

AB type. The adjacent overbank sections are composed dominantly of shale but contain thin sandstones and siltstones that are massive to laminated and rippled, and form more complete turbidites of the ABC type. All sandstones have graded texture and are volcanic-chert arenites of moderate quartz content.

The channels appear to be of constructional origin, and log correlations above and below the channel facies suggest that they are inserted in the sedimentary section rather than filling eroded channels. The several facies illustrated by cores have characteristic responses on borehole logs which permit recognition of channels and overbank sections by logs alone. These distinctive log characteristics may permit the prediction of channels in exploratory and development drilling.

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Calpionellids and Nannoconids of Taraises Formation (Early Cretaceous), Santa Rosa Canyon, Sierra de Santa Rosa, Nuevo León, Mexico

Santa Rosa Canyon dissects the Sierra de Santa Rosa at the western end of an arcuate range in south-central Nuevo León, Mexico, about 40 km west of Linares. About 2,000 m of Late Jurassic (Tithonian) to Late Cretaceous (Maestrichtian) rocks are exposed. The Taraises Formation is composed mainly of dark gray to black, well-indurated lime wackestones and mudstones 132 m thick. The upper part of the formation includes 31 m of dark calcareous shale which contains a few thin beds of moderately indurated lime wackestone which bear ammonites of Valanginian age. Other megafossils are rare throughout the formation. Microfossils are common to abundant in about one third of the samples collected at 2-m intervals. Induration and recrystallization allowed micropaleontologic study by thin section only. The microfossils include radiolarians, ostracods, echinoderm debris, and unidentified biogenic grains as well as calpionellids and nannoconids, but only the last two are persistently common.

Calpionellid taxa include *Amphorellina subacuta* Colom, *Calpionella alpina* Lorenz, *Calpionella elliptica* Cadisch, *Calpionellites darderi* (Colom), *Calpionellopsis oblonga* (Cadisch), *Calpionellopsis simplex* (Colom), *Remaniella cadischiana* Catalano, *Salpingellina levantina* Colom, *Stenosemellopsis hispanica* (Colom), *Tintinnopsella carpathica* Colom, and *Tintinnopsella longa* (Colom). The distribution of these taxa indicates that the Taraises ranges in age from middle Berriasian to the Hauteriviian-Valanginian boundary. No calpionellids were found in the overlying Tamaulipas (= La Pena and Cupido of many workers).

Although abundant in some thin sections, nannoconids were less useful than calpionellids. *Nannoconus steinmanni* Kamptner appears intermittently throughout the Taraises Formation. It has been reported to range throughout the Berriasian and Valanginian. Other species of nannoconids were tentatively identified but they are comparable in form and range and their occurrence was plotted with *N. steinmanni*.

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Preliminary Report on Microplankton and Microbenthon Responses to 1979 Gulf of Mexico Oil Spills (Ixtoc I and Burmah Agate), with Comments on Avenues of Oil to Sediments and Fate of Oil in Column and on Bottom

During 1979 the Gulf of Mexico was the scene of the world's largest oil spill (Ixtoc I in the Bay of Campeche) and a major oil tanker spill near a metropolitan area and an estuarine system (Burmah Agate spill off Galveston). Pre-spill sampling provided base-line data on the microplankton and microbenthon. Post-spill sampling (after the oil came ashore in each area, the south Texas and Galveston beaches) illustrated immediate responses to oil in the water column (death of meroplanktonic and holoplanktonic forms, but an apparent congregation of copepods feeding on the oil) and perhaps rapid (increase in nematode standing stock) and longer term (increase in nematodes and benthonic foraminiferans) responses to the oil as it reached the bottom. Four pelagic avenues of oil to the bottom were recognized (tar balls and perhaps on the bodies of dead plankton near the Burmah Agate, flocculation or adhering of clay-sized particles to sheen or mousse, fecal pellet transport, and aerosol transport to the turbid nearshore zone with the adhering of silt-sized particles). Impact was noticeable near the Burmah Agate, in nearshore regions, and under open ocean areas covered by extensive mousse and tar balls; however, most of the open ocean continental shelf appeared to be unaffected.

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Depositional Systems and Lignite Prospecting Models—Wilcox Group and Meridian Sandstone (Eocene), Northern Mississippi

The first year of a three-year Mississippi Mineral Resources Institute project to map the surface and subsurface terrigenous clastic depositional systems and lignite units of Mississippi has been completed. Data from 620 oil- and water-well electric logs, 65 sample logs, and 35 surface exposures have been used to determine the distribution of the principal sandstone bodies in the northern third of the state. Evidence from eight regional cross sections indicates that the Wilcox-Meridian vertical stratigraphic interval can be subdivided into a minimum of four distinct units: (1) a basal Wilcox progradational interval, (2) a lower Wilcox fluvial-deltaic unit; (3) an upper Wilcox fine-grained fluvial unit; and (4) a Meridian coarse-grained fluvial unit. In extreme northwestern Mississippi the highest 200 ft (61 m) of the Wilcox is composed of massive sandstone and is genetically related to the overlying Meridian Sandstone (Claiborne Group). This is the Meridian—upper Wilcox aquifer system (basal part of the Memphis aquifer) of hydrologists. Hence, a fourth Wilcox subdivision, a massive upper Wilcox coarse-grained fluvial unit, can be delineated for the northernmost counties of the study area.

