HAM, THOMAS L., and RANDAL J. LANDRY, Centenary College, Shreveport, LA

Suggested Nomenclature Change and New Reference Locality for DeQueen Formation, Pike County, Arkansas

The DeQueen Formation of the Trinity Group, Comanchean Cretaceous, crops out in southwestern Arkansas and southeastern Oklahoma. The outcrop, located in the Highland gypsum quarry of Pike County, southwestern Arkansas, is described in detail in this paper and presented as a reference locality. Data from the locality provide the basis for a nomenclature change from the DeQueen Limestone Member to the DeQueen Formation. The formation consists of 64.23% clastic sediments, 24.72% gypsum, and 11.05% limestone. Hopper salt casts, ripple marks, scattered pyrite and marcasite nodules, celestite, and chickenwire gypsum can also be found. The DeQueen Formation is underlain by clays and the Ultima Thule Gravel lentil, while the top is unconformably overlain by Upper Cretaceous Tokio gravels.

The general paleoenvironment represents a normally low-energy subtidal environment ranging from brackish to normal to hypersaline waters in a lagoonal setting that shallows upward.

HAMLIN, H. SCOTT, Univ. Texas at Austin, Austin, TX

Fluvial Depositional Systems of Carrizo–Upper Wilcox in South Texas

In the Rio Grande embayment of south Texas, the Carrizo-upper Wilcox interval (Eocene) consists of two sand-rich coastal plain fluvial depositional systems that grade basinward into several deltaic complexes. The bedload channel system is dominated by multi-story, multi-lateral, fluvial, channel-fill sandstones. This system is typically > 90% sandstone. Shales are thin and laterally discontinuous, the remnants of abandoned channel fills. Bedload channel sandstones dominate the major fluvial axes and form the depositional framework of the interval. The mixed alluvial system consists of a more typical suite of coastal plain facies. Mixed-load channel-fill sandstones tend to be isolated and surrounded by overbank shales and thin sandstones. Crevasse splay and lacustrine facies occur in the flood-plain area.

Total-interval isopach patterns, sandstone geometries, and depositional systems distributions indicate that fluvial sediment input was converging upon the embayment from the west, northwest, and north.

Economically, the Carrizo-upper Wilcox of south Texas has a threefold significance. The updip Carrizo sandstone is a major source of fresh groundwater, includes several large oil fields, and also contains deposits of uranium minerals. The downdip upper Wilcox trend is an area of active hydrocarbon exploration.

HANOR, JEFFREY S., Louisiana State Univ., Baton Rouge, LA, and JANET E. BAILEY, Texaco USA, New Orleans, LA

Use of Hydraulic Head and Hydraulic Gradient to Characterize Geopressured Sediments and Direction of Fluid Migration in Louisiana Gulf Coast

Characterization of geopressured sediments in the Gulf Coast is commonly made on the basis of increases in pressure gradient or geostatic ratio, i.e., in-situ fluid pressure divided by total depth. Fluids and sediments having geostatic ratios > 0.47 psi/ft are usually considered "geopressured;" those with geostatic ratios > 0.70 psi/ft are considered "hard-geopressured."

An alternative and more informative way of characterizing geopressured sediments is by use of the parameter *hydraulic head*. Hydraulic head can be used not only to distinguish between hydropressured and geopressured sediments, but also to provide potentially quantitative information on the direction and rate of subsurface fluid flow. Hydraulic head, h (ft), is defined as $h = z + Pg/\rho$, where z is depth below a reference datum, P is measured or calculated fluid pressure, g is acceleration due to gravity, and ρ is fluid density. In the absence of osmotic effects, the *hydraulic gradient*, dh/dl (dimensionless), where l is path length, can be used in conjunction with hydraulic conductivity in Darcy's Law to predict the direction and rate of fluid migration.

Variations in calculated hydraulic head have been correlated along several regional cross sections through the Tertiary sedimentary sequence of south Louisiana. Four distinct hydrodynamic zones can be distinguished with depth in the region studied.

