4 mi north of the Arkansas-Louisiana border in Columbia and Lafayette Counties, Arkansas. The trap is provided by the northern limit of a Smackover oolite facies which changes to equivalent Buckner shales and fine-grained limestones. The geologic model proposes that additional bar units, of slightly older geologic age, could be developed farther updip.

A new 7-mi (11 km) seismic line was recorded north-south across the field. Two displays of conventionally processed seismic data define a subtle amplitude feature at the apparent Walker Creek field limits. One seismic display contains data with a 10-55-Hz filter, and a broader band section, containing 0-110-Hz data, certainly adds to the trap definition.

Seislog (trademark of Teknika) inversion of these seismic data and detailed correlation of sonic logs to the Seislog line provide further definition of the facies geometry creating the amplitude feature. Definition of the updip limit of the 100 ft (30 m) of producing Smackover oolite is offered on the inverted seismic traces from 10, 800 ft (3,292 m; 2.1 sec).

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Land Development and Faulting Near Houston, Texas

Once a developer acknowledges the possible presence of faults on his land, he needs to consider such questions as their reality, location and extent, and likely rate and amount of movement. The final answers to these questions commonly must come from the subsurface, where they may be obtained by drilling a series of boreholes, 150 to 500 ft (45 to 150 m) deep. These are logged for electric spontaneous potential, and for resistivity using a single-point electrode to obtain maximum bed resolution and character. The borehole method has the advantages of economy, speed, and reliability; it can be done almost everywhere; and the electric logs provide a permanent, objective record of the strata penetrated. Airphotos, 1-ft (0.3 m) contour-interval topographic maps, and field inspection are useful guides in determining locations for boreholes for maximum efficiency. The subsurface information enhances the accuracy of the surficial methods.

The client's reaction generally depends on whether he is siting an industrial building or developing residential lots. Industrial builders usually are very concerned about exact choice of location, and plan carefully taking the faulting into consideration. However, land developers have a very wide range of reactions, and even the most responsible lack flexibility for much replanning because of prior commitments to major thoroughfares, etc. Although the presence of faults frequently delays full development of a tract, it does not seem to prevent it. Where one operator drops his option because of faulting another (ignorantly?) will come along and build. Also, a few large (but low) buildings have been designed and constructed knowingly over fairly active faults, and certainly many more have been built unknowingly.

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Quaternary Fault Activity in Texas Gulf Coast

Normal faults that offset Quaternary sediments fringing the Gulf of Mexico are best known in the vicinity of Houston, but have been recognized from east of Baton Rouge, Louisiana, to the Mexican border—a distance of nearly 1,100 km. Throughout this large area, scattered faults 1 to 20 km long are active—a term that is here limited to faults whose movements have damaged man-made structures. High-resolution shallow seismic lines across selected faults demonstrate that scarps mapped at the surface represent only the most recent displacements along faults that persist to depths in excess of several hundred meters and show evidence of continued Quaternary movement. Additional data support the general conclusion that observed scarps are the surface expressions of both Tertiary growth faults and faults associated with the intrusion of salt domes.

Current fault activity is probably related to both natural and man-induced factors. Topographic maps based on 1915-16 surveys provide direct proof that some faults had already displaced the land surface before large-scale fluid extraction had significantly altered the stress state within shallow subsurface sediments. This and additional evidence suggest that natural faulting of the land surface was characteristic of the Quaternary history of much of the Gulf Coast, and locally may be continuing. In general, however, natural rates of fault motion are probably so low as to be of little consequence to man. Damage resulting from current fault motion is more likely attributable to widespread extraction of subsurface fluids. Several observations suggest that most offset of the land surface in the heavily pumped Houston area has taken place only within the last few decades: (1) few scarps are evident on early topographic maps; (2) faults are more visible on recent (1970s) aerial photographs than on photographs of comparable scale and quality taken in 1930; and (3) present rates of fault creep are far in excess of average prehistoric rates of land-surface offset.

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Handil Field, East Kalimantan, Indonesia

Handil field is located in the swamp area of the present delta of the Mahakam River in East Kalimantan, Indonesia, in the central part of the Tertiary Kutei basin. The anticlinal feature was found by seismic work in 1973, the discovery well being drilled in April 1974.

An east-west fault perpendicular to the axis of the anticline (10.5 km long, 4.5 km wide) divides the field into two blocks of equivalent area. Areal closure is 35 sq km. Vertical closure increases with depth through the hydrocarbon-bearing section. Most of the 120 reservoir sands between 500 and 2,900 m are tidal to fluvial delta-plain sediments (middle to late Miocene). Most of them are oil bearing with a gas cap. Their types of deposition can be identified as channel fills, offshore bars, etc.

A high pressure zone is encountered below 2,900 m, where deeper prospects remain for investigation. More than 50 significant markers (lignite, carbonate streaks) are used to correlate the sand bodies. Vertically, the field has been divided into six zones corresponding to changes in environmental conditions and/or oil characteristics.

