Rocks that fill both subbasins are probably as old as late Miocene or Pliocene and are gently deformed, except near the Portlock anticline and near the shelf-break uplift.

If hydrocarbon-source characteristics of rocks offshore are similar to those of rocks onshore, good hydrocarbon source rocks do not underlie the shelf. Eocene through middle Miocene rocks onshore, and upper Miocene or Pliocene rocks offshore, contain less than 0.5 wt % organic carbon, which is predominantly of herbaceous and humic orgin. The volume of total extractable hydrocarbons (C_{15+} Soxhlet extraction) from onshore Eocene through Miocene rocks ranges from 165 to 412 ppm. Offshore upper Miocene and Pliocene strata are thermally immature. Paleogene rocks, which are thermally mature, are the most likely sources for any hydrocarbons generated offshore, although indications are that they are low-quality sources.

Onshore Paleogene rocks generally have poor reservoir properties—porosities range from 1 to 10% but most are less than 5%, and permeabilities are less than 1 md. The best offshore reservoirs are probably in late Miocene and younger strata.

Structural traps for hydrocarbons include Portlock anticline, anticlines in the central-shelf uplift, and parts of Albatross Bank.

FITZGERALD, DON D., Houston Oil and Minerals Corp., Houston, TX, and J. C. THERIOT and P. L. YORK, Dresser Atlas Corp., Houston, TX

Dipmeter Validity in Deviated Bore Holes

Usually, offshore field development wells will be drilled as highly deviated bore holes and evaluated by a series of logs including dipmeters. Dipmeters run in a deviated bore hole have often been treated with the same respect for validity of accuracy as any regular dipmeter run in a practically vertical bore hole. However, when the formations exhibit small dip magnitudes (from the horizontal) and are penetrated by rather highly deviated bore holes, accuracy of the dipmeter results should be held suspect. Recent work has indicated any small error in any one of several instrument measured parameters can result in an error in the final dipmeter results such that the formation dip magnitude will be erroneous and even the dip direction can be wrong.

Errors in relative bearing and bore-hole diameters (including caliper accuracy and pad depth of investigation) are the most susceptible to causing errors in the final computed results. This could have serious consequences in that erroneous dip vectors would be displayed as valid dip vectors. Unfortunately it is almost impossible, even for an "expert," to visibly determine that wrong dipmeter vectors have been plotted as the result of poor input data.

Several actual and theoretical dipmeter computation results will be presented wherein a controlled amount of error will be deliberately introduced to show its effect upon the computed dip vectors.

Results of these computations indicate that to give consistently good dipmeter results under most conditions encountered in highly deviated bore holes, practically all of the instrumentation must perform at accuracy levels considerably in excess of current instrument capabilities to yield results of the same quality as those obtained in nearly vertical bore holes.

FITZGERALD, DUNCAN M., Boston Univ., Boston, MA, and DAG NUMMEDAL, Louisiana State Univ., Baton Rouge, LA

Ebb-Tidal Delta Stratification and Its Relation to Tidal Inlet Processes

Shallow, high resolution seismic reflection profiles at nine tidal inlets along the South Carolina coast have shown that ebb-tidal delta stratification is dominated by small to large-scale accretionary beds associated with channel cutting and infilling sequences. The deeper parts of the ebb-tidal delta (15 to 25 m) are comprised chiefly of shallow-landward and seaward-dipping beds (3 to 6°) and horizontal stratification. These beds represent initial sedimentation in large channel-fill sequences and original delta deposits. At intermediate depths (5 to 15 m) the stratification is dominated by large-scale (2 to 5 m in height) multidirectionally dipping accretionary beds (3 to 15°) that were formed owing to channel migration. Small channel cut and fill deposits are also prevalent at this depth. The upper delta is characterized by laterally continuous landward-dipping foresets formed by landward-migrating swash bars. Because of the depth of the ebb-tidal delta sediments (25 to 30 m) their preservation through a transgression appears likely.

The development of this stratification is caused by a southerly migration of the inlet's main ebb channel through the ebb-tidal delta sediments. Eventually, the channel becomes hydraulically inefficient and a new channel is breached through a spillover lobe to the north. The abandoned channel is then filled with sediment that is derived from seawash sand shoals which flanked the old main ebb channel and with sand that is transported seaward in the new main ebb channel. The landward transport of sand which causes an infilling of the abandoned channel and a southerly migration of the main ebb channel is the result of accretion through bedload sediment transport and landward-migrating swash bars.

FOSTER, NORMAN H., and EDWARD D. DOLLY, Independent Geologists, Denver, CO

Petroleum Potential of Basin and Range Province, Western United States

Five oil fields have been discovered within the Basin and Range province of the western United States. They are Eagle Springs (1954), Trap Spring (1976), and Currant (1978) fields in Railroad Valley graben of east-central Nevada, and in the Great Salt Lake area of Utah, Rozel Point (circa 1904) and West Rozel (1978) fields. Rozel Point and Currant fields are non-commercial accumulations. Reservoirs are either fractured Oligocene ignimbrites, Eocene lake sediments, or fractured Miocene-Pliocene basalts. Accumulations occur in truncation-fault traps or in drape over faulted structure. The source of the oil is believed to be Tertiary lake deposits and/or Chainman Shale of Mississippian age.

