geometrically consistent with all observed data. The methods described are especially useful for resolving sparse or erratic data and predicting subtle traps and deep structures from shallow control.

BENNETT, RICHARD H., and TERRY A. NELSEN, National Oceanic and Atmospheric Adm., Miami, FL

Sea-Floor Characteristics and Dynamics Affecting Geotechnical Properties at Shelf-Slope Breaks

Shelf-break geotechnical and sea-floor stability investigations are rare but such studies offer challenging scientific and engineering opportunities in a unique sea-floor environment. The uniqueness stems from the highly variable sea-floor properties, morphology, and dynamic processes. Some characteristics and processes at the break are nonexistent in nearshore environments where most of our understanding and experience exists. The geotechnical properties and stability of submarine deposits are strongly influenced by the nature of the geologic environment, dynamic processes, sediment type, and sea-floor slope. Sediment properties and sea-floor morphology at the break can be highly variable over relatively short horizontal and vertical distances.

The outer shelves and slopes off Cape May, New Jersey, and the Mississippi delta are among the few geotechnically investigated continental margins. Off Cape May, mobile shelf sands contribute to sandy silts overlying the upper slope muds which occasionally exhibit structures and geochemical properties suggesting slope-creep processes. In contrast, the Mississippi delta's shelf-slope break is characterized by clays and silty clays that mobilize as mudflows which encroach upon the upper slope. Geotechnical properties such as shear strength and water content display striking differences between the two areas as a function of regionally differing dynamic processes, sedimentation rate, type, and texture.

BENSON, D. JOE, ERNEST A. MANCINI, and RICHARD P. WILKERSON, Univ. Alabama, University, AL

Hatter's Pond Field: Complex Combination Trap in Smackover and Norphlet Formations (Upper Jurassic), Southwest Alabama

The Hatter's Pond field in northern Mobile County, Alabama, has produced 7 million bbl of condensate and 26 Bcf of gas since its discovery in 1974. Production is from the Upper Jurassic Norphlet and Smackover Formations which form a transgressive-regressive package overlying the Jurassic Louann Salt. The Norphlet Formation is a subarkose which was deposited in a coastal dune complex. Subenvironments identified include dune, interdune, wadi, and an upper, massive marine sand lithology which is gradational into the overlying Smackover Formation. The Smackover Formation in the Hatter's Pond field is composed of mudstones, peloidal packstones, oolitic grainstones, and nodular anhydrite deposited in a coastal sabkha complex. The Smackover grades upward into the Buckner Anhydrite Member of the Haynesville Formation. Reservoir development in both the Norphlet and Smackover is facies selective and a product of diagenesis.

Porosity in the Norphlet is most abundant in the massive marine and dune lithlogies and is mesogenetic, secondary porosity formed by the solution of eogenetic carbonate cement and/or solution of grains. Smackover porosity is moldic in the higher energy lithofacies and intercrystalline to vuggy in the finer grained lithologies, with dolomitization and leaching as major factors in porosity evolution. Algal-rich mudstones within the Smackover provide an internal source for the hydrocarbons.

The trapping mechanism in the field is a highly complex, combination structural and stratigraphic trap. The structural component involves salt movement in association with normal faulting. Porosity distribution, and hence reservoir development, is facies selective and is significantly modified by diagenetic alteration. A thorough understanding of facies distribution, diagenetic alteration, and structural relations is necessary for delineation of combination petroleum traps in the Hatter's Pond area.

BENTOR, Y. K., Hebrew Univ., Jerusalem, Israel, and Scripps Inst. Oceanography, La Jolla, CA

Spontaneous Subsurface Combustion of Rocks of Monterey Formation, California

Rocks of the Monterey Formation rich in organic matter have undergone spontaneous subsurface combustion (combustion metamorphism) at many localities, particularly during the Pleistocene. At the best studied locality, the Grimes Canyon area, the burnt-out rock body is 20 km long, 1 to 3 km wide, and at least 400 m thick. The original rocks were mainly mudstones with lesser amounts of diatomites, phosphorites, shales, some cherts, and carbonate rocks. The trace element composition of the parent rocks is that of oil shales; Ba, Cr, Ni, Sb, and Se contents are higher. Rock melting started below 1,000°C. The initial melt (5% of rock volume) is highly differentiated and has a major, minor, and trace element composition indistinguishable from high-calcium granites. These melts intruded to form sills and dikes, and cooled to obsidian-like glasses. As the temperature rose, the melt changed composition and approached the composition of the parent rocks. These melts formed intrusive stocks and cooled to crystalline rocks resembling, in the field, scoriaceous basalt. At the highest temperatures, in excess of 1,650°C, phosphorites were molten; the resulting melt had the composition of apatite and was immiscible with the coexisting silicate melt, with which it formed an emulsion.

BERG, ORVILLE ROGER, Phillips Petroleum Co., Bartlesville, OK

Seismic Detection and Evaluation of Delta and Turbidite Sequences: Their Application to the Exploration for the Subtle Trap

Energy conditions at the seaward edge of deltas allow their division into fluvial-dominated, wave-dominated, and tide-dominated deltas. Each kind of delta has a distinct framework orientation and depositional pattern which results in a characteristic seismic reflection pattern. Fluvial-dominated deltas are characterized by clinoform seismic reflection patterns which include: oblique (tangential), complex oblique (tangential), sigmoid, and complex sigmoid-oblique. Seismic facies analysis can be used to define those facies which contain sand. Wave-dominated deltas are characterized by shingled seismic reflection patterns. Seismic facies analysis of this delta is not effective in identifying those facies which should be sand prone. Shingled reflections may be used in determining the possible location and depositional attitude of strandline sands. Tide-dominated deltas have not yet been identified using