1978 is 113,309 bbl of oil and a small amount of gas.

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Applications of Solar Energy: What is Practical in the Near Term?

Applications of solar energy to building heating and cooling systems, industrial process heating, and power generation have been examined. Passive heating and cooling of buildings by solar energy are now technically and economically competitive with energy derived from fossil fuels.

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Subsurface Neogene Stratigraphy of Bay County, Florida

The Neogene of Bay County, Florida, contains three subsurface units, the Bruce Creek, St. Joe, and Intracoastal Formations which make up the Coastal Group and range in age from middle Miocene to Pliocene. They are overlain by a blanket of Pliocene-Pleistocene sands. The Bruce Creek Formation is the oldest of the three units (middle Miocene) and rests upon the Suwannee Limestone which is generally considered Oligocene in age.

The Bruce Creek, St. Joe, and Intracoastal units thicken southward down the paleoslope and pinch out toward the north. The Coastal Group extends laterally across Bay County and into neighboring counties to the east and west. Their full lateral extent is not known.

The St. Joe and Bruce Creek are fairly fossiliferous micrites which contain some quartz sand. The Intracoastal changes from a micrite in the west to a sandy clay in the east. The Intracoastal contains a large percentage of planktonic and benthic Foraminifera.

Biostratigraphic analysis of the Neogene of Bay County based on planktonic Foraminifera shows the Intracoastal Limestone to be Pliocene in the western part of the county (*Globorotalia margaritae* Zone) whereas it is significantly older in the east (*G. fohsi fohsi* Zone). The Bay County planktonic Foraminifera assemblages are somewhat unusual in that the presence of biostratigraphically useful planktonic Foraminifera assemblages in the nearshore Neogene sediments of the Gulf Coast is rare. The zonation schemes of Blow and Bolli which were developed in tropical sediments can be used only with difficulty in the temperate water sediments of the Florida Panhandle.

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Nuclear Power and Geology of Uranium

Nuclear and coal-fueled power plants are the only economically viable large-scale sources of new electrical energy available to man in the next several decades. Even without the ERA-required "best-available technology" of stack-gas scrubbers for coal-fired power plants, the total cost to produce electricity from nuclear power plants is clearly less expensive than from coal-fired power plants at most locations in the United States. Current "economic equivalency" of electrical-generating costs between coal and nuclear would support a nuclear fuel cost of approximately $100/lb of U_3O_8 (the 1979 price is $43/lb of U_3O_8).

The present domestic worldwide supply-demand relations indicate a continued strong need for successful uranium exploration and development programs through the next several decades. The economic realities would cause the price of uranium to rise to permit the development of low-grade uranium resources (100 to 500 ppm U_3O_8) competitively with coal should the discoveries of higher grade uranium resources be insufficient to fulfill the increased demand.

Historically (1950s to 1978), the bulk of the world's uranium has been produced from: (1) lower Proterozoic uraninite placer deposits in quartz-pebble conglomerates of braided-river systems, (2) epigenetic uranium deposits in sandstones located at or near groundwater oxidation-reduction interfaces, commonly in close association with organic material in fluvial sandstones, and (3) hydrothermal vein uranium deposits. These three distinctly different geologic environments continue to be important exploration targets in the search for new uranium deposits.

Exploration for economic uranium deposits has expanded to many geologic environments which have generally been overlooked in the past. Most notable among these are: (1) granitic uranium deposits (commonly anatectic), (2) alkalic igneous-hydrothermal uraniferous environments, (3) altered acidic or alkalic volcanic ash, ash flow, or volcaniclastic environments, (4) metamorphic-hosted uranium deposits, variously interpreted as a metamorphic-hydrothermal or unconformity-related environment, (5) calcrete uranium deposits in evaporative, desert groundwater environments, and (6) unconformity-related environments. Significant uranium deposits have been discovered in each of these geologic environments in the 1970s.

The expanded search for economically viable uranium resources and the improved market and technology factors have caused exploration and development efforts to advance far in recent years. Low-grade uranium resources that have been long known and ignored, such as uraniferous, black, organic-rich shales and marine phosphorites are currently being developed for uranium production. In-situ solution-mining activities have permitted economic exploration of uranium deposits that heretofore have been uneconomic because of their small size, low grade, or depth. Exploration drilling and development activities are expanding to greater depths.

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Clasticity Index—Key to Correlating Depositional and Diagenetic Environments of Smackover Reservoirs, Oaks Field, Claiborne Parish, Louisiana

Oaks field is a stratigraphically trapped Smackover field which produces from at least three separate reservoirs. Individual reservoirs are shoaling-upward carbonate grainstone cycles. The three reservoirs are offlapping and are separated from each other by clastic facies rich in terrigenous matter. The two oldest reservoirs were deposited as well-defined barrier-island complexes up to 4 mi (6.4 km) long and less than ½ mi (0.8 km) wide. The youngest reservoir is less well defined and was deposited primarily as coalescing bars which were only occasionally emergent. All carbonate facies were deposited as mud-free oolitic and rhodolitic grainstones. Most porosity occlusion was by early cementation in the meteoric phreatic and mixed phreatic zones, paralleling depositional strike.

