Stratigraphic Traps in Paleocene Sands in Balder Area, North Sea

The Balder oil field in blocks 25/10 and 11 in the Norwegian sector of the North Sea contains 25° API oil in a Paleocene deep-water sandstone reservoir. The sands were deposited from high concentration, high-energy turbidity currents as a complex of channelized sand lobes which formed a small fan. Depositional topography and subsequent submarine erosion created a geometric closure on the upper surface of the fan. Oil is stratigraphically trapped by this closure. Recognition and definition of this mounded surface on seismic records and the development of a sedimentary model has made it possible to drill successful appraisal wells after disappointing initial drilling results.

SAVIT, CARL H., and C. WU, Western Geophysical Co., of America, Houston, TX

Geophysical Characterization of Lithology—Application to Subtle Traps

Traps for oil or gas consist of a geologic material whose physical properties may differ from those above and around it. In its first half century, geophysical exploration by the reflection seismic technique was used to delineate the boundaries between subsurface materials of different properties. The technique could not discriminate between the properties on either side of those boundaries. If geologic information from nearby wells or from outcrop was absent, the wildcatter drilled blindly through trap boundaries in the hope of finding the right kind of material.

Technology has advanced sufficiently that it is now possible to determine from seismic data at least one physical property of subsurface materials. That property is seismic velocity. Because seismic velocity generally decreases with increased porosity and because gas under pressure further decreases that velocity, it is now possible to define some non-structural traps and to identify some hydrocarbon accumulations.

Seismic velocity measurements displayed on computer-plotted cross sections in color, graphically identify a variety of subtle traps in many parts of the world. When applied to 3-D survey data the velocity methods can yield enough information to define all the boundaries of a hydrocarbon accumulation. The characteristic seismic velocites in a 3-dimensional subsurface block can most graphically be displayed as a motion picture depicting passage through the earth in selected directions.

New seismic techniques under investigation should make possible the simultaneous determination of additional physical properties so that even more subtle traps can be found.

SCHENK, CHRISTOPHER J., U.S. Geol. Survey, Denver, CO

Porosity and Textural Characteristics of Eolian Stratification

An analysis of experimentally formed eolian stratification has shown that processes of deposition are the major factors controlling the primary porosity and texture in the avalanche, grainfall, and ripple-produced types. Avalanche stratification generally exhibits the highest primary porosity (avg 47%) because of loose packing and grain arrangements that occur as a mass of sand shears downslope. Wind ripple-produced stratification has the lowest primary porosity (avg 39%) due to the relatively close packing and the presence of finer grained sublayers developed near the base of each inversely graded ripple stratum during ripple migration. Primary porosity of grainfall stratification (avg 43%) is usually intermediate between that of avalanche and ripple-produced deposits because the packing is between the avalanche and ripple produced types.

Avalanching forms the high-angle, porous, lee-slope stratification commonly observed in eolian deposits. Ripple-produced stratification is formed in two principal localities—on the low-angle windward slope where potential for preservation is poor, and on the lower part of the lee slope where preservation potential is excellent. The ripple deposits, produced by winds moving across the lee slope, form the tangential foreset-to-bottomset stratification common to eolian dunes. The relatively low porosity observed in these deposits is due to the stratification being composed of ripple-produced deposits. Grainfall stratification has a poor preservation potential because of redeposition by avalanching on the upper part of the lee slope. Grainfall on the lower lee slope usually occurs on a rippled surface, and these grains are incorporated into the ripple-produced stratification being formed at that site.

SCHLAGER, W., Univ. Miami, Miami Beach, FL, and N. P. JAMES, Memorial Univ., St. John's, Newfoundland, Canada

Bahama Platform Slopes: Carbonate Diagenesis Within and Below Thermocline

Sediments on Bahamian slopes, reef rubble, gully sands, and periplatform carbonate ooze, consist of calcite, magnesian calcite, and aragonite. When not continuously buried by new material, these sediments harden to limestone crusts, 10 cm to several meters thick, on the sea floor. The pathways of sea floor diagenesis vary with depth. (1) Reef wall and talus slope (50 to 400 m) are pervasively cemented by micritic magnesian calcite; botryoidal aragonite fills the large voids. There is no evidence of selective dissolution; primary and diagenetic minerals coexist. (2) On the gullied slopes between 500 and 1,300 m most sediment lithifies to calcite limestone or chalk, with 3 to 7 mol % $MgCO_3$; however, about 20% of the samples are micritic magnesian calcite limestones of 8 to 14% $MgCO_3$. (3) On the gullied slopes from 1,300 to at least 2,500 m, calcite limestones with 2 to 4 mol % $MgCO_3$ prevail.

The downslope trend from aragonite and magnesian calcite to calcite is explained by the decrease in water temperature and carbonate saturation. The magnesian-calcite limestones between 500 and 1,300 m do not follow this trend even though their oxygen isotopes indicate formation in cold bottom water. Micritic ooids of magnesian calcite with globigerinids as nuclei and coccoliths in the cortex are associated with the limestone crusts and obviously form in this current-swept deep-water environment. This suggests that magnesian calcite precipitates from a pore fluid close to, and derived from, sea water. The microenvironment may be controlled by micro-organisms or by inorganic precipitation of calcium carbonate that increases the Mg:Ca ratio in the pore fluid, thus raising the magnesian content of the precipitating calcite.

SCHMIDT, CHRISTOPHER J., Western Michigan Univ., Kalamazoo MI, CALVIN JAMES, Univ. Notre Dame, Notre Dame, IN, and JAY N. SHEARER, Indiana Univ., Bloomington, IN

Estimate of Displacement in Major Zone of Tear-Thrusting in Fold and Thrust Belt, Southwest Montana

The most pronounced deflection of the marginal fold and thrust belt in Montana occurs in the northern Tobacco Root