Biogenic and Nonbiogenic Ore-Forming Processes in South Texas Uranium District, Panna Maria Deposit

Geochemical and petrographic studies of core samples from the Panna Maria uranium deposit, a roll-type orebody in the Jackson Group (Eocene) in Karnes County, Texas, yield important constraints on the origin of the deposit. Organic carbon content averages about 0.42 wt. % in reduced rock and correlates positively with sulfur content. Pyrite is the dominant iron disulfide (FeS_2) mineral in most of the ore zone and throughout a surrounding zone of reduced barren ground and is commonly associated with organic debris. Marcasite is sparse except in ore adjacent to the altered tongue in one core and locally in mineralized lignite. Sulfur isotopic compositions ($\delta^{34}S$) of FeS_2 minerals range broadly from -1 to -34 per mil; the lightest $\delta^{34}S$ values (less than -20 per mil) were measured in samples from mineralized lignite and from the nose of the ore roll. Petrographic and geochemical characteristics of the Panna Maria deposit contrast greatly with those of three other south Texas roll-type uranium deposits (the Benavides, Felder, and Lamprecht deposits), which are devoid of organic carbon and which contain more sulfide than does the Panna Maria. These three deposits are characterized by abundant isotopically light ore-stage marcasite and by isotopically heavy pre-ore (in the Benavides) or post-ore (in the Felder and Lamprecht) pyrite. We concluded in earlier reports that sulfide-bearing fault-leaked solutions from underlying hydrocarbon accumulations were important in the formation of the Benavides, Felder, and Lamprecht deposits. Although the Panna Maria deposit shows an apparent alignment along a fault zone, and although underlying formations in the Karnes County area contain sour gas $\delta^{34}S) \simeq +14$ per mil) and produce oil, the deposit lacks characteristics indicating that its formation and/or preservation involved extrinsically derived reductants such as fault-leaked hydrogen sulfide. Mineralization of the Panna Maria, rather, appears to have been controlled by intrinsically derived reductants related either directly or indirectly to the presence of organic matter.

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Structure and Salt Tectonics of Northwest Gulf of Mexico Banks

Members of the Oceanography Department at Texas A&M University have conducted extensive geologic and geophysical surveys across the shelf-edge banks off Texas and Louisiana in the northern Gulf of Mexico. These prominent topographic features are the surface expression of isolated salt diapiric structures, in places capped by carbonate sediments and reefal communities. There is great variability in the details of their physiography and structure. However, analysis of the geophysical data indicates that the banks may be classified into three main structural types: (1) rectangular, fault-controlled, uplifted blocks of sedimentary strata; (2) circular domes modified by faulting more or less parallel with the shelf edge; and (3) circular domes with radial and/or annular fault patterns. The majority of the banks, particularly types two and three, show some evidence of collapse, probably a result of dissolution of salt. Based on the variety and regional setting of the observed structures, evolutionary models have been developed. Ubiquitous local topographic trends associated with the banks occur along the shelf edge and upper slope. They strike roughly northwest-southeast and may reflect structures formed during the early tectonic history of the Gulf of Mexico.

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Interactive Color Display and Analysis—Added Dimension to Seismic Interpretation

Interactive color video display systems provide a new dimension to the analysis of seismic data. Subtle concurrent changes in multiple seismic parameters such as reflection strength, velocity, frequency, and structure can be assimilated more effectively with the aid of interactive color technology. We examine here two typical interpretation problems—bright spots and 3-D data—and illustrate the use of interactive color display and analysis in formulating a solution. The successful analysis of hydrocarbon indicators relies on both the ability to measure the auxiliary effects that hydrocarbon indicators have on seismic data and to display these effects in a form that is visible to the interpreter. If the interpreter can view an optimum combination of subtle changes in these parameters, his ability to predict both the lateral extent of the reservoir and the amount of gas saturation can be substantially improved.

One way to display simultaneous variation in several seismic parameters is through the use of an interactive color imaging system. After digital displays of the seismic reflection data variables are input, color assignments are made interactively among the seismic variables and the primary colors. This process can vary from a simple assignment of a primary color for each variable to a more complex analysis technique that dynamically assigns proportions of the seismic variables to all colors. Unlike some approaches that "color" a single parameter to better illustrate its dynamic range, the methods described here use color to illustrate the simultaneous changes in all variables. These video imagery systems provide flexible, high-resolution displays that can cope visually with large volumes of data that are typical for 3-D surveys. It allows the interpreter to perform a variety of instant, on-the-spot enhancement techniques. Thus, the technology significantly minimizes some of the problems in dealing with 3-D data. Typical vertical sections or horizontal time-slice displays from a cube of 3-D data can be shown in a variable intensity mode. The horizontal Seiscut displays can be viewed in a flexible and easily controlled movie fashion or overlaid in color to enhance delineation of structural features. When the multiple parameter technique is employed on the Seiscut display, it produces an "instant geologic map." Each lithologic unit boundary can be distinguished by its unique color pattern.

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Tectonic Control on Deposition of Frontier Formation (Upper Cretaceous), Northeastern Uinta Basin

Vertical block tectonics significantly affected the deposition of the Frontier Formation of Late Cretaceous age. This syntectonic relationship was identified by detailed facies mapping which recognized seven major lithofacies on the basis of lithology, sedimentary structures, sandstone geometries, fossils, and trace fossils. Each lithofacies is a process-controlled genetic unit and can be related to a depositional environment within a wave-dominated deltaic system. The ascending sequence of environments and lithofacies is: (1) prodelta shales and siltstones; (2) hummocky-stratified, distal delta-front sandstones; (3) low-angle trough to tabular-stratified, delta-front and mouth-bar sandstones; (4) lenticular, medium to coarse-grained, distributary-channel sandstones; (5) lagoonal and delta-plain carbonaceous shales and coals; (6) medium-grained fluvial sandstones; and (7) bioturbated, offshore and shelf sandstones and shales.

These lithofacies change laterally across two east-west-trending basement faults. Delta-front and distributary-channel deposits thicken between the faults, indicating a topographic low or graben at the time of deposition. Within the graben, sandstone