ably channel deposits. The lower part is composed of thinner beds about 1 ft (0.3 m) thick of more complete sequences which include ripple laminae. These sandstones represent turbidites of the ABCE type and were probably overbank deposits. Some adjacent sandy shales are moderately bioturbated, generally on a fine scale.

The Technik nonreservoir facies is 31 ft (9.5 m) thick in a core from the Harkin-Five Resources 1 Cyrus Paul well. The section consists of thinly interbedded shales and turbidite sandstones which are typically incomplete sequences of the AE, BE, and CE types. The shales are not bioturbated. The nonreservoir facies may be characterized as "distal" overbank deposits. The nonreservoir facies of the overlying Kubena zone is similar.

The reservoir sandstones are fine grained (0.17 mm) and contain 59% quartz, 12% other mineral grains, 14% matrix, and 15% kerogenlike organic material. Silica overgrowths and calcite cements comprise an average 13% of bulk volume. Composition results in a relatively low average permeability of 4 md and porosity of 18%.

The Technik reservoir sandstone appears to represent the fill of outer-shelf channels along which sands were transported to the shelf margin and into the deeper basin beyond. The nonreservoir facies represents overbank deposits adjacent to channels, but the relation between channel and overbank deposits is not clear. The overbank deposits could have been either contemporaneous, levee sediments adjacent to channel-fill sandstones, or they may represent deposits into which later channels were eroded and then filled.

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Characteristics of Lower Vicksburg Reservoirs, McAllen Ranch Field, Hidalgo County, Texas

Lower Vicksburg sandstones in the McAllen Ranch field, Hidalgo County, Texas, form multiple reservoirs for natural gas at depths that range from 9,300 to 15,400 ft (2,790 to 4,620 m). Core examination shows that the sandstones display ordered sequences of sedimentary structures within beds that average about 4 ft (1.2 m) in thickness. Thicker sandstones are massive below and horizontally laminated above and represent turbidites of the AB type which are probably of channel origin. Thinner sandstones are dominated by laminated and rippled beds that represent turbidites of the BCD type which are probably of overbank origin. Reservoir sandstones appear to represent channel deposits that were closely bounded by levee sediments. Isopach maps show that the sandstones are narrow, linear bodies which have dip trends in the upper part of the section. *However, deeper sandstones in the east part of the field* show an anomalous strike trend.

Average grain size of the sandstones is 0.13 mm (fine grained), and bed sets typically show textural gradation. Average detrital composition is 16% monocrystalline quartz, 35% feldspar, 39% rock fragments, 9% matrix, and 1% other grains. Total cement, mostly calcite, averages 36% of bulk volume. Porosities range from 7 to 24% and permeabilities from less than 0.1 to 118 md. Higher permeabilities are found in thicker channel turbidites.

Structure within the field appears to be dominated by a deep-seated shale uplift which caused the formation of a major growth fault. The normal fault has about 600 ft (183 m) of throw on the downdip side of the shale uplift, but fault-plane dip decreases with depth and becomes essentially parallel with bedding. Below the fault, the Jackson Shale is abnormally pressured and probably folded. Early shale uplift controlled sand distribution by diverting turbidity flows from their normal dip trends. Continued uplift caused slump faulting on the basinward flank, and the fault shows continuous growth with increased thicknesses of lower Vicksburg intervals on the downthrown side. Shale uplift soon ended because trends of later sandstones in the lower Vicksburg are not greatly affected. However, the major growth fault was active through the end of lower Vicksburg deposition. This pattern of early shale uplift and subsequent growth faulting contrasts with previous ideas that attribute shale uplift and faulting to rapid deposition of overlying sediment.

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Subsurface Stratigraphy of Midway-Wilcox, Zapata County, Texas

A subsurface study of the Midway-Wilcox (Paleocene-Eocene) in Zapata County, south Texas, led to the recognition of several stratigraphic units of possible formation rank within the Wilcox section. These units, which together with the Midway may reach a thickness of 15,000 ft (4,570 m) in extreme eastern Zapata County, were established mainly on the basis of depositional patterns as reflected on electric well logs. Four Wilcox units have been identified and named, in ascending order, the Lopeno, Volpe, Vela, and Hinnant. Although gas-bearing sandstones are present in all four units, the more important ones are in the Hinnant and Volpe. Deposition of the Midway-Wilcox appears to have been closely controlled by synchronous structural activity initiated in connection with the formation of the Tertiary Rio Grande embayment. This structural activity caused extensive faulting and great variations in sedimentary thicknesses, and is also responsible for the formation of local and regional unconformities in the study area.

