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GL03686

First order, single dependency Markov chain analysis of cross-set to cross-set changes in indicated current direction reveals a weak memory effect, i.e. the orientation of each foreset is partially dependent on that of the immediately underlying cross-set. This has implications for the preservation potential of sedimentary structures and the general braided stream model, for it tends to counter commonly held assumptions regarding the ephemeral nature of braid bars and their random preservation in the geological record.

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MIOCENE DELTAIC OIL HABITAT, TRINIDAD

The island of Trinidad is located on the north flank of the Eastern Venezuela Tertiary basin. The structure and stratigraphy of Trinidad are similar to and continuous with Eastern Venezuela.

The primary objectives for oil exploration in Trinidad are middle and upper Miocene deltaic sandstones. Hydrocarbon source rocks for these reservoirs are the underlying deep marine shales of Paleocene through lower Miocene age. Overlying Pliocene and Pleistocene sediments are primarily continental clastics.

A proto-Orinoco delta system was present during Miocene time and prograded over Trinidad and the adjacent offshore areas. Isopach, seismic isochron, and facies studies have established the location of the delta depocenter offshore of the southern and eastern coasts. Rapid thinning of the deltaic units is evident north of the depocenter, where the Miocene section is thin and lacking in sands.

Four structural provinces have been recognized in Trinidad: (1) the Northern High province, characterized by a shallow, complexly faulted basement, (2) the Diapiric Fold province, an east to northeast-trending zone of diapiric shale anticlines coincident with the Miocene delta front, (3) the Block Fault province characterized by north-northwest-trending growth faults coincident with the deltaic depocenter, and (4) the Monoclinial province, an area of regional north dip and sedimentary thickening from the Guayana shield into the deltaic depocenter.

Oil production is associated with the diapiric anticlines at the Miocene delta front. Gas production has been established from the north-northwest-trending fault block structures in the Miocene deltaic depocenter. No significant production has been developed to date in the Northern High or Monoclinial provinces.

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THE APPLICATION OF TREND SURFACE ANALYSIS TO GEOTHERMAL AND GEOPRESSURE DATA IN PETROLEUM EXPLORATION

Trend surface analysis provides a means for quickly and automatically mapping broad regional gradients for subsurface basin studies, and it provides an easy method of extracting the local components or variations from a regional distribution of geological information. The application of this technique lends itself readily to the investigative study of the subsurface geothermal and geopressure distribution patterns within the potentially productive section of the lower Tertiary system in the Uinta Basin, Utah.

Second order trend surface maps express the regional distribution of the temperatures recorded at the top of the lower Tertiary pay zones and the maximum shut-in pressures recorded within these pay zones. The higher temperatures and the higher pressures parallel the axial trend of the basin but are displaced southward coinciding with the hydrocarbon producing trends within the basin. Second-order residual maps which represent local temperature anomalies and geopressure anomalies closely relate to the occurrence of productive hydrocarbons within the lower Tertiary. Residual right-angle trends to the regional trend can be detected in the orientation of both the temperature and pressure anomalies. Higher order polynomial studies made on these data more clearly delineate the right angle trends which relate significantly with similar patterns in the varying productivity of the producing zones within the Bluebell-Altamont trend in the lower Tertiary.

A direct relationship has been documented between the occurrence of productive hydrocarbons within the lower Tertiary pay zones and the simultaneous occurrences of high geotemperatures, abnormally high pressures, and an organic-rich lacustrine facies. These relationships are currently being investigated as a potential tool for the exploration of stratigraphic traps in Tertiary basins.