Ten of the 13 producing wells and all four dry holes were conventionally cored. Thin sections were made at 1-ft (0.3 m) intervals from perm plugs, corresponding with measured values of porosity and permeability. Detailed petrographic correlation of wells allowed the individual reservoirs to be subdivided into distinct mappable units on the basis of a plot of the diameter of the largest coated grain ("clasticity index") in each thin section. Clasticity index provides a simple, rapid tool for precise well correlation within individual reservoirs; the correlation is not possible by conventional log methods.

Prior to the incorporation of petrographic analysis in the development drilling program, the field consisted of seven producing wells and three dry holes. Combining clasticity plots and other petrographic information with porosity isopach values enabled the field size to be almost doubled with the successful completion of the next six holes.

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Bayou Middle Fork Field, Claiborne Parish, Louisiana—Case History from Discovery to Waterflood

Bayou Middle Fork field, Claiborne Parish, Louisiana, is located in north-central Louisiana near the Arkansas-Louisiana border in an area known as the "State-Line trend" of the Upper Jurassic Smackover Formation. Smackover production in the area is associated with a complex fault system masked by approximately 10,000 ft (3,000 m) of younger sediments. A geophysical program combined with geologic studies indicated a faulted, deep-seated east-west-trending anticline. On the basis of this evidence, Cities Service Co. drilled a test well on the structure and discovered the Smackover reservoirs at Bayou Middle Fork field in March 1975.

Core and sample studies made as the field developed showed the Smackover at Bayou Middle Fork field to be a limestone composed mainly of oolites, hardened pellets, pisolites, oncolites, and micrite. This limestone has been divided into three units designated as the Smackover A, B, and C. The general environmental setting that produced these sediments varied from low- to high-energy conditions over a broad, shallow, gradually south-sloping marine shelf. This environmental setting underwent continual minor sea-level fluctuations and structural changes, producing an interfingering and mixing of the various carbonate sediments. One major change occurred as sea level completely receded. The shelf was exposed to supratidal conditions which resulted in the deposition of evaporitic and continental sediments. This regression ended Smackover "C" deposition and produced the Buckner "B" member of the stratigraphic section, which was followed by a partial transgression and subsequent regression resulting in the Smackover "B" and "A" being deposited in an offlap sequence. This second withdrawal of the sea ended Smackover deposition and again produced conditions for accumulation of supratidal and continental sediments.

Porosity preserved within the oolitic rocks is primary intergranular and has been enhanced by leaching of the oolites. Effective porosity varies from a low of 8% to a high of 23.7% and permeability ranges from less than 1 to 270 md. During early development of the field, the porosity and water values from log analysis indicated the possibility of substantial water production. However, as wells were completed, no water was produced; scanning electron microscope and petrographic work revealed the presence of microporosity containing irreducible water.

Smackover production at Bayou Middle Fork field is from three separate reservoirs, the Smackover "C," and upper and lower "A." The lower Smackover "A" reservoir, the largest of the three, contains volatile oil, that through primary production is produced by solution gas drive, with recovery of only 20% of the oil in place. To provide pressure maintenance, a water-drive system was chosen. It is estimated that an additional 20% of the oil in place will be produced by the waterflood program.

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Interpretive Well-Logging Concepts Solve South Texas Formation-Evaluation Problems

Proper selection and application of properly calibrated well logs provides valuable information for exploration, drilling, and reservoir engineering. Interpretive log-derived concepts allow determination of subsurface pressure, temperature, and salinity variations, define the type of depositional environment, and evaluate the production potential of clastic and carbonate reservoir rocks. Overpressure detection and pore-pressure evaluation are of further assistance. Gamma-ray spectral-logging techniques have located permeable and/or fractured reservoir intervals in the Cretaceous carbonate trend (Austin Chalk, Eagle Ford Shale, and Buda Limestone), to determine the source-rock potential of shales, and the type of clay minerals present. A new method allows a reliable log-derived estimate of the cation exchange capacity and hence improved water saturation estimates in shaly, hydrocarbon-bearing clastic reservoir rocks.

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Log Evaluation of "Tight Rocks" of South Texas

South Texas has several productive zones that can be described as "tight rocks"—the relatively low-porosity, low-permeability sandstones of lower Oligocene, Eocene, and Upper Cretaceous Gulfian Series. They include such important producing formation as "Deep