Deep Wilcox structure and stratigraphy are controlled by regionally extensive shale anticlines. These shale uplifts control deep Wilcox sand distribution, create large anticlines, and cause regional growth faults which frequently influence local structure. Each regional uplift presents a new exploration frontier holding the promise of vast reserves in the deep Wilcox.

The history of Frio-Vicksburg exploration is analogous to the deep Wilcox trend of today. It took 40 years to expand Frio exploration from shallow stratigraphic traps down into the enormous reserves in the Gulf of Mexico, because each new fault block extension was considered to mark the downdip limit of Frio production. This assumption was not true, and is not true in the deep Wilcox today. The deep Wilcox trend remains virtually unexplored, and it is my belief that continued work will prove the existence of much more deep Wilcox potential than is currently thought to exist.

LEWIS, CHRISTOPHER J., Sohio Petroleum Co., Houston, TX

Are Our Oil and Gas Resource Assessments Realistic?

This paper reviews the results of assessments made in the past of United States oil and gas resources, including bidding in OCS lease sales (which are considered to reflect industry estimates of resources). It concludes that most estimates tend to be overly optimistic and suggests that the problem may be partially in the assessment of risk and partially in errors in the assumed resource distribution. It recommends that more use be made of the historical record in making these assessments.

LIANG, LONG-CHENG, JONATHAN G. PRICE, and PATRICIA BOBECK, Bur. Econ. Geology, Austin, TX

Electron Microscopy and Microanalysis of Uranium Phases in Primary Ores, Eocene and Miocene of South Texas

Two contrasting types of roll-front uranium deposits occur in south Texas. In the barrier-bar sands of the Eocene Jackson Group, organic matter was essential to uranium reduction, whereas in the fluvial sands of the Miocene Oakville Formation, epigenetic pyrite was the reductant.

In a sample of reduced Oakville ore, a uranium phase with grains ranging in diameter from < 1 to $20\mu m$ was recognized by SEM backscattered-electron imaging and wavelength-dispersive spectrometer (WDS) elemental-dot mapping. Quantitative microprobe analyses indicated that the phase is a uranium-calcium silicate-phosphate with molar Ca/P approximately equal to 1.0, U/P equal to 2.8 ± 0.4 ($n = 27$), and U/Si approaching 1.0 in samples uncontaminated with quartz, feldspar, or clay minerals. Highest uranium content is 59%. Oakville ore is typically easy to leach by in-situ methods.

Jackson ore contains 2 uranium phases. Sulfur-rich organic matter contains $4.1 \pm 1.6\%$ uranium ($n = 27$). Although individual grains of a possible uranium mineral within the organic matter are too small to be resolved by electron imaging, a consistent molar U/Fe (0.5 ± 0.1) suggests a uranium-iron oxide phase. Alternatively, uranium is adsorbed by or otherwise bound to the organic matter. The second phase is a uranium-calcium silicate-phosphate that differs from the Oakville ore. Molar Ca/P equals 0.8 ± 0.2 ($n = 13$), and U/P equals 4.7 ± 0.4. Small grain size (generally less than 1 μm) prevented analysis of samples uncontaminated with quartz and pyrite. The grain with highest uranium content (43%) has U/Si equal to 0.34. Jackson ore is less favorable for in-situ leaching than Oakville ore in part because the organic-associated uranium is difficult to extract.

LIBBY-FRENCH, JAN, U.S. Geol. Survey, Denver, CO

Sedimentary Sequence of Offshore Southeastern United States: Preliminary Study Based on Exploration Wells

In 1982, geologic data from the exploratory wells in the offshore southeastern United States were released to the public. Prior to this time, well data were limited to the COST (Continental Offshore Stratigraphic Test) GE-1 well, the first deep-penetration well, which was completed in 1977. Six additional exploration wells were completed thereafter. Although these wells were dry holes, information provided by them has contributed to the geologic interpretation of the Atlantic margin.

The oldest rocks penetrated by these wells are Paleozoic indurated shale and argillite, sandstone and weakly metamorphosed quartzite, and igneous rocks. The post-Paleozoic section ranges from 2,220 to 3,660 m (7,280 to 12,000 ft) thick at the well sites, but seismic data indicate that the equivalent section thickens to 10–12 km (6–7 mi) beneath the Blake plateau. The Lower Cretaceous through Cenozoic section represents a progression from nonmarine and marginal marine to marine sedimentation. Three main units are recognized: lower siliciclastic, middle calcareous mudstone, and upper limestone. The siliciclastic unit consists of interbedded gray to red-brown sandstone, siltstone, and shale with some conglomerate, coal, evaporites, and carbonate rocks. Based on petrographic examination, the sandstone compositions vary between arkose, litharenite, and quartz arenite.

Calcareous clay and shale (grading to shaly limestone) overlie the siliciclastic rocks. The upper limestone contains chert, oolites, and shell fragments and ranges in composition from micrite to sparite. By comparing these units to the onshore Georgia sedimentary section, regional lithofacies trends that can be useful for future exploration are recognized.

LIGHTY, ROBIN G., Texas A & M Univ., College Station, TX

Diagenetic Capping of Carbonate Reservoir Facies

Submarine cementation commonly forms a narrow zone of low permeability within a carbonate unit that may act as a diagenetic seal over potential reservoir facies. Although the process of submarine cementation still is not clearly understood, it does appear to be a near-surface, rock or sediment/water interface phenomenon. The diagenetic model proposed here involves the effect of submarine cementation on previously lithified carbonates, such as submerged relict shelf-margin buildups (e.g., drowned reefs, ooid shoals) or previously subaerially exposed formations (e.g., dune ridges) that were submerged by later sea level rise. These deposits generally have pronounced topographic relief (visible on seismic), good reservoir geometries, and high internal porosity of either primary or secondary origin.

Petrologic studies on examples of both of these situations—a submerged early Holocene barrier reef off Florida and a 175-km (110-m) long submerged Pleistocene eolian ridge in the Bahamas—show that their exposed surface and uppermost facies (0-1 m, or 0.3 ft, below top) are further infilled and cemented, creating an extensively lithified, low porosity/low permeability zone or "diagenetic cap rock." Quantitative mineralogic studies of occluding cements reveal an exponential reduction in porosity while moving upward into the seal zone. Submarine cements effectively infill and form a surficial permeability barrier that acts to impede further diagenesis and porosity reduction within underlying potential reservoir facies.

To form this diagenetic seal only requires that the original carbonate buildup be resubmerged for some brief period of time prior to subsequent burial by sediments. If buildup accumulation later resumes without intermediate sediment burial—a common stratigraphic situation—the diagenetic seal would represent a disconformity separating two similar facies.

The early formation of a diagenetic cap rock lends support to models of early hydrocarbon migration and emplacement. Prediction and recognition of submarine diagenetic seals will aid in exploration and development of obvious buildup reservoirs as well as subtle intraformational traps.

LINEBACK, JERRY A., Robertson Research (U.S.) Inc., Houston, TX, and MARK S. ROTH and MARY L. DAVIDSON, Consultants, Houston, TX

Contrasts Between Ordovician and Mississippian Carbonate Depositional Styles in Williston Basin

Upon superficial comparison, the Madison Group (Mississippian) and the Bighorn Group (Ordovician) in the Williston basin appear to be similar sequences of carbonate mudstones and wackestones capped by evaporite-carbonate alternations. Detailed studies demonstrate significantly different depositional styles.

The Madison Group is an example of a deep-water sediment-starved basin that was filled in by turbidites derived from a ringing carbonate shelf. As the basin filled, the Madison was capped by a basinward pro-