the natural relationship of many associated trace fossils.

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Hydrocarbon Exploration in Western Oregon and Washington

Recent discovery and successful development of a gas field near Mist, Oregon, have conclusively demonstrated the presence of commercial quantities of hydrocarbons in western Oregon and Washington. Understanding of the source and reservoir facies of this discovery may help develop additional exploration targets.

Reservoir sandstones of the Mist area occur in the Cowlitz Formation of middle Eocene age (Narizian Foraminifera Stage). The Cowlitz Formation of northwest Oregon and southwest Washington consists of nearshore-marine and brackish-water deposits of massive arkosic sandstone, shale, subbituminous coal, and interbedded basalt. It was deposited as part of a broad marine-deltaic system that extended from southern Oregon to northern Washington during middle Eocene time.

The feldspathic-quartzose sandstone of the Cowlitz Formation has porosities ranging from 14 to 41%, averaging approximately 25%. Permeabilities range from 46 to 8,500 md, averaging approximately 200 md.

Marine shale outcrops of the Cowlitz Formation in Washington contain dominantly terrestrially derived organic matter and have total organic carbon content averaging approximately 0.75%. Vitrinite reflectance values average approximately 0.45% for rocks inferred to have been buried to a depth of approximately 10,000 ft (3,000 m).

Traps, including the Mist gas field, appear to be structural-stratigraphic with reservoir sandstones thinning against plunging basement noses. These traps are complex and masked beneath several unconformities, underscoring the importance of geophysical exploration.

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Tectonics of Monterrey Salient, Sierra Madre Oriental, Northeastern Mexico

The Monterrey Salient formed as a result of uplift in the Mesa Central of Mexico and consequent gravitational sliding of the detached cover to the northeast during the Laramide orogeny. The salient is located south of Monterrey where the Sierra Madre Oriental orogenic belt arcs abruptly from an east-west to a north-south direction. It is composed of a series of arced, doubly plunging, en echelon anticlines, most of which are overturned to the north. Exposed in the area are Upper Jurassic carbonates and terrigenous rocks, and Lower Cretaceous carbonates. The salient also contains a few outcrops of Upper Jurassic evaporites which have flowed to the surface along fault planes. These evaporites, recognized as the Minas Viejas Group, are believed to be the decollement above which the deformation occurred.

A crustal shortening of 50% is calculated in the Monterrey Salient. Most of the shortening is attributed to folding, in as much as surprisingly few major thrust faults have been observed. Field work also demonstrates that structural trends are directly related to buttressing effects of paleohighs and thick sedimentary basins. On the basis of these structural trends and recent stratigraphic studies, the Mesozoic Coahuila peninsula is found to extend in the subsurface farther to the south than has previously been assumed.

Both the stratigraphy and structural style make the Monterrey Salient a classic example of a gravity-induced orogenic belt.

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Evolution of a Fore-Arc Basin, Luzon, Philippines

The Tertiary Central Valley of Luzon is a remarkably well-exposed fore-arc basin, with both the trenchward and arc flanks uplifted and dissected. A study of outcrop geology, drilling results, and seismic reflection records determined the changing geometry of the basin through time, facies distributions, sediment-distribution patterns, and hydrocarbon potential for the basin. The uplifted western flank exposes an ophiolite sequence, pelagic deposits, and deep-sea to shallow-marine clastics that document the emplacement and uplift of the seaward side of the basin. The eastern flank shows nonmarine and shallow-marine volcaniclastic aprons shed off the arc, overlain by reefs, shallow-water clastics, and a progressively deepening slope/basin turbidite sequence.

Basin geometries and detrital mineralogy suggest that the Central Valley formed as an elongate geomorphic feature in the middle Miocene and progressively subsided and filled into Pliocene time. Over 35,000 ft (10,668 m) of sediment accumulated prior to a westward jump of the fore-arc basin to a site nearer to the Manila Trench. The positions of shelf/slope boundaries and prograding deltas can be documented from seismic-stratigraphic analysis. The history of basin formation and relative positions of possible source and reservoir rocks suggest that the Central Valley has undiscovered hydrocarbon potential.

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Destin Dome and Western Florida Shelf

The U.S.G.S. has acquired a network of 1,280 km (800 mi) of common-depth-point seismic data connecting eight wildcat wells north of the latitude of Tampa and tied to the Destin dome area in the northeastern Gulf of Mexico. Line layout facilitates ties to onshore and offshore wells and to the regional multichannel net of the University of Texas. These lines reveal the structural growth of the salt-related Destin dome and a salt pillow with Jurassic and Early Cretaceous growth 30 km (20 mi) south of the Destin structure. Elsewhere in the West Florida Shelf, numerous low relief anticlines are present above basement highs.

Destin dome is a large, west-northwest trending anticlinal structure off northwest Florida. The dome is more than 80 km (50 mi) long and 30 km (20 mi) wide and has relief of a kilometer (3,000 ft) on Lower Cretaceous rocks. The dome appears to be the result of a salt swell that was uplifted during the Late Cretaceous and early Cenozoic. In 1973, 32 tracts (184,320 acres) constituting the eastern half of this structure were leased for $728,000,000. The highest bid lease (near the crest of the anticline) was purchased for $211,997,600 ($36,805/acre). Leases were not offered on the western half of the dome as it lies within a bombing range administered by the U.S. Department of Defense. Structural crests of Lower