(1) Near surface to 7,000 ft (2,100 m) in depth. Hydropressured fresh to saline waters having hydraulic heads near zero and vertical hydraulic gradients of 0.01 or less.

(2) 7,000 ft (2,100 m) to 10,000 to 14,000 ft (3,000 to 4,300 m) in depth. A transition zone of weakly geopressured sediments with hydraulic heads ranging from 0 to 3,000 ft (900 m) above sea level. Hydraulic gradients range from 0.1 to 4 and show many reversals with depth. Many commercially important hydrocarbon plays occur within this zone.

(3) 10,000 to 14,000 ft (3,000 to 4,300 m) to 12,000 to 18,000+ ft (3,600 to 5,500 m). The hard geopressured zone in which hydraulic head progressively increases with depth from values of 3,000 to 16,000+ ft (914 to 4,900 m) of head above sea level. Gradients of 4 to 5 are typical but locally can exceed 25. There are few reversals in gradient with depth.

(4) Depths below Zone 3. Suggestion, based on sparse data, that hydraulic gradients begin to decrease with depth.

In contrast to the hard geopressured zone, where hydraulic flow appears to consist of a broad, generally upward-moving front, hydraulic flow in the transition zone appears to be more strongly focused through preferred channels.

HARWOOD, GILL, The University, Newcastle-upon-Tyne, U.K., and CHRIS FONTANA, Phillips Petroleum Co., Aurora, CO

Controls on Hydrocarbon Production in Bryan's Mill Area, Cass and Bowie Counties, Texas

Production from the Bryan's Mill, Frost, and Carbondale fields in the Bryan's Mill area is from Jurassic upper Smackover dolomitized ooid grainstones. Within the upper Smackover, three coarsening upward sequences culminating in ooid grainstones have been recognized, and they extend across the area. Shortly after deposition, leaching by meteoric fluids resulted in oomoldic porosity in many of the ooid grainstones; other carbonate facies were affected very little. During early diagenesis, dolomitization both preserved existing porosities and generated an effective intercrystalline porosity, thereby enhancing permeability. After dolomitization, brittle compaction during burial increased permeability further by the interconnection of oomolds.

The center of the Bryan's Mill area was a positive feature during late Smackover deposition. Faulting during Buckner deposition resulted in a series of southeasterly tilted fault blocks, perhaps due to regeneration of basement structures. Later, post-Hosston faulting had an east-west trend and is possibly associated with doming of the sediments over two highs. There is little evidence of Jurassic or early Cretaceous movement on the east-west trending faults.

Production in the area is dependent on a combination of structural, stratigraphic, and diagenetic factors. Although the grainstones are continuous across the northernmost structural high, production is only from dolomitized areas. Thus diagenesis, and in particular dolomitization, is the ultimate control on production in the area.

HOWARD, PERRY C., Coastal Environments, Inc., Baton Rouge, LA

Development of Tidal Inlet on Mississippi River Deltaic Plain

Surface sampling and bathymetric surveying in 1981 and charts from 1853 to 1934 are used to formulate the history of Quatre Bayou Pass, a major inlet within the transgressive environment of the Mississippi River deltaic plain. Over this period, land loss processes caused marsh to give way to lakes and bays; therefore, tidal exchange intensified through a break in the coastal barrier. Beach sand was reworked into small tidal deltas. As lakes and bays enlarged further, the tidal prism increased; consequently, both the pass and the sandy tidal deltas increased in size. Over the last century, the increased tidal flow caused Quatre Bayou Pass to have an eight-fold cross-sectional area enlargement and a three-fold ebb-tidal delta volume increase. At present, the throat is 15 m (49 ft) deep and 1.2 km (0.7 mi) wide, while the ebb-tidal delta is comprised of 14.9 by $10^6 \pm 10\%$ m^3 of sediment.

