Pennsylvanian and Wolfcampian kerogen is yellow-orange to orange, suggesting that temperatures were high enough to begin to generate hydrocarbons from lipid-rich amorphous organic material. Palo Duro basin samples have a broad range of vitrinite reflectance values, but populations with the lowest reflectance probably indicate the true temperatures that were reached in the basin. The average reflectance in representative Pennsylvanian vitrinite is 0.52%; in Wolfcampian samples the average reflectance is 0.48%. These values are consistent with the kerogen color and suggest that basinal source rocks may have begun to generate hydrocarbons.

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Plate Tectonics of Permian Basin

The recorded plate history in the Permian basin began in Early Cambrian time. The area was uplifted and eroded over one of a line of mantle plumes that extended across the southern North American plate. Rift-rift-rift triple junctions formed over these hot spots and sea-floor spreading led to plate separation.

As the new ocean opened up to the south, the craton cooled and the sedimentation in the lower and middle Paleozoic was controlled by cooling.

In Pennsylvanian time, the North American plate probably came temporarily to rest over a hot spot located under the Tabosa basin. Thermal doming occurred and the Delaware-Val Verde-Marfa triple junction was formed. By the close of the Pennsylvanian, a large part of the dome was elevated above sea level. Thermal activity waned, or the plate resumed its movement again before new oceanic crust formed and all three basins became failed arms or aulacogens.

Intracrustal melting and intrusion accompanied the period of high heat flow; individual oil-producing anticlinoria are upwarps over intrusives. Optimum conditions for generation and migration of hydrocarbons accompanied this time of high heat flow.

On the south, ocean closing occurred along a subduction zone with the suturing reflected by the Marathon-Ouachita overthrust belt. There is little reflection of this collision in the tectonic history of the Delaware and Val Verde basins, but much of the basin fill was from this southerly source.

Cooling and contraction controlled the sedimentary and structural history throughout the remainder of the Permian.

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Tertiary Volcanic Centers as Constraints on Oil and Gas Potential of Basin and Range Province: New Mexico Segment of Pedregosa Basin

Stratigraphic similarities with the Permian basin and structural similarities with the Overthrust belt make the New Mexico segment of the Pedregosa basin an attractive target for petroleum exploration. Middle Tertiary volcanic cover and postvolcanic faults introduce constraints, as elsewhere in the Basin and Range province.

Geologic mapping in southwesternmost New Mexico (Hidalgo County) has traced Oligocene ash-flow tuff sheets to at least nine major cauldrons, including Valles-type resurgent cauldrons 10 to 40 km wide (Apache Hills: Apache cauldron; southern Pyramid Mountains: Muir cauldron; southern Animas Mountains: Tullous, Juniper, Animas Peak, Cowboy Rim, San Luis cauldrons; southern Peloncillo Mountains: Rodeo and Geronimo Trail cauldrons). Faulted-off cauldron segments continue beneath the Playas, Animas-San Luis, and San Simon-San Bernadino Valleys.

Composite batholiths probably underlie cauldron clusters, as in the San Juan and Mogollon-Datil volcanic fields. Exposed monzonitic plutons (Apache Hills, Pyramid Mountains, Animas Mountains) are apophyses, emplaced during resurgence. Other plutons, apparently unrelated to cauldrons, are present in the northern Pyramid and Little Hatchet Mountains. Distribution of cauldrons and plutons suggests that much of the Pyramid, Peloncillo, Little Hatchet, and Animas Mountains, Apache Hills, and adjacent valleys are unfavorable for petroleum accumulations. However, destructive thermal effects may be confined to aureoles extending only about 1,000 m from intrusive contacts, as in the KCM 1 Forest Federal wildcat. Cauldrons and thermal effects deleterious to petroleum potential are unknown in southeastern Hidalgo County (Dog, Alamo Hueco, Big Hatchet Mountains, southern Sierra Rica).

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Depositional Environments, History, and Biostratigraphy of Upper Albian Rocks, Trans-Pecos Texas

Upper Albian rocks in Brewster, Presidio, Jeff Davis, Reeves, and Pecos Counties, Texas, between the *Adkinsites brazoensis* and *Pleisioturrilites brazoensis* zones are divided into 10 lithofacies and associated depositional environments. These lithofacies represent deposition in environments ranging from nearshore high-energy carbonate and quartz sands, to offshore high-energy carbonate shoals and rudistid banks, to medium- to low-energy offshore shales and biomicrites, to deeper water low-energy micrites. All or parts of the Benevides, Loma Plata, Sue Peaks, Santa Elena, Boracho, Fort Terrett and Fort Lancaster Formations are included in this study.

The wide variety of lithofacies present reflects variations in local source areas, depositional slope, source area and basin stability, and paleogeography. Distribution and thickness of lithofacies during the late Albian indicate that the Glass Mountains area and Diablo platform were structural highs separated by a shelf basin which occupied the position of the Paleozoic Hovey channel. The northern part of the area was a gently sloping shallow-water shelf; the southern part was the northern edge of the Chihuahua trough. The use of ammonite zones to trace lithofacies and depositional environments through space and time shows an initial transgressive followed by a lesser regressive sequence. The overall effect of late Albian deposition was transgressive.

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Genetic Stratigraphy of Uranium Host Facies, Tordilla Sandstone Member, Upper Jackson Group, Panna Maria, Texas

Uranium mineralization in the Panna Maria, Texas, area occurs in the Tordilla Sandstone Member of the Eocene upper Jackson Whitsett Formation on the reduced side of a linear alteration front that extends more than 3 mi (5 km) along strike. Two open-pit mines at Panna Maria expose parts of a strike-oriented sand belt associated with a barrier island-tidal inlet system.

The east pit exposes (1) a tidal inlet-embayment entrance, overlain by (2) tidal-channel, and (3) tidal-flat facies. The inlet facies, the uranium host, is dominantly fine to very fine sand