ISPHORDING, WAYNE C., and JOHN A. STRINGFELLOW, Univ. South Alabama, Mobile, AL, and GEORGE C. FLOWERS, Tulane Univ., New Orleans, LA

Sedimentary and Geochemical Systems in Transitional Marine Sediments in Northern Gulf of Mexico

The coastal zone of the northern Gulf of Mexico is marked by a series of bays and estuaries that serve as the principal depositional basins for rivers draining an area of greater than 160,000 km^2. These rivers annually contribute a sediment load to the basins in excess of 12 million tons. Because each river drains a watershed of different lithologic character and each river is further characterized by a different flow regime and hydraulic properties, the sediments deposited in the marginal basins have unique characteristics.

Extensive municipal and industrial dumping of effluent over the years has also acted to imprint geochemical differences on each of the depositional basins. Depending on the degree of industrialization within the watershed, the bays and estuaries may be described as heavily impacted (Mobile Bay), moderately impacted (Apalachicola Bay, Mississippi Sound), or slightly impacted (Pensacola Bay). A strong correlation was observed between the degree of heavy metal contamination and the textural and organic content of the sediments. Analyses further indicated that most metals were partitioned in the bottom sediments in forms that would permit their subsequent release back into the water column or would allow transference of the metal to fauna by ingestion.

JACOBS, J., Sohio Petroleum Co., San Francisco, CA

Fluvial Responses to Hydrologic Changes on Red River in Northeast Texas

Changes in meander patterns of the Red River in northeast Texas from 1860 to 1980 were identified from various maps, aerial photographs, and fieldwork by a 430-km stretch from the Denison Dam on Lake Texoma downstream to Texarkana. Denison Dam closure in 1943 resulted in increased daily base flow and substantially reduced frequency and intensity of flood peaks. The Red River responded to the closing of the dam by increasing width, depth, meander wavelength, amplitude, radius of curvature, and channel length.

Changing only discharge and sediment load downstream from the dam reveals a geologically instantaneous fluvial response to the dam closure. Qualitative prediction of these recent changes on the Red River is generally confirmed by empirical studies in the literature.

Three ancient meander patterns preserved on the Holocene Red River flood plain record a different hydrologic regimen in which well-sorted, clay-rich sediment was transported in a paleoriver having low wavelength, amplitude, width, and depth with high sinuosity. Bankfull discharge is estimated to have been quite low. Archeological remains suggest these features formed 5,000 ± 1,000 years ago.

In perspective, the isolated hydrologic changes that occurred as a result of the closure of the Denison Dam are minute by comparison to the climate-related changes the Red River has undergone over the last 5,000 years.

JANKS, J. S., Robertson Research U.S., Inc., Houston, TX (present address: Texaco USA, Houston, TX), and T. SANNESS and B. A. RASMUSSEN, SAGA Petroleum A/S, Hovik, Norway

Diagenesis of Cotton Valley Sandstones, Catahoula Creek Field, Southern Mississippi

Three conventional cores from the deep Cotton Valley clastics in south Mississippi were analyzed by thin-section petrography, scanning electron microscopy, x-ray diffraction, and cathodoluminescence. The $\delta^{13}C$ and $\delta^{18}O$ values were determined on carbonate cements in sandstones. The sandstones are predominantly subarkose, arkose, and quartzarenites, with minor amounts of quartz and feldspathic wackes. K-feldspar, muscovite, and plagioclase are relatively fresh. Authigenic clay in sandstones is almost exclusively chlorite that occurs as a pore-lining and pore-filling phase, most commonly associated with porous zones. Feldspar diagenesis includes overgrowths of both potassic feldspar and albite. Typically, fresh detrital K-feldspar grains have overgrowths of K-feldspar that are partly dissolved, whereas plagioclase grains (with partly dissolved interiors) have unaltered albite overgrowths. Quartz overgrowth development is pervasive where not hindered by chlorite. Carbonates include intergranular calcite, dolomite, and iron-rich dolomite. The earliest phase is a pore-lining dolomite cement, followed by a later ferroan calcite. Ferroan dolomite (or ankerite) is associated with chlorite in relatively porous intervals. The $\delta^{13}C$ values of mixed carbonates in sandstones range from -0.8 to -4.4 ‰ (PDB), which is typical of normal marine carbonates. The $\delta^{18}O$ values range from -5.0 to -12.3 ‰ (PDB). Formation temperatures of approximately 115°-160°C are suggested by the oxygen isotope data from almost pure late-stage ferroan dolomite.

Petrographic evidence suggests that coarser grained sands were cemented early in the burial history by dolomite and calcite. These cements were later leached by formation waters, possibly related to the generation of organic acids and/or carbon dioxide released during kerogen maturation. Resultant secondary porosity was preserved by formation of bladed chlorite. The source of the iron, manganese, and magnesium necessary for chlorite formation was presumably the release of ions from smectite to illite conversion in shales, because ferromagnesian rock fragments in the sandstones are rare. The feldspar volume and stability and the $\delta^{13}C$ values of carbonate cements suggest the pore water was probably initially seawater and later brine that migrated upward from the Louann Salt. Present brines contain 7,300 ppm of potassium and 51,113 ppm of sodium. Meteoric diagenesis of these rocks was likely minimal. These data suggest that original depositional porosities and permeabilities and carbonate cementation are significant controls in secondary porosity formation in the Cotton Valley sandstones.

JOHNSON, D. JAY, Conoco Inc., Oklahoma City, OK, JERRY ALLIGER, Conoco Inc., Larkspur, CO, and ROBERT K. AAKER, Conoco Inc., Littleton, CO

Evaluation of Radioelement Geochemistry for Detection of Petroleum Reservoirs

We tested the hypothesis that radioelements are either enriched or depleted over petroleum accumulations. Total count surveys are subject to signal variations due to changes in soil composition and to variations in soil moisture. Methods have been determined to lower the variations due to soil composition and to eliminate variations due to soil moisture. We conclude that, if hydrocarbon-related anomalies are present, they are overwhelmed by changes in soil composition.

Changes in soil composition can cause: (1) a fourfold change in total count and eU, (2) a twofold change in K, and (3) a thirteenfold change in eTh. Modified eU/K, eTh/K, and eU/eTh ratios reduce the variations caused by soil composition to ±50% of normal conditions. This permits detection of anomalies as low as 1.0 ppm eU, 2.0 ppm eTh, or 0.7% K. Statistical detection limit for the surveys is ±0.24 ppm eU at 2.0 ppm eU concentration.

The detected anomalies are of equal amplitude and frequency both on and off the fields. This, plus the lack of anomaly repeatability from line to line, precludes a hydrocarbon source. The majority of all anomalies are attributed to soil or lithologic sources. The others are caused by uranium mineralization.

KINGSTON, JIM, Baylor Univ., Waco, TX

Long-Term Effects of In-Situ Leach-Mining Restoration in Oakville Aquifer System near George, West Texas, with Implications for Shallow Waterflooding

The Miocene Oakville Formation is a major Gulf Coast freshwater aquifer and uranium host. The impact of long-term pumping during the restoration phase of leach mining depends on the efficiency of water-quality improvement methods, characteristics of the aquifer, and meteorological fluctuations affecting recharge. Newly acquired data from this industry have improved understanding of fluid migration in a fluvial depositional system.

Development of the in-situ leach-mining industry has added vast amounts of subsurface hydrogeological data obtained from operation of an extensive network of wells. Both surface and subsurface data were combined in this investigation, which included analysis and interpretation of outcrop samples, uranium drill logs, cross sections loaned by com-