Concurrent with these developments, recession of the barrier and much of the shoreface proceeded at a rapid rate. Because the ebb-tidal delta had a simultaneous increase in volume, the shoreface in front of the pass remained relatively stable. In other words, bathymetric expression of the ebb-tidal delta did not develop solely through progradation, but was also formed through erosion of the surrounding Gulf bottom. Accordingly, the shoal is termed "ebb-tidal delta retreat body."

ISPHORDING, W. C., Univ. South Alabama, Mobile, AL

Interpretive Mineralogy: Examples from Miocene Coastal Plain Sediments

Gulf Coast Miocene sediments are among the most lithologically complex in the entire nation. This varied lithology stems in part from multiple source areas that were active during this interval; but also it reflects major tectonic events that influenced depositional patterns throughout the Gulf Coast during the Miocene. Because fossils are scarce or lacking in many of the units, important questions relating to a number of geologic problems have been addressed by analysis of sediment mineralogy. Examples are discussed illustrating how such analyses can be used to: (1) clarify stratigraphic relationships between units in contact, (2) define environmental conditions in the depositional basin, (3) reconstruct paleoclimate conditions, and (4) identify provenance areas. A major anomaly in the mineralogy of central Gulf Coast Miocene sediments is explained by postulating a major "ancestral Tennessee River" originating in the southern Appalachians and flowing southwestward across Alabama and Mississippi to a terminus in the ancient Gulf of Mexico.

KELLER, WALTER D., Univ. Missouri-Columbia, Columbia, MO, CHARLES G. STONE, Arkansas Geol. Commission, Little Rock, AR, and ALICE L. HOERSCH, LaSalle College, Philadelphia, PA

Textures of Chert and Novaculite: An Exploration Guide

Textures of chert and novaculite observable in scanning electron micrographs (SEMs) are useful as a practical, geologic thermometer for estimating the maximum temperature of those rocks since deposition. Such information may be further applied during exploration for hydrocarbons (maturation or degradation), and for metallic and nonmetallic minerals, in those and associated rocks.

Scanning electron micrographs taken of cherts and novaculites that crop out in the Ouachita Mountain foldbelt of Arkansas and Oklahoma, and in areas adjacent to exposed and buried intrusives, show a sequential range in textures from cryptocrystalline, anhedral quartz in the nonmetmorphosed chert and novaculite to coarse euhedral, polygonal, triple-point quartz 60 μm in diameter. A similar range of textures occurs in chert of a contact metamorphic aureole on the Isle of Skye, Scotland, where classic metamorphic mineral suites from talc through tremolite, diopside, and forsterite grades are represented. Hence, some chert and novaculite of the Ouachita Mountain foldbelt shows textures morphologically correlative with classic representatives of varied metamorphic conditions.

Measurements were made of grain sizes of the quartz along transects across the SEMs of chert and novaculite from the Ouachita foldbelt. From them an isopleth map was made showing mean grain sizes of the polygonal triple-point texture developed. The map defines a linear 25 to 65 km (15 to 40 mi) wide belt that extends from Little Rock, Arkansas, about 250 km (155 mi) west to Broken Bow, Oklahoma. The texture increases from the margins to the core of the Ouachita Mountain foldbelt and contains two coarse-grain anomalies, one near Little Rock (35 μm diameter) and another near Broken Bow (15 μm diameter). This textural belt, with anomalies, conforms to the most intense, predominant late Paleozoic, structural deformation in the Ouachita Mountains. Previous interpretations have considered the rocks in the core of the foldbelt to have attained a maximum metamorphic grade in the zeolite to lower greenschist facies.

Cherts and novaculites adjacent to Magnet Cove, a Cretaceous age pluton in the eastern Ouachita Mountains of Arkansas, illustrate a superposed overprinting of polygonal triple-point texture. It ranges from a background of about 2 μm (talc grade) in chert 1,370 m (4,500 ft) from the pluton to about 45 μm (forsterite grade) from near the contact. Private drilling operations indicate that the pluton contact dips about 45° beneath much of the sedimentary rock that exhibits locally anomalous crystallinity. Homogenization temperatures of vein quartz, determined by H. Jackson in 1973, show a gradient along this profile of slightly more than 200°C (390°F) in quartz 1,370 m (4,500 ft) from the pluton, to about 440°C (825°F) near the contact. Novaculite xenoliths in the adjoining Potash Sulphur Springs intrusive are coarser in texture, 60μm or larger, and represent the higher temperature periclase metamorphic grade, approximately 760°C, 1,400°F, at Crestmore, California, according to Carpenter.

