Origin and Development of Barrier Islands on West-Central Peninsula of Florida

The origin of barrier islands has been discussed and debated in the literature for nearly a century. Virtually all interpretations have been based on stratigraphic and geomorphic data. Two small barriers have formed in Pinellas County during the past 2 decades. Both aerial photography and field data show that these islands originated as shallow subtidal shoals. Continued accumulation of sediment occurred through normal low-energy waves and currents with assistance from occasional intense storms.

North Bunces Key became intertidal in 1957 and showed marked growth after Hurricane Donna in 1960. It is now 1.5 km long and rises more than 1 m above mean sea level. South Bunces Key was subtidal until 1974. It is 1.3 km long and rises nearly a meter above mean sea level. Anclote Key, which is 35 km north of Bunces Keys, is 4 km long and shows remarkable geomorphic similarities to North Bunces Key. Caladesi Island, located 9 km south of Anclote Key, is 6.5 km long and displays a "drumstick" configuration. Interpretation of depositional environments from 17 cores reveals that this island also originated as a shallow shoal on the inner shelf. Initial development of Caladesi Island has been dated at 5,000 to 7,000 years B.P.

Data from the modern environment and the stratigraphic record lead to the postulation that shoaling of shallow linear sand bodies has been a common mode of origin for barrier islands along the west-central peninsula of Florida.

DEAN, WALTER E., and JOHN R. DYNI, U.S. Geol. Survey, Denver, Colo.

Statistical Zonation of Oil Shale on Basis of Chemical Characteristics

Several objective statistical techniques have been used to isolate zones of distinctive chemical characteristics within the saline facies of the Eocene Green River Formation. The data consist of measured concentrations of Al, Si, Na, K, Ca, Sr, Fe, and S in 374 composite samples collected at 0.61-m intervals in a 232-m section of the saline facies from a core of the Green River Formation, Piceance Creek basin, Colorado. The techniques were also applied to the oil-yield (Fischer assay) data for the entire core. The first statistical technique used was analysis-of-variance zonation. Zone boundaries determined by this technique separate portions of the core that have maximum between-zone variance and minimum within-zone variance. The second technique involves computation of moving correlation coefficients between two variables over successive 31-sample intervals. This technique isolates zones of strong positive and negative associations among geochemical variables.

On the basis of these two statistical techniques, the saline facies and underlying Garden Gulch Member of the Green River Formation have been divided into six geochemical zones. The most useful variables for zoning are Si, Al, Fe, S, Na, and oil yield. Concentrations of silicon and aluminum exhibit considerable variation and are positively correlated throughout the saline facies, expressing a strong correlation between quartz and dawsonite. The minerals most characteristic of the saline facies of the Green River Formation are dawsonite and nahcolite. Concentrations of iron and sulfur (present mainly as pyrite and marcasite) are positively correlated with oil yield in zones of higher salinity (as indicated by zones containing highest concentrations of nahcolite) and negatively correlated with oil yield in zones of lower salinity. This suggests that the effect of organic content on iron diagenesis, probably through controls on pH and Eh, was optimum during periods of higher salinity.

DELFINER, P., and J. P. DELHOMME, Ecole des Mines, Fontainebleau, France; L. M. GAUDEMET and Y. GUERRINI, Gax de France, Paris, France; and G. DE MARSILY, Ecole des Mines, Fontainebleau, France

"Kriging" of Top of Reservoir from Seismic and Borehole Data

This paper is part of an ongoing study to assess the performance of a natural sandstone reservoir considered for underground storage of gas. The specific problem dealt with is contour mapping the top of the structure in order to assess the closure zone. Data are from 56 wells, most of which were drilled in the central part of the dome, and four seismic surveys. A particular difficulty encountered is the small number of reliable velocity measurements.

The method used is "kriging," an optimal interpolation procedure based on random-fields theory. Its advantage over conventional methods is the use of the variogram, a structure function that depicts the spatial variability of the phenomenon under study. This method results in an interpolation algorithm tailored to each particular data set. Furthermore, error variances are attached to kriging estimates, telling how reliable the estimates are.

Depths to the top of the structure are obtained by adding estimated thicknesses of the intermediate layers to estimated depths of the seismic marker. Kriging of the thicknesses is performed after aggregation of the intermediate layers into approximately uncorrelated sets. For seismic-marker depths, three different methods, combining seismic and borehole information, can be used.

DEMAREST, JAMES M., ROBERT B. BIGGS, and JOHN C. KRAFT, Univ. Delaware, Newark, Del.

Interpretation of Pleistocene Coastal-Barrier Complexes from Holocene Models, Southeastern Delaware

The Pleistocene Columbia Group in Sussex County, Delaware, has long been identified as a complex of nearshore marine and coastal deposits. However, interpretation of the internal geometry of the sedimentary lithosomes has proved to be difficult because of the extreme variability of these units. Environmental lithosome models of the morphology and internal geometry of the Holocene transgressive shoreline complex along the present Delaware coast provide an analog for the interpretation of the Pleistocene sedimentary sequences.