Isobath maps show a displacement to the southwest (approximately 2.5 km) of the top of the anticline from deeper horizons to surface. In the upper and shallow zones, hydrocarbons are found in the south block only, divided into smaller blocks by an east-west fault pattern. Daily production is 160,000 bbl. Cumulative production is 125 million STB (October 1978).

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Grondin Oil Field, Gabon

After deposition of thick Aptian salt while the Atlantic Ocean was opening, the Gabon sedimentary basin was filled with mainly sandy continental and littoral deposits on the eastern margin and marine deposits on the west. The marine formations are mainly shaly, but a few sand layers, some thick, may be intercalated. Grondin oil field is related to one of these sands—the Batanga sandstone of Maestrichtian age. The sandstones are generally clean with good porosity, but some shales are interbedded. Gross thickness may reach more than 150 m.

The trap is an anticlinal salt structure, without noticeable piercing, though a median fault is obvious at the top. The producing sandstone is reduced by an internal unconformity. Nevertheless, the oil field, with a small gas cap, consists of a unique pool with a unique oil-water contact. Source rocks are post-salt marine shales, particularly in the Turonian. Migration probably occurred during the Miocene.

Grondin oil field, situated 40 km offshore, was discovered in 1971 by Elf Gabon and was rapidly developed. The initial recoverable reserves are estimated at 30 million tons (approximately 200 million bbl).

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Great Carbonate Bank of Yucatan and Its Petroleum Potential

Since 1972, numerous large and giant fields have been discovered in Chiapas and Tabasco States, southern Mexico, and in the offshore platform west of Campeche. Most of these fields produce from fore-bank talus, now largely dolomitized, of Late Jurassic and Early to middle Cretaceous ages. Drilling depths to the tops of the reservoirs generally are 3,800 to 4,500 m. Offshore discoveries include fields which also are productive in fore-bank talus of Paleocene age. The petroleum source materials for the Jurassic-Cretaceous fields are believed to be mainly Jurassic. Proved reserves in these new fields are 20 billion bbl.

Although some porosity and permeability are primary, most is secondary—the result of solution, dolomitization, and intense microfracturing. The original trap for the Late Jurassic–middle Cretaceous fields was stratigraphic, but the present traps are fractured, faulted, domal salt pillows created during the Laramide orogeny.

The basis for the discovery of the fields was the widespread presence on the Yucatan Peninsula, and in the states of Campeche, Chiapas, and Tabasco, of Cretaceous through Tertiary back-reef or lagoonal facies—carbonates, anhydrites, and some halite. In addition, more than 200 oil seeps were known in a linear zone along the foot of the Sierra Madre, adjacent to the coastal plain. By analogy with the Golden Lane, it was concluded that a great fore-bank talus deposit should lie gulfward from the lagoonal facies. With this geologic concept in mind, seismic work was commenced, and drilling during 1971-72 led to the dual discoveries of the Cactus and Sitio Grande fields in 1972.

The great carbonate bank of Yucatan is believed to continue northwestward into Veracruz State, where several discoveries have been made in carbonate rocks of Early to middle Cretaceous age in thrust sheets buried beneath the coastal plain. We believe that large, subthrust, anticlinal structures underlie the thrust sheets of the Veracruz basin and that, when drilled, these also may be the sites of giant-field discoveries.

Although the potential for this large area is great, it is too early to speculate on the potential reserves of the numerous but still untested structures of the region.

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Controls on Late Cretaceous–Paleocene Sedimentation in Wyoming

Recent developments in the time-stratigraphic interpretation of seismic record sections have indicated the need for separating tectonic and eustatic processes. The combination of a eustatic rise with a major orogenic episode during the Paleocene in Wyoming resulted in a stratigraphic sequence of economic importance. This sequence was deposited during a period of worldwide onlap, and a period of thrusting and foreland uplift. More than 5,000 ft (1,500 m) of stratigraphic fill of intermontane basins record these processes. Lithologic, environmental, and petrographic observations indicate sea-level changes, strandline positions, paleocurrent patterns, and areas of provenance.

Authigenic glauconite suggests an area of brackish to marine transgression within the "Cannonball sea." Supporting this observation, specific vertebrate faunas indicate that central Wyoming was inundated by the worldwide post-Danian transgressive onlap. Other environmental criteria support the paleogeographic reconstruction of a broad interior sea invading an area of rising uplifts, encroaching thrust plates, and subsiding basins. These boundary conditions provided the framework for the development of commercial hydrocarbon and coal accumulations.

Lacustrine and marine source and reservoir rocks, coastal swamps, and thick subbituminous coals were developed in response to the climatic, tectonic, and eustatic history. These aspects are interpreted from the mineralogy, palynology, petrophysical responses, and the facies patterns in outcrop and subsurface sections.

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