Exploration for Tertiary accumulations is carried out by: (1) mapping source rocks in basins with proper depth for maturity, (2) establishing presence of reservoir rocks, and (3) delineation of traps by photogeologic-geomorphic techniques, gravity surveys, and seismic shooting.

Numerous shows of oil and gas have been recorded in wells drilled in various basins, both in Paleozoic and Tertiary rocks. Other oil and gas indications include the Bruffey oil and gas seeps (Pine Valley, Nevada), the Wells oil seep (west of Wells, Nevada), an asphaltite dike in Mississippian sediments (Piñon Range, east of Pine Valley), the West Brigham City and Farmington gas areas (east of Great Salt Lake, Utah), and the Fallon gas area (Carson Sink, Nevada). Oil source units include Cretaceous to Tertiary lake deposits (Sheep Pass Formation, Elko Shale, Kinsey Canyon Formation, Newark Canyon Formation, and King Lear Formation), Mississippian Chainman Shale, Devonian Pilot Shale, and Ordovician Vinnini Shale.

Several Paleozoic plays exist in Nevada, including the Mississippian Diamond Peak (Illipah, Scotty Wash) sandstone pinch-outs. Reef buildups may be present in the Silurian and Devonian section.

Exploration in the Basin and Range province should result in significant discoveries of oil and gas in the future.

FOSTER, W. R., and H. C. CUSTARD, Mobil Research and Development Corp., Dallas, TX

Smectite-Illite Transformation—Role in Generating and Maintaining Geopressure

Mixed layer smectite-illite clays comprise a significant fraction of fine-grained clastic sediments in many basins around the world. Abnormally high fluid pressure (geopressure) is associated with parts of these basins. The presence of smectite-illite is a necessary but not sufficient criterion for the existence of geopressure.

Smectite reacts with potassium feldspar producing illite, silica, sodium-calcium feldspar, and releasing loosely bound water. Observations in the northern Gulf of Mexico support an equilibrium model for the reaction, the shift in the logarithm of the equilibrium coefficient with depth being proportional to the product of the reaction enthalpy and the geothermal gradient. Reaction enthalpies range from 2,000 to 26,000 cal/mole, highest reaction enthalpies occurring along the south Texas coast, lowest in the Mississippi delta. Abrupt diagenesis-depth profiles are associated with geopressure, gradual reaction with depth associated with near hydrostatic fluid pressure gradients.

Sediments compact over intervals where the effective pressure increases. Geopressure is associated with porosity increase and effective pressure decrease with depth. The top of the zone of sediment under-compaction coincides with change in sign of the effective pressure gradient from positive to negative. In this interval, fluid pressure increases with depth faster than does the overburden pressure. Very high fluid-pressure gradients are associated with the combination of low shale permeability, high shale porosity, and rapid basement subsidence. Because of the close connection between high fluid-pressure gradient and abrupt conversion of smectite to illite, we conclude that this reaction is responsible for abnormal loss of permeability, probably a result of the finely divided silica that is produced.

FOULKES, DONALD E., and JOHN A. WARD, Teknica Inc., Houston, TX

Application of Inversion Processing to Exploration for Point-Bar Sandstones

West Moorcroft field, Crook County, Wyoming, produces from a point-bar sandstone of the Fall River formation of Cretaceous age. New Bielau field, Colorado County, Texas, is productive from an Eocene age, Wilcox formation point-bar sandstone. Although both reservoir sandstones were deposited in a similar "meander belt" facies, the expressed geometry of the trap as defined from the Seislog® traces is unique to each field.

In West Moorcroft field, at 4,800 ft (1,463 m) hydrocarbons are trapped by the arcuate shape of channel-filling shale that forms a seal for approximately 40 ft (12 m) of sandstone. Analysis of bandpass filtered sonic logs suggests that the frequency content of conventional seismic data is likely inadequate to uniquely separate porous sandstone from shale. Inversion of the seismic data facilitated identification of a higher velocity event, which although not discretely sandstone could be related to the productive unit. Updip, the channel-filling shale, the real trap, does form a mappable stratigraphic unit.

The producing point-bar sandstone at New Bielau is both deeper (8,700 ft; 2,652 m) and thicker (65 ft; 20 m) than at West Moorcroft. As predicted by bandpass filtered sonic logs, the sandstone is not uniquely resolved on inverted seismic data.

In this example, a high velocity marker beneath the productive interval clearly illustrates the concave morphology of the channel and serves to define the trap. Although poorly defined, the shale in the channel fill is recognizable.

In a comparative sense, the two fields illustrate the ability of inversion processing to identify very subtle stratigraphic units that can then be related to a reasonable geologic model. The expression of this stratigraphy on the conventional seismic section reminds us just how subtle those indicators really are.

FRANKS, STEPHEN G., ARCO Oil and Gas C., Dallas, TX, and DAVID M. HITE, ARCO Oil and Gas Co., Anchorage, AK

Controls of Zeolite Cementation in Upper Jurassic Sandstones, Lower Cook Inlet, Alaska

Field and petrographic studies indicate that the major factors controlling zeolite cementation in Upper Jurassic sandstones of Lower Cook Inlet were provenance, depositional environment, and igneous activity. The Jurassic strata record the unroofing of a Mesozoic volcanic-plutonic arc complex related to subduction and plate accretion beginning at least by Triassic time. Petrologic-stratigraphic trends show a striking increase in the ratio of quartz to volcanic rock fragments from Lower Jurassic to Upper Jurassic sedimentary rocks, re-