On the basis of sedimentary structures, lithologic se-

quences, and geomorphology, four linear barrier complexes have been identified within 10 km of the present coast. Each is a transgressive, peak-sea-level barrier complex including barrier and washover sands and gravels, tidal-marsh muds, and fossiliferous lagoonal sands and muds. A regressive sequence of sand and gravel occurs between each barrier. From most landward to most seaward, the barriers were formed at sea levels of about +5.4 m, +4.3 m, +2.8 m, and −1.0 m relative to present sea level. Age estimates based on amino acid racemization for shells within lagoons behind these barriers suggest a Sangamon age for at least the three most landward barriers.

Thus the upper 15 m of the horizontally correlative Pleistocene Columbia Group consists of at least four chronologically discrete, parallel, linear barrier-lagoon complexes formed during multiple marine transgressions and regressions. This interpretation of trends and vertical sequences of nearshore marine and coastal deposits may prove useful in the understanding of other ancient coastal deposits.

DICKINSON, KENDALL A., U.S. Geol. Survey, Denver, Colo.

Detailed Stratigraphy and Sedimentology of Whitsett Formation in Uranium Area of Western Karnes County, Texas

The Whitsett Formation of the upper Eocene Jackson Group contains, in ascending order, the Dilworth Sandstone, Conquista Clay, Deweesville Sandstone, Dubose, Tordilla Sandstone, and Fashing Clay Members. In Atascosa to McMullen Counties, the Calliham Sandstone Member, considered to be a stratigraphic equivalent of the Tordilla, is apparently the same age as the Fashing. The Deweesville is called the Stones Switch Sandstone Member by some geologists.

The Fashing contains flood-plain, lagoon-bay, and distributary-channel facies. The Kellner and Rosenbrock uranium mines are in the distributary-channel facies of the Fashing. These mines have previously been considered to be in the Tordilla Sandstone Member. The Calliham Member apparently represents tidal-delta sandstone at its type locality.

The Tordilla is a transgressive barrier-beach unit in the areas of the Pfiel-Wright and Weddington-Butler-Galen-Sickenius uranium-ore trends. Farther east, in the Manka and Stoeltje uranium mines, the Tordilla is represented by a back-barrier island facies.

Although the predominant facies of the Dubose is paludal and bay-lagoon mudstone, the ore in the Lauw and Bieker uranium mines is in a sand-filled distributary-channel facies.

A back-beach facies of the Deweesville contained the ore of the Searcy mine, and the F. Brysh mine is in the lower of two beach units in the Deweesville.

The sandstone members of the Whitsett Formation were deposited in transgressive barrier beaches, although locally they may be represented by progradational beaches or tidal inlets and deltas. Sandstone deposited in the distributary channels is equivalent in age to the clay members. The grains of the sandstone units in the Whitsett are composed mostly of feldspar and quartz. Some facies also contain abundant volcanic shards. Montmorillonite and clinoptilolite and part of the feldspar are authigenic constituents in the sandstone. The sandstone of the distributary channels is coarser grained than that in the beach sequences.

DODGE, M. M., and R. G. LOUCKS, Bur. Econ. Geol., Austin, Tex.

Mineralogic Composition and Diagenesis of Tertiary Sandstones along Texas Gulf Coast

The upper Gulf Coast Wilcox Formation is composed dominantly of quartz with feldspar, metamorphic and volcanic rock fragments, and mud clasts. The lower Gulf Coast Wilcox Formation contains more quartz and volcanic rock fragments. Lower Gulf Coast Yegua and Jackson Formations are composed of quartz, volcanic, and lesser carbonate rock fragments. Northward they become more quartz-rich and contain metamorphic rock fragments and mud clasts. Lower Gulf Coast Frio and Vicksburg Formations are similar to the Yegua and Jackson. Northward, they become more quartz-rich, but carbonate rock fragments are absent.

Despite variations in composition, Tertiary sandstones exhibit a similar diagenetic sequence idealized as follows.

Surface to shallow subsurface diagenesis (0 to 4,000 ft; 1,200 m) begins with pedogenic clay coats and with leaching and calcite replacement of feldspar. Minor kaolinite, feldspar overgrowths, and iron-rich carbonate material are also precipitated. Porosity is commonly reduced by compaction from the original 40% to less than 30%.

Moderate subsurface diagenesis (4,000 to 11,000 ft; 1,200 to 3,300 m) involves leaching of early carbonate cements and subsequent cementation by quartz overgrowths and later carbonate cement. These stages commonly reduce porosity to 10% or less, but this trend may be reversed by late leaching of feldspar, rock fragments, and carbonate cements. Restoration of porosity to more than 30% can occur, but this may be reduced by late cementation by kaolinite and iron-rich dolomite and ankerite.

Deep subsurface diagenesis (11,000 ft; 3,300 m) is a continuation of late iron-rich carbonate cements.

DONOGHUE, JOSEPH F., Univ. Southern California, Los Angeles, Calif.

Sedimentation Rates in Coastal-Plain Estuary, Rhode River, Maryland

Estuarine sedimentation rates have traditionally been determined by indirect means or by estimation. A recently developed and potentially useful, absolute dating method for modern sediments—lead-210—previously has been applied with success to lacustrine and continental-shelf sediments. The results of the present study indicate that lead-210 may be useful in the estuarine environment as well.

The Rhode River estuary is a shallow, western arm of Chesapeake Bay. Piston cores 2 m long were collected in areas of suspected high deposition rates throughout the estuary. Subsamples taken at regular intervals down