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Upper Mississippian Deltas in Black Warrior Basin of Mississippi and Alabama

Terrigenous clastic and carbonate depositional systems comprising the lower two-thirds of the Chester Series were laid down on the shallow northern shelf of the Black Warrior foreland basin. The evaluated section involves the rock units between the Tuscumbia Limestone and the "*Millerella*" limestone tongue of the Bangor formation. Three significant cycles of deltaic progradation have been identified in northeastern Mississippi

and northern Alabama through data gathered from 550 oil well logs and 10 measured sections. Two deltaic depocenters, a carbonate-shelf complex, and a shallow-basin carbonaceous shale unit are the primary depositional systems in the area.

Three genetic intervals have been identified on the basis of thin marine transgressive carbonate units. The lowest (Lewis) interval involves a high-constructive lobate delta system whose axes of maximum sandstone thickness extend southeastward from Lee and Itawamba Counties, Mississippi, as far as Tuscaloosa County, Alabama. Maximum net sandstone thicknesses for individual lobes average 60 ft (18 m). The middle interval includes a western high-destructive wave-dominated delta complex (Evans) centered in Lee and Itawamba Counties, Mississippi and a more easterly high-destructive wave-dominated delta system (Hartselle) in northwestern Alabama. The Hartselle system attains net sandstone thicknesses greater than 160 ft (48 m) along a northwest-southeast trend that extends almost to Birmingham. Evans delta-lobe maxima average about half that thickness. The upper interval is dominated by the thick, multistoried Muldon high-constructive elongate delta system (Rea through Carter sandstone units), centered in Monroe County, Mississippi. On the northeast, and laterally equivalent to the Muldon delta, is the Bangor carbonate shelf.

The Lewis, Evans, and Muldon units represent relatively thin, cratonic deltas whose sandstone provenance is north-northwest of the Black Warrior basin, in perhaps a southeastern Missouri source area. Hartselle terrigenous clastic rocks were transported from the northeast and southeast and probably have an Appalachian source.

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How to Create and Submit a Winning Prospect

The oil and gas energy crisis will last until other sources of energy become available in abundance. For much of its hydrocarbon supply, the United States now relies on countries which may be subject to political instability. Therefore, it would appear that the need for good, drillable prospects within the United States will be present for the next 20 to 30 years, so that the creation and marketing of prospects will continue to be of primary importance to the oil and gas industry and to the country.

The drilling deal or prospect may be discussed in terms of its elements: reserves, risk, and terms. Practical ways of evaluating reserves include simple volumetric analysis and comparison methods. The study of risk inquires about the chances for commercial success of a drilling prospect, and involves the geology. Risk may be studied in terms of the presence or absence of control for the structural and stratigraphic elements of a prospect. The terms of a deal involve cost; the buyer wants to know what he will pay for how much working interest which will yield how much revenue interest.

A "winning" prospect is one that will sell fast and has a high chance of bringing in a producing field. Submittals should include exhibits which represent clearly the geological reasons for the prospect. Unless the exhibits of maps, cross sections, and other representational data are entirely self explanatory a written description of the prospect should also be included.

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Ecologic Niches of Radiolarians, Planktonic Foraminifers, and Pteropods Inferred from Studies on Living Forms in Gulf of Mexico and Adjacent Waters

Living radiolarians, planktonic foraminifers, and pteropods have been collected during 1972-74 from the waters of the Gulf of Mexico and adjacent seas using Nansen closing nets, DUCA high-speed plankton nets, water bottles, and plankton pumps by micropaleontologists at Rice University. These samples included other shelled microplankton (diatoms, dinoflagellates, silicoflagellates, mollusk larvae, etc), nonshelled microplankton (blue-green algae, dinoflagellates, etc), and larger plankton (e.g., copepods, chaetognaths). Radiolarian, planktonic foraminifer, and pteropod species compositions, diversities, and densities were compared with those of other plankton, and were related to physical and chemical oceanographic parameters. Our studies suggest that certain radiolarian, planktonic foraminifer, and pteropod species may be nannoherbivores, bacterivores, detritivores, and/or associated with symbiotic algae and may be characteristic of eutrophic, mesotrophic, or oligotrophic conditions.

This information can be applied to studies of the fossil record for finer resolution of paleoecologic conditions (e.g., paleoproductivities) and for inference of the presence and nature (abundance and diversities) of certain nonfossilizable planktonic components.

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Relict and Expatriate Radiolarian Fauna in Gulf of Mexico—Implications

The presence of living specimens of *Spongaster pentas* and related spongadiscid forms, *Buccinosphaera invaginata,* and certain other radiolarians in plankton samples from the Gulf of Mexico is evidence of a unique radiolarian population that is composed in part of relict and/or expatriate forms. These populations may have survived in the Gulf because: (1) the closure of the Tethys seaway by the uplift of the Panamanian block isolated the equatorial and temperate Atlantic waters and blocked radiolarian faunas from entering the Pacific