proving our basic understanding of barrier-island dynamics.

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Seismic, Stratigraphic, and Economic Analysis of Potential Gas Accumulation, Gulf of Mexico

Study of selective seismic and geologic data in a portion of the offshore Gulf of Mexico indicates that with proper application of new geoseismic techniques, the hydrocarbon (gas) potential of an area may be assessed and a specific reservoir quantified. Various techniques, such as wavelet processing of seismic data, petrophysical analysis of well log data, and calibration methodology are essential to establishing the technical framework for further analysis of a stratigraphic trap. Enhancement and special treatment of these data by various new proprietary techniques, used with sound geologic concepts, permit a more reliable qualitative as well as quantitative interpretation of a potential reservoir.

The geologic meaning of seismic amplitudes and their measurements are important not only to explorationists, but to exploitation geologists and reservoir engineers as well. Experience gained in areas (fields) of known production can lead to expansion of confidence limits into wildcat areas where there is little or no control.

Although the example demonstrated is in the Tertiary clastic section of the Gulf of Mexico, concepts and techniques employed are applicable in any geologic environment, so long as physical principals permit.

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Controls of Sedimentation of Lower Mississippian Waulsortian-Type Mounds of Fort Payne Formation, Northern Tennessee

The Fort Payne Formation (Osagian), which extends from the type section in Alabama to Indiana, has a wide range of carbonate and clastic lithologies. In the subsurface of Scott County, Tennessee, where the Fort Payne currently produces oil and gas, it consists of a carbonate platform and associated Waulsortian mound sequence. This sequence may be divided into two lithologic units: (1) a cherty dolostone with remnant evaporites, and (2) a fossiliferous limestone. Each of the units is divisible into several microfacies.

At the beginning of Fort Payne deposition, an erosional surface existed on the underlying Chattanooga Shale. A transgression brought about intertidal to shallow subtidal conditions. Lithologic unit 1, deposited in sabkhalike condition, was draped over the Chattanooga, thus preserving its topography. Further transgression brought about more nearly normal-marine conditions and colonization of the area by crinoids and bryozoans. They served to baffle and trap fine-grained carbonate material into mud lenses. Multiple lenses coalesced into the Waulsortian-type mounds of lithologic unit 2, up to several kilometers long and 25 m high. Subsequent subaerial exposure resulted in solution and development of secondary porosity in favorable grainstone types. Other early diagenetic effects included partial collapse of the mounds to form fractures during dewatering. Later diagenetic effects included emplacement of petroleum in reservoirs now producing oil and gas.

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Beatrice Field, Moray Firth, North Sea

Beatrice field is located in Block 11/30 in the United Kingdom sector of the North Sea. The field lies just 14 mi (22.4 km) from the Scottish coast. The water depth is 160 ft (49 m). In August 1976, well 11/30-1, the seventh wildcat in the subbasin, discovered oil at about 6,000 ft (1,800 m) in an 831-ft (253 m) gross column, at a time when most companies had written off the inner Moray Firth as a major oil province. The well produced an aggregate of 6,060 BOPD (38° API) with a low GOR. The crude, though light and sweet, has a high wax content (17%) and high pour point (65°F; 18.3°C).

An additional four wells, three productive and one dry, have delineated the 4,271-acre (1,728 ha.) field, in which there are an estimated 476 million bbl of oil in place (162 million bbl recoverable).

The field reservoir is an alluvial to marine Jurassic (Sinemurian-Callovian) sandstone and shale sequence. Stratigraphic markers within the sequence can be related to outcrops fringing the Moray Firth. The oil accumulation is in an elongate, fault-bounded anticlinal trap.

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Seismic Stratigraphy and Geologic History of Campeche Escarpment, Gulf of Mexico

Interpretation of multifold seismic data from the Campeche Escarpment northwest of the Yucatan Peninsula shows geologic features that suggest the sequence of events in the evolution of the Gulf of Mexico. Profiles of the "basement" surface resemble topography typical of subaerial erosion, that is, a pediment surface. An inferred Jurassic salt layer that covers sediments in a downthrown basement block pinches out against the pediment surface. Updip of the salt pinchout and topographically higher are possible Late Jurassic carbonate banks or reefs which onlap the basement erosional surface. A major unconformity separating the carbonate seismic unit from the overlying slope-front-fill unit probably corresponds to a worldwide middle Cretaceous unconformity. Since Late Cretaceous, deep-water turbidites emanating from the east coast of Mexico and northern Gulf Coast have dominated the study area.

