potential. Recent discoveries in the Western Desert tilted fault blocks are leading to a reevaluation of new play concepts based on an east-west Tethyan rift structure model. Facies favorable to hydrocarbon accumulation are associated with shallow-water marine depositional environments. Production has not been great on a per-well basis, but fields have consistently outproduced the original recoverable reserve estimates.

The Gulf of Suez lies within the rift between North Africa and Arabia-Sinai. It remains a major producing area with production from sandstones which range in age from Carboniferous to Cretaceous. The Upper Cretaceous and Lower Tertiary carbonates are potentially attractive zones, as are the Miocene clastics and carbonates. Miocene marls and Upper Cretaceous shales are source rocks, and thermal maturation can be directly related to continental rifting with the oil window most attractive in the southern third of the Gulf of Suez. Structural style is strongly rift-influenced with tilted and locally eroded hosts prevalent. The central gulf has a general eastern dip, whereas the northern and southern areas have a regional westward dip. This has had a direct influence in isolating some major oil fields and has adversely affected reflection seismic surveys.

Exploration has been difficult because of excessive Miocene and younger salt thicknesses. With increasingly refined technology, attractive targets now are being delineated in the hitherto unexplored lows between horsts within the gulf.

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Depositional Environments of Schuler Formation (Cotton Valley Sands), Upshur County, Texas

Exploration for "tight" gas (F.E.R.C. Section 107) production from the Schuler Formation (Cotton Valley sands) has provided recent data for the recognition of the lower Schuler (Shongaloo member) shoreface facies and delineation of the upper Schuler (Dorcheat member) delta plain complex in Upshur Country.

Shoreface facies within the lower Schuler have a typical funnel-shaped log pattern (coarsening-upward clastic), with individual sequences ranging from 90 to 100 ft (27 to 30 m) thick. In core, the corresponding coarsening-upward sequence grades from offshore to upper shoreface facies. Upper offshore sediments are dominated by a heavily bioturbated and intercalated sandstone/shale sequence with numerous trace fossils, escape traces, and shell debris. Intensity and diversity of this bioturbation decrease toward the upper shoreface. The lower shoreface is a very fine-grained quartz sandstone with horizontal to slightly inclined stratification. Climbing vertically in the sequence, the upper shoreface is interbedded fine-grained quartz sandstone and biomodal, pebbly carbonate cemented quartz sandstone exhibiting a steep inclined stratification with low-angle truncations.

Associated facies overlying the upper shoreface are lagoonal. Thin marsh deposits are characterized by carbonaceous shales with visible root traces cutting across partings. Subaerially exposed mottled red and green siltstone and red mudstone show evidence of root penetration and are interpreted as coastal plain to tidal flat. The marsh deposits (green siltstones and red mudstones) gradationally interbed with a subtidal lagoonal facies containing dark gray, fossiliferous, argillaceous, limestone containing oysters, echinoid fragments, and annelid worm tubes.

In an effort to tie the limited core data (4 wells) to a countywide environmental interpretation, sand percent interval slice maps were constructed above and below the ubiquitous subtidal lagoonal "marker." These maps and core data in the lower Schuler delineate a strike-oriented, linear clastic shoreline (ENE-WSW). Within Upshur County, lower Schuler sediments were deposited as interdeltaic, shoreface facies. Slice maps and sample logs indicate a significant environmental discontinuity exists between the upper and lower Schuler. The upper member is characterized by a dip-oriented sandstone trend interpreted as an aggradational delta plain complex associated with the Lone Oak delta system.

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Preliminary Synthesis of Eocene-Oligocene Stable Isotope Data from Atlantic, Indian, and Pacific Ocean Sites

Generally consistent patterns of Eocene-Oligocene oxygen and carbon stable isotopic change are emerging from all ocean basins where well-preserved pelagic carbonates have been studied. The major features of benthic foraminiferal oxygen isotopic change are enrichment of close to 1‰ in ^{18}O associated with the middle-late Eocene boundary and the Eocene-Oligocene boundary at locations which differ by more than 3 km (2 mi) paleodepth. The Eocene-Oligocene enrichment occurs mostly in the earliest Oligocene and is clearly isochronous according to planktonic foraminiferal biostratigraphy. Completion of the Eocene-Oligocene event took less than one million years, with maximum earliest Oligocene $\delta^{18}O$ values giving rise to lower values later in the Oligocene. Surface-dwelling planktonic foraminifera from low latitude locations become enriched in ^{18}O by only a few tenths ‰ from the Eocene to the Oligocene, whereas at high latitude locations they show the same enrichment as benthic foraminifera (about 1‰).

Down-core oxygen isotopic trends are best interpreted as reflecting changes in the thermal or density structure of the ocean from Eocene to Oligocene time. This reasoning follows from the general lack of covariance of benthic and planktonic $\delta^{18}O$ from tropical locations, which in the Quaternary is the strongest evidence of large glacial-interglacial changes in seawater isotopic composition. Thus, high latitude locations where the planktonic $\delta^{18}O$ increased the most were probably the source of dense water to the deep ocean everywhere. A major increase in the density structure of the ocean should be evident in plots of planktonic foraminiferal $\delta^{18}O$ versus paleolatitude and benthic foraminiferal $\delta^{18}O$ versus paleodepth. Our preliminary data indicate the $\delta^{18}O$ versus latitude gradient increased from Eocene to Oligocene times, although more data from non-upwelling areas is required to establish the significance of this change. Reconstructions of vertical $\delta^{18}O$ structure in the late Eocene suffer from too little data from individual basins, although our synthesis of the early Oligocene North Atlantic reveals about a 1‰ $\delta^{18}O$ increase between 1 and 2 km (0.6 to 1.2 m) paleodepth.

Carbon isotopic results apparently do not vary systematically in time series, but display differences which probably reflect the hydrographic conditions overlying each site. For example, there are large variations in planktonic foraminiferal $\delta^{13}C$, which vary symmetrically about the equator, as does the $\delta^{13}C$ of total CO_2 today. Some of the lowest $\delta^{13}C$ values come from sites which backtrack to equatorial latitudes, perhaps reflecting upwelling. Benthic foraminiferal $\delta^{13}C$ varies by as much as 1‰ within the North Atlantic during the Oligocene, unlike today when similar variability is only seen between deep basins. This probably reflects dramatically different Paleogene circulation patterns due at least, in part, to the absence of the Panama Isthmus as a barrier between the Atlantic and Pacific.