The triple-point texture and coarseness of chert and novaculite are related to the degree of thermal maturation resulting from various heating events. The crystal morphology is equivalent in the two processes described (regional and contact metamorphism), but the changes due to individual agents, temperature, physical deformation, time, depth of burial, and mineralizers have not yet been resolved separately.

Very small quantities of chert and novaculite, by using SEM techniques, can serve as a guide to areas that have undergone elevated rock temperatures resulting from deep burial, mechanical stresses, intrusions, exhalations, and other thermal events. These investigations are relevant in determining temperature levels that may mature or degrade hydrocarbons, and offer clues in exploration for thermally related metallic and nonmetallic minerals. SEM studies of cherts and novaculite now provide another method of ascertaining the thermal maturation of rocks.

KONTROVITZ, MERVIN, and RENÉ A. DE HON, Northeast Louisiana Univ., Monroe, LA

Diagenetic Changes to Microfossils: Experimental Study

An understanding of taphonomic processes including diagenesis would enhance the usefulness of fossils such as the Foraminifera. In this study, shells of five modern species of calcareous Foraminifera were subjected to temperatures and pressures (T-P) that simulated burial. One kilometer (0.6 mi) increments were used with a maximum simulated depth of 10 km (6 mi) in wet sediment.

An increased alteration of shells occurred at each higher T-P in each sediment type (quartz, illite, or calcite). Shells in quartz were more altered than those treated in either illite or calcite. Compared to untreated shells, pores in quartz at 5 km (3 mi) were enlarged by 15%, and tiny hillocks were visible at high magnification (2,000 X). At 6 km (3.7 mi), high sharp pinnacles were formed and pores were enlarged 30 to 50%. At 7 km (4.3 mi), long narrow solution channels developed while pores were increased by 40 to 60% in diameter. The next T-P increment (8 km, 5 mi) caused even greater pore solution, whereas at 9 km (5.6 mi) sutures were obliterated and the previously formed pinnacles were removed. At the highest T-P (10 km, 6 mi), chambers and shell outlines were highly altered and newly formed crystals appeared. There were platelets oriented perpendicular to the shell surface; often they were arranged as rosettes.

Under experimental conditions, alteration features of Foraminifera shells appear diagnostic of certain T-P levels. If such features develop on shells in natural sediments they may be useful to reconstruct some conditions of diagenesis.

KOSTERS, ELISABETH C., Louisiana Geol. Survey, Baton Rouge, LA, and ALAN BAILEY, Univ. Southwestern Louisiana, Lafayette, LA

Characteristics of Peat Deposits in Mississippi River Delta Plain

Variations in organic-rich sediment (peat) from the Mississippi River delta plain can be explained by differences in three interrelated parameters: (a) depositional setting, (b) balance between subsidence and detrital influx, and (c) marine inundation. Variations are observed in geometry of the overall deposits, organic matter content, and the mineralogy of peats and related ashes.

Using a vibracorer, samples were collected from two brackish areas (Avery Island/Sale–Cypremort and Barataria basin) and one freshwater area (Gueydan). Geometries of the deposits are different for the two brackish settings; interdistributary peats of Barataria basin tend to be discontinuous and somewhat thicker than blanket peats of Avery Island/Sale–Cypremort. The freshwater peat is an elongate body in a Pleistocene channel cut.

Peats in all areas average 90% moisture content. Dried peat averages 81.3% organic matter with a bulk density of 0.12 g/cm^3. Holocene differential compaction has been minimal (< 4%).

Conventional ash values indicate different distributions of organic material for the two brackish areas. For the area containing interdistributary peats, approximately 5% of the subsurface contains more than 70%