The scenario revealed at Campeche Escarpment suggests that an early Mesozoic mantle event (plume?) uplifted this once continental area and caused thinning of the crust to near oceanic thickness. Whether and how much of the Gulf of Mexico is underlain by thinned Paleozoic or Mesozoic continental crust, or true oceanic

crust, is still uncertain. The central gulf and interior basins subsided after this period of crustal thinning. It was in these basins that the Sigsbee and Louann Salt were deposited. Later, as the basin margins subsided farther, carbonate sediments onlapped and covered these margins, marking 5 km of subsidence by the Cretaceous. Since the Cretaceous, clastics have infilled the northwestern Gulf, causing an additional 3 km of subsidence of the gulf basin, while the central Florida and Yucatan platforms have stabilized above sea level.

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Reservoir Quality in Tertiary Sandstones along Texas Gulf Coast

Three data bases were developed for a regional survey of reservoir quality in Tertiary sandstones along the Texas Gulf Coast.

1. Core analyses from 252 wells (10,900 datum points) are the basis of plots which indicate that porosity and permeability do not simply decrease with depth but commonly increase at depth by development of secondary leached porosity.

2. Point count analyses of 535 thin sections from 169 wells for mineralogy, diagenetic features, and porosity types indicate, within formations, regional mineralogic trends that affect reservoir quality, especially at depth. The average Tertiary sandstone is a moderately sorted, very fine-grained quartzose lithic arkose. Each Tertiary formation shows a similar general diagenetic history; primary porosity is dominant in the shallow subsurface, and secondary leached porosity is dominant in the moderate and deep subsurface.

3. Plots of interval transit time versus depth for 87 acoustic logs indicate general compaction and consolidation histories of complete stratigraphic sections, and they are useful for comparing compaction and consolidation histories among different areas. Both the Wilcox and Frio trends exhibit a general pattern of more rapid compaction and greater degree of consolidation in the lower Texas Gulf Coast than in the upper Texas Gulf Coast.

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Porosity in Giant Gas Field, Ellenburger Formation, Puckett Field, Pecos County, Texas

The Lower Ordovician Puckett field has produced nearly 2.5 Tcf of gas from the Ellenburger Dolomite since the discovery of the field in 1952 by Phillips Petroleum Co. Production is from a depth interval of approximately 12,000 to 15,000 ft (3,600 to 4,500 m), and the estimated ultimate recovery is 3.3 Tcf.

The Ellenburger facies are interpreted to have been deposited in several major environmental settings—subtidal, intertidal-channel belt, and supratidal. Subtidal deposition is represented by burrowed, irregularly laminated mudstones and wackestones and by oolitic grainstones. In the intertidal-channel belt, intraclastic packstones and stromatolitic boundstones accumulated. Laminated mudstones and algal-laminated mudstones were deposited on the supratidal flats in which desiccation produced mud cracks and thin layers of flat-pebble conglomerates. During Ellenburger sedimentation there were many periods of subaerial exposure which resulted in formation of soil zones and karst terranes as deep as 20 ft (6 m). Solution collapse produced thick brecciated zones.

Maximum porosity in the reservoir is 12% and the greatest permeability is 117 md. Porosity originated dominantly from tectonic and karst fractures and karst vugs. The generally low porosity is locally enhanced by intercrystalline, moldic, and interparticle porosity. The greatest porosity and permeability is commonly in the facies of the supratidal and intertidal environments most affected by tectonic fractures and by soil and karst development.

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Error in X-Ray Diffraction Estimates of Dolomite in Carbonate Rocks—Causes and Cures

Three independent errors affect X-ray diffraction estimates of dolomite in pre-Cenozoic carbonate rocks. If calcite:dolomite main-peak [104] ratios are used, each 1% of excess calcium in the dolomite lattice causes a 2% overestimate of the amount of dolomite. Use of the second-intensity [113] ratios avoids the stoichimetry problem, but the [102] quartz peak (2.282A) interferes with the [113] calcite peak (2.282A). Where more than 20% quartz is present, the dolomite proportion in the sample may be seriously underestimated. The third source of error is due to difference between the crystallite size in the standards used to prepare the calibration curves and the crystallite size in the sample unknowns. These three errors can be avoided or corrected; however, point count of stained thin sections, a simple reliable technique, is preferable for analysis in most cemented carbonate rocks.

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Upper Devonian Turbidites of Central and Southern Appalachian Basin—A Prodeltaic Clastic Ramp?

The Brallier Formation (Upper Devonian) of the central Valley and Ridge province is a thick (600 to 900 m) regressive sequence of distal to proximal turbidites composed of interbedded siltstones, olive-gray mudstones and shales, and organic-rich black shales. This sequence is transitional westward to the thinner, distal, Devonian black shale facies. Regional and vertical patterns in sedimentologic features differ from those of most models for turbidite sedimentation.

The uniformity of turbidite bed thickness, implying a triggering mechanism of uniform intensity, and the absence of slump structures in the proximal facies suggest that turbidity currents were initiated by means other than localized mass movement. Storm surges or high river discharges are more likely mechanisms.

The Brallier depositional sequence differs significantly from existing submarine-canyon–fan models in