ABSTRACTS

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Petroleum Geology of Senonian Sediments in Anambra Syncline, Southeastern Nigeria

More than 2,500 m of predominantly terrigenous Senonian sediments have been penetrated in the Anambra Syncline. These sediments define three cycles of fluviodeltaic and shelf units, namely the Awgu Shale–Agbani Sandstone cycle, the Ogugu Shale–Owelle Sandstone cycle and the Nkporo Shale–Mamu–Ajali–Nsukka cycle. This depositional mechanism has resulted in successive alternations of potential source, seal, and reservoir units propitious for petroleum generation and accumulation. Potential source and seal beds are better developed for the Agbani and Owelle sandstones.

Total organic content (TOC) ranges between 0.22 and 4.16%, soluble organic matter (SOM) between 84 and 1,850 ppm, and saturated hydrocarbon (SHC) between 9 and 240 ppm in the Senonian shale units. Awgu and Nkporo shales appear to have the better source-rock characteristics.

Senonian sandstones in the basin are predominantly mature quartzarenites but lose porosity drastically with depth due to cementation by calcite, chert, and quartz overgrowth. The coarser grained, probably fluviatile sandstone facies have a dominant quartz cement and are generally more porous than the finer grained, probably deltaic sandstones cemented predominantly by calcite and chert.

Both diastrophic and synsedimentary, non-diastrophic structures abound in the Senonian sections here. These and possible stratigraphic pinch-outs in the sandstone units constitute potential entrapment features. However, successful exploration in the hitherto unproductive Upper Cretaceous units here will require a careful integration of structural, stratigraphic, geochemical, and diagenetic analysis.

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Petroleum Accumulation Trends in East Texas Salt Dome Area

Three main genetically related classes of salt domes can be recognized relative to the regional structures in the East Texas basin—anticlinal, synclinal, and flank domes. The anticlinal domes are deep seated while the synclinal and flank domes occur at shallow and intermediate depths. High dome maturity and associated flank bed configurations were achieved in the synclinal domes such as Hainesville and Bethel, only partly achieved in some flank domes such as Grand Saline, while other flank domes such as Keechi and presumably the anticlinal domes are immature.

The largest oil and gas accumulations in the east Texas dome region occur in crestal anticlines of the deep-seated anticlinal domes. The shallow domes on the regional flanks and synclines have all been nonproductive from their crestal anticlines probably because they do not uplift adequate sedimentary sections. The synclinal and flank domes therefore appear to have poor potentials except for entrapment beneath overhangs and porosity pinch-outs on the flanks when the evolution of the domes promotes these features. Patchy carbonate porosity and sandstone pinch-outs may develop around elevated dome flanks during the immature earlier history of the mature synclinal domes and throughout the history of the immature flank and anticlinal domes. Salt overhangs appear to be better developed in the more mature domes.

This model highlights the potential targets around salt domes in east Texas and can be used to reevaluate both the producing and nonproducing domes in the basin. The genetic basis for the model also underscores its applicability in other halokinetic basins.

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Early Cretaceous Arc Sedimentation and Volcanism in Coastal Ranges, Central Peru

The late Valanginian Pucusana Formation in central Peru consists of more than 800 m of pyroclastic breccias, lapillistones, tuffs, and interbedded flows of intermediate to basic composition. Minor amounts of limestone, marl, and laminated gypsum occur toward the top of the formation. This unit records the construction and lateral facies relations of a single arc vent and its stratovolcano cone.

Field evidence indicates volcanism under subaerial to subaqueous conditions. Four facies in the formation represent different processes and environments of deposition. Facies A is non-welded structureless pyroclastic debris up to 50 cm in diameter. The largest size of the clasts was controlled not only by the distance from the volcanic vent but also by differences in the eruption style. The lack of welding is indicative of emplacement of these breccias in a cool state, probably by air fall and debris flowage very close to volcanic vent. Facies B consists of massive pyroclastic breccias in units showing reverse grading and matrix support. The material was deposited by debris flows originating on the flanks of the volcano. Facies C includes well-stratified lapilli and pyroclastic debris, generally less than 6 cm in diameter, deposited subaqueously around the volcano by high-density turbidity currents. Facies D consists of well-stratified fine-grained tuff and granule to pebble breccia deposited by relatively diluted turbidity currents. Near the top of the section, there are some interbedded fossiliferous and oolitic limestones and laminated gypsum representing a more distal marine facies. These facies document lateral changes from proximal subaerial to distal subaqueous conditions and a secular decrease in the rate of volcanic activity.

Modal analysis indicates a relatively homogeneous composition of an intermediate calc-alkaline magma. The volcanic source was apparently related to Cretaceous subduction beneath western South America. This sequence provides an excellent example of vent-to-basin facies in an arc setting.

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Evaluation of Temperate Zone Coastal-Marsh Sediments as Hydrocarbon Source Beds