Sandstone-body geometry and lignite distribution in the Wilcox-Meridian systems are indicated by net sandstone isolith, net sandstone percent, thickness of most

massive sandstone unit, and lignite isopleth maps. Dendritic, contributory sandstone belts of low to moderate sinuosity comprise the dominant geometry displayed by these terrigenous clastic rock bodies, even with the basal Wilcox progradational interval. Nine distinct sandstone belts between 6 and 10 mi (9.6 and 16 km) wide are noted in the lower Wilcox; seven of these same belts occur in the upper Wilcox. The Meridian has a much higher overall sandstone content than the Wilcox units, averaging 70%, but the 90% sandstone contour line highlights 8 sandstone belts occupying roughly the same positions as maximum sand belts in the lower Wilcox.

A bifurcating, distributary net sandstone pattern characteristic of upper delta plain facies is noted for the basal Wilcox, lower Wilcox, and upper Wilcox stratigraphic intervals of southern Bolivar, Yazoo, Sharkey, Issaquena, and Washington Counties. Lignite isopleth maxima of 17 and 18 lignites, respectively, for the lower and upper Wilcox of central Washington County lend further support for this interpretation. The principal distal deltaic sand bodies of the Wilcox high-constructional Holly Springs delta system, however, have been mapped by other researchers 75 to 125 mi (120 to 200 km) downip from this area.

Lignite prospecting in the Wilcox-Meridian section of North Mississippi can be greatly aided through an understanding of the geographic and stratigraphic distribution of the major depositional systems.

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Chester and Pottsville Depositional Systems, Outcrop and Subsurface, in Black Warrior Basin, Mississippi and Alabama

Terrigenous clastic depositional systems of the Upper Mississippian Chester Group and the overlying Lower Pennsylvanian Pottsville Group in the Black Warrior basin of Alabama and Mississippi were deposited in distinctly different tectonic settings. The predominantly deltaic Chester sandstone units accumulated on the stable northern shelf of the basin and had a cratonic source to the north or northwest. Detailed subsurface mapping of these cratonic delta systems indicates that the northern shelf can be subdivided into a terrigenous clastic western element (Parkwood and Floyd Formations) and a largely carbonate eastern element (Bangor, Hartselle, Monteagle, and Pride Mountain Formations). Total thickness of the Chester interval on the shelf averages 1,200 ft (366 m). Pottsville sediments, in contrast, had a principal source to the southwest of the Black Warrior basin. They represent the thick clastic wedge shed from the Ouachita orogenic belt. Pottsville deposition occurred in a rapidly subsiding foreland basin and involved a maximum sediment accumulation exceeding 12,000 ft (3,658 m) in the basinal core.

Within the Chester Group four cycles of deltaic progradation have been identified through data gathered from 600 well logs. Two deltaic depocenters, a carbonate shelf and ramp, and a shallow basin carbonaceous shale unit comprise the principal depositional systems along the northern margin of the basin.

With the surface and shallow subsurface Pottsville of

the Black Warrior basin in Alabama, the 2,000-ft (610 m) stratigraphic interval can be subdivided into a minimum of seven vertical genetic components. In contrast with the Chester units, however, laterally extensive coal seams rather than marine transgressive limestone tongues form the bounding elements. On the surface, the lowest Pottsville unit has no productive coal seams and is dominated by massive, quartzarenite sandstone bodies interbedded with dark gray shale.

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Subsurface Wilcox Lignite in West-Central Louisiana

The Wilcox Group in west-central Louisiana is a wedge of terrigenous clastic sediments which prograded into the northern margin of the ancestral Gulf of Mexico. Subsurface correlations provide the basis for dividing the Wilcox Group into three primary intervals—lower Wilcox, upper Wilcox, and Carrizo Formation. Furthermore, lower Wilcox is subdivided into four regional lithologic units, informally referred to as intervals 1, 2, 3, and 4.

Lignites occur as component facies of fluvial, deltaic, and lagoonal rocks. Lignites are identified from electric log response based on "operational" definition. Associated environmental interpretations are derived from log responses characteristic of deltaic environments. Expected properties of lignites are predicted from their geologic setting analogous to modern peat deposition and other ancient lignite accumulations.

The Carrizo Formation represents a meander-belt facies within an alluvial plain. The Carrizo Formation is devoid of any significant lignite accumulation because of the destruction of overbank deposits.

The upper Wilcox is a lagoon-barrier bar complex characterized by fine-grained deposition updip and strike-oriented accumulation of coarse sediment downip. The interval is basically not lignitiferous. A maximum of 8 seams occur updip of major strike-oriented sand accumulation. These lignites are expected to be lagoonal and of poor quality.

The lower Wilcox is a typical progradational deltaic complex to the east and marginal delta plain to the west. The lower Wilcox is the major lignitiferous interval of the Wilcox Group. Thirty-five lignite seams are found within the interval, are associated with interdistributary flood-basin deposits, and should be of good quality, based on similarity to deposits elsewhere.

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Reservoir Quality, Pliocene-Pleistocene Sandstones, Offshore Gulf of Mexico

Significant variations in the quality of sandstone reservoirs commonly reflect the amount of clay content which is controlled by the environment of deposition and diagenesis.

In the Pliocene-Pleistocene sandstones, offshore Gulf of Mexico, the clay content varies significantly between sands deposited in delta and submarine fan environments. The overall shapes of the gamma ray and SP curves for both environments are commonly similar,