sandstone, Power Glen Shale, Grimsby Sandstone, and Thorold Sandstone was studied in the outcrop belt along the Niagara escarpment from St. Catharines, Ontario, east to Rochester, New York. These formations represent facies changes in a wave-dominated environment.

The Whirlpool Sandstone and Power Glen Shale are a transgression succession of shoreface to delta-front sediments. Regression followed with deposition of the Grimsby Sandstone in lower to upper delta-plain environments.

The Whirlpool Sandstone contains lower shoreface, upper shoreface, and foreshore deposits. These deposits are clean, well-sorted white orthoquartzites. The overlying Power Glen Shale, deposited in a delta-front environment, contains numerous lenses of storm-deposited, hummocky, cross-stratified, fine-grained sandstone; scattered colonies of crinoids