ferent situations of fault entrapment of hydrocarbons in Tertiary sediments of the Gulf Coast salt basin, and (2) the role of juxtaposed sediments in a sandstone-shale sequence in creating sealing and nonsealing faults.

Fault-controlled accumulations in the hydropressured Tertiary section were studied in 10 Gulf Coast fields located on low relief structures. Investigations were limited to traps associated with faults which restrict vertical migration of hydrocarbons, that is, where an accumulation is in contact with the fault. The relations observed among fault, lithology, and accumulation are (1) fault sealing, with hydrocarbon-bearing sandstone in lateral juxtaposition with shale; (2) fault nonsealing to lateral migration, with parts of the same sandstone body juxtaposed within the hydrocarbon column; (3) fault nonsealing to lateral migration, with sandstone bodies of different ages juxtaposed within the hydrocarbon column; and (4) fault sealing, with sandstone bodies of different ages juxtaposed within the hydrocarbon column. In some places these four relations are present at different levels along the same fault.

In the examples studied, faults nonsealing to lateral migration were observed only where parts of the same sandstone body are juxtaposed across a fault. With sandstone bodies of different ages juxtaposed, some faults are sealing and others are nonsealing to lateral migration, but sealing faults are the most common. The fault seal apparently results from the presence of boundary fault-zone material emplaced along the fault by mechanical or chemical processes related directly or indirectly to faulting.

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Ellenburger Group, Delaware Basin, West Texas

The Ellenburger Group in central and west Texas is part of a vast sheet of Lower Ordovician carbonate sediments deposited on the southern edge of the North American craton. In the west Texas area the Ellenburger, a 1,000 to 2,000-ft (300 to 600 m) section of dolomite, is extremely important as an oil and gas reservoir. Since the first discovery in 1928, the Ellenburger has produced more than 500 million bbl of oil in the Permian basin and, more recently, huge gas reserves have been established in the deep Delaware basin.

During deposition of the Ellenburger carbonate sequence, the predominant environment was probably similar to the area of carbonate mud and pelletal carbonate mud deposition on the Great Bahama Bank. Today the Delaware basin section is largely microcrystalline to coarsely crystalline dolomite with many sedimentary structures indicative of shallow-water to supratidal deposition. On the basis of textures, fabrics, and insoluble residues, the Ellenburger Group in the Delaware basin may be divided into three units. Generally, porosity is confined to the middle and lower units and is related to subaerial solution and associated brecciation. Tectonic fracturing, related to late Paleozoic deformation, apparently is responsible for greatly increasing permeability.

Several Ellenburger fields produce up to 50% carbon dioxide with methane. The carbon dioxide content increases in the west and south toward low-salinity formation water.

Ellenburger hydrocarbons probably were derived from the overlying Simpson (Middle Ordovician) shale.

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Sedimentary Subenvironments of Wilkins Peak Member of Green River Formation (Eocene), Wyoming

The Wilkins Peak Member of the Green River Formation is a nonmarine, closed-basin, dolomitic carbonate deposit that intertongues with siliciclastic deposits at the basin edges. A transect from the basin margin to the basin center reveals six major subfacies. (1) The alluvial-fan subfacies is poorly sorted boulder conglomerates, cross-bedded gravels, and horizontally laminated grits and sands. These are interpreted, respectively, as fan-apex incised channels; mid-fan channel-bar deposits; and fan-toe, shallow, braided channels. (2) Sand-flat subfacies consists of wedge-shaped sheets of dolomitic sands extending tens of kilometers into the basin center and changing from "Bouma-like" graded units (20 to 30 cm thick) near the basin edge to horizontally laminated or coarse graded beds (1 to 10 cm thick) toward the basin center. These are interpreted as having been deposited by decelerating sheetfloods. (3) Dry-mud-flat subfacies includes densely mud-cracked and graded dolomitic mudstone laminites and thin beds. These are interpreted as subaerial mud flats in which sheetflooding and in-basin, shallow debris flows were the important depositing mechanisms. (4) Nonsaline-ephemeral-lake subfacies is dolomitic mudstones with laminations composed of pinch-and-swell sand, a thick mud cap, and sparse deep mud cracks. These are interpreted as sporadically exposed, shallow-lake margins or isolated shallow ponds. (5) Perennial-lake subfacies is oil shales or finely laminated dolomitic mudstones that are rarely cracked. These are interpreted as having been deposited in a shallow but persistent lake. (6) Saline-ephemeral-lake subfacies consists of either dolomitic mudstones and oil shales disrupted by intrasediment salt-crystal molds, or massive trona and/or halite beds containing mud partings. These are interpreted as brine-soaked lake and mud-flat deposits, or deposits in very shallow brine pools.

These subfacies occur as asymmetric cyclic sequences 3 to 4 m thick that are interpreted as random sheetflood deposits superimposed on transgressive and regressive beds laid down in a shallow central lake which occasionally dried up. The small-scale lacustrine cyclic sequences probably provide delicate indications of minor climatic changes. These sequences not only provide a facies model for other deposits but also a possible criterion for predicting the large-scale geometry of less well-exposed basins.

