shore marine (delta-front and inner-shelf) sandstones disconformably overlain by crossbedded (active) to deformed (abandoned) distributary-channel sandstones and conglomerates. The sequence is capped by delta-plain mudstones and silty sandstones.

Tight-gas sandstone reservoir facies are nonhomogenous and include crevasse splay, abandoned and active distributary channel, shoreface, foreshore, and inner shelf sandstones. Distributary-channel facies represent 80% of perforated intervals in wells in the southern part of the Moxa area, but only 50% to the north. Channel sandstone bodies are occasionally stacked, occur on the same stratigraphic horizon, and are laterally discontinuous with numerous permeability barriers. Percentage of perforated intervals in upper shoreface and foreshore facies increases from 20% in the south to 50% in the north. These sandstones thicken to the north and east and are more laterally continuous than channel facies. The lower Frontier contains strike-oriented shoreface (delta front) and dip-oriented distributary channel sand bodies in approximately equivalent amounts. Delta-plain mudstones thin to the north and east and are an important stratigraphic seal. Highest gas production rates are from distributary-channel sandstones closer to the axis of Moxa arch. However, there appears to be little correlation between the thickness of any reservoir facies and net production.

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Geology and Major Oil Plays, Coastal Margin Basins, Brazil

Six major tectonic-depositional sequences, reflecting rift and passive margin evolution, variously characterize the filling of Brazilian coastal margin basins: (1) Late Jurassic prerift, (2) Early Cretaceous tectonic rift, (3) Early Cretaceous quiescent stage (evaporitic or calcilutitic), (4) middle Cretaceous initial drift carbonate platform, (5) Late Cretaceous platform/deltaic progradational and deep marine retrogradation, and (6) Tertiary main passive margin progradation.

Habitat of oil discovered to date meets two regional geologic conditions: (1) in tectonic rifts known to have basin core of starved, lacustrine shales, and (2) in basins which developed a quiescent phase during the transition from tectonic rift to passive margin.

Two major plays characterize the central core rifts, including (I) underlying prerift sediments in fault contact with the central core, and (II) sublacustrine fans overlying the central core. These plays, typified in the Recôncavo basin, constitute about half the recoverable oil found to date.

A structurally related variation of type II play and a third regional play exist where the quiescent condition occurred, including reservoirs of the rift below evaporitic or calcilutitic regional seals and carbonate platform and turbidite reservoirs in the passive margin above the quiescent episode. The subevaporitic-calcilutitic subplay is prominent where overlying regional seals are structurally unmodified, contains about 15% of the discovered oil, and has typical development in the Sergipe (evaporitic) and Potiguar (calcilutitic) basins. Where regional seals of the quiescent phase have been mobilized, structurally modified, or cut by subsequent submarine canyons, carbonate platform and turbidite reservoirs of the overlying passive-margin fills are the prominent play (type III). This play, with typical development in Campos basin, in Mosqueiro low in Sergipe basin, and onshore Espirito Santo basin accounts for 35% of the discovered oil.

Exploration implications of the established plays are: (1) source is from tectonic or quiescent stage fill (Aptian or older); (2) structural integrity of the quiescent stage seals is critical to oil migration; and (3) tectonic rifts are productive when a core of deep lacustrine shales was developed.

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Diagenetic Relationships and Hydrocarbon Resource Implications, Nanushuk Group and Torok/Topagoruk Formation, National Petroleum Reserve, Alaska

Petrographic, X-ray diffraction, and scanning electron microscope investigations of Nanushuk Group and Torok/Topagoruk formation (Brookian) sandstones and siltstones from 9 wells in the National Petroleum Reserve in Alaska resulted in recognition of features of interest regarding the diagenetic development of these rocks. Several kinds of labile materials are present, and secondary dissolution porosity has been developed to various degrees. Mineralogic, geochemical, and textural characteristics indicate the potential for development of appreciable porosity of this type in equivalent horizons and/or similar materials within the northern Alaska Cretaceous basin.

Known regional geologic, geochemical, and geophysical relationships are consistent with this view. Considerations of hydrocarbon resource potential should include concern for these relationships as integral to appreciation of the overall diagenetic evolution of the region.

Heretofore, the potential for the occurrence of significant reservoir rocks in these horizons has been considered to be rather low, based on primary petrologic characteristics. However, this should be reappraised in light of increased knowledge and understanding of the principles and realities regarding diagenetic events, inorganic and organic, including secondary porosity development, clay mineral relationships, and maturation of organic material.

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Late Cenozoic Pull-Apart Graben Development, Big Bend Region, Texas

The Big Bend region is a giant rhomb-shaped structure with the Presidio (west) and Black Gap (east) pull-apart grabens marking the north-northwest-trending ends and the north and south branches of the Texas lineament (TL) marking its west-northwest-trending strike-slip ends. This large rhomb is broken internally by many faults (west, west-northwest, and north-northwest trends) that have generated numerous small to large pull-apart grabens.

Black Gap graben is divided into segments by west-northwest faults that drop each segment deeper (250-1,050 m, 820-3,450 ft, structural relief) and southeastward in the United States part. The continuation into Mexico has not been studied.

Presidio graben also has a complex bounding fault pattern of north-northwest-, west-northwest-, and west-trending segments. Depth of the graben in unknown, although outcrop and well data give a minimum of 800 m (2,600 ft). The internal shape is poorly known because of widespread pediment gravel cover.

The Presidio and Black Gap grabens are the southeastern continuation of the Rio Grande graben system that terminates southward against the north-branch of the TL (that extends from El Paso to Valentine Black Gap across Texas). The south-branch of TL extends east-southeast from near Presidio across Mexico to the Gulf of Mexico near the mouth of the Rio Grande.

Right slip along the west-northwest trends is demonstrated in the Sierra del Carmen by slickensides and by a first-motion study of the Valentine earthquake. Strike-slip displacement is presumably modest across the region (under 10 km, 6 mi, ?), but actual slips are indeterminate with the present data set.

The Presidio graben lies along the eastern boundary of the Laramide Chihuahua overthrust belt. The Black Gap graben lies along the eastern boundary of the Laramide Rocky Mountain front.

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Magnetotelluric Sounding Method as Applied in Ouachita Thrust Belt, Central Texas: A Case History

A 25-station magnetotelluric (MT) traverse across central Texas has been recorded and analyzed. The 84 line-mi (135 line-km), northwest-southeast-trending traverse begins 13 mi (21 km) southeast of Lampasas and ends 6 mi (10 km) north-northeast of Lexington, Texas. Geologic elements crossed are the Ouachita foreland facies, frontal and interior zones, and the rimming gravity high described by Flawn et al, Nicholas and Rozendal, and others.

Interpretation of the MT data, supported by 1- and 2-dimensional modeling, borehole data, and previously published gravity data, suggests northwest transport on the order of 22 mi (35 km) for the allochthonous Ouachita frontal zone.

A shallow resistive zone in the Precambrian and the overlying autochthonous Ouachita foreland facies is traced southeast 46 mi (74 km) from the sites nearest Lampasas, but become indeterminate north of Taylor, Texas. Data from the Shell 1 Purcell (Williamson County) suggest the