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Compaction Effects in Fusulinid Limestone

Of 14 fusulinid genera in the Upper Pennsylvanian–Lower Permian Bird Spring Formation, only *Pseudoschwagerina?* shows evidence of deformation caused by compaction. Most deformation occurred in the outermost whorl; the wall and septa were jumbled, and the whorl collapsed. Only slight fracturing was observed in inner whorls. In places, the outer whorl was completely closed, the shell being flattened on top and bottom. In other specimens, chomata (internal structures) acted as a brace, preventing total flattening. At several places where the shell is particularly badly crushed, another fossil is in surface contact with the fusulinid. As compaction proceeded, grain-to-grain contacts (where stress was localized) changed to those along a surface; strain was realized by brittle failure of the fusulinid. No pressure solution took place. The major compressional stress, oriented normal to bedding, led to horizontal stresses away from the center of each fusulinid; extension cracks and buckling of the wall near the polar ends resulted. Most other fossils and the micrite matrix had sufficient strength to withstand later compaction, in part because of early submarine cementation. However, individuals belonging to this one fusulinid genus were selectively crushed during limestone compaction because of inherent weaknesses in the structural architecture of the shell. *Pseudoschwagerina?* was a large fusulinid with a thick, heavy wall; outer whorls were inflated, making it comparatively hollow. Septa which supported the wall were thin, straight (unfluted), and widely spaced.

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Petroleum Engineering–Geology Synergism: Key to Discovering Large Reserves in Mature Basins

No abstract available.

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Kef Anticline—Box Folding in Tunisian Atlas, Clue to Regional Tectonic Style

Near Le Kef, Tunisia, Triassic gypsum and supratidal carbonates with subordinate terrigenous clastic rocks and metabasites (so-called ophites) form the highly deformed core of a northeast-southwest anticlinal structure. The competent enveloping strata, chiefly massive limestone and marlstone, range in age from Aptian-Albian to early Tertiary. The Triassic rocks are multiply deformed and so dismembered as to be best described as tectonic breccia. The Kef anticline, as well as numerous analogous features in the northern Tunisian Atlas, commonly has been interpreted as a diapiric structure emplaced into the younger cover rocks during the early deformation phases of the Alpine orogeny (i.e., Late Cretaceous to Paleogene) and partly reactivated during the Neogene (late Alpine). Our detailed mapping and structural analysis of the Kef structure suggest modifications of this model involving the following major elements: (1) local or regional unconformity between Triassic and Cretaceous strata, (2) regional decollement gliding in part localized within the Triassic evaporite-rich sequence, and (3) late-phase box folding of both the highly deformed Triassic assemblage and the more competent cover rocks.

The unconformity between Triassic and Cretaceous rocks is preserved only locally, for late brittle faulting along the margins of the anticline and local bedding-plane thrusts between the competent cover and the incompetent core are common. However, where well-preserved, a distinctive bedded sedimentary carbonate breccia overlies the Triassic assemblage. This sedimentary breccia is in turn conformably overlain by Aptian-age rocks and, thereby, indicates major pre-Aptian uplift and erosion prior to the main phase of deformation in the Tunisian Atlas. The nature of this uplift is problematic, but pre-Aptian diapirism is a viable hypothesis. According to this model, diapirism was restricted to pre-Aptian time, whereas compressive buckling and associated lateral shortening are Neogene deformation mechanisms superimposed on earlier halokinesis.

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Geologists and Politics—A Matter of Survival

In 1976, legislation to decontrol natural gas failed by four votes in Congress. In 1978, legislation to permit federal exploration in the Arctic Wildlife Range failed by two votes. Also in 1978, a proposal to consider the Natural Gas Policy Act separately from other parts of the National Energy Plan failed by the vote of 206 to 205. Many times energy legislation is approved or disapproved by very narrow margins.

Geologists, with some notable exceptions, are largely inactive in the political process. What a waste, as no one has greater potential to be effective. No one understands the occurrence, distribution, discovery, and production of oil and gas better than geologists. In the meantime, domestic supplies of oil and gas decline in the face of increasing federal intervention.

AAPG has recognized the necessity for becoming active in politics and has created the Committee of Strategic Affairs. Other geologic organizations are similarly active. A compelling argument can be made that all geologists should mobilize in a massive assault on energy issues in an attempt to arrest the decline. Changing just a few votes in Congress would do the job.

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Radiolaria—Present and Past Indicators of Distance from Shore, Water Depths, Currents, Water Masses, Upwelling, Eutrophy, and Tectonism

Certain living radiolarian species and taxonomic groups identified in plankton tows from North Atlantic, Gulf of Mexico, Caribbean, Pacific, and Antarctic waters are useful biologic indicators of physical oceanographic parameters. Changes in dominance and diversity of these radiolarians may signal: (1) distance from shore or position on shelf; (2) relative depths (e.g., above and below seasonal and permanent thermoclines); (3) direction, strength, and provenance of cur-