where the belt crosses the shelf. These offshore prolific areas represent only 25% of the total shelf area. The reported offshore ultimate recoverable oil is 4.8 billion bbl or 25.4% of the Nigerian total. In general, the proportion of natural gas to oil in Nigeria is relatively high and increases basinward. Reserves in the order of 40 to 50 tcf have been reported. However, due to the lack of marketing opportunities, this gas has been found incidentally to oil exploration. It is, therefore, possible that in the least prolific offshore areas, considerable reserves of gas could be established if the proper economic incentives existed.

PAYNE, JOHN B., and ALAN J. SCOTT, Univ. Texas at Austin, Austin, TX

Late Cretaceous Anastomosing Fluvial Systems, Northwestern Colorado

Basal Mesaverde deposits exposed near Rangely Dome in northwestern Colorado indicate a progradation of deltaic sandstones over the marine Mancos Shale. Overlying these deposits is a thick nonmarine sequence containing four major facies: (1) extensive organic-rich siltstones with laterally discontinuous coals, (2) elongate lenticular cross-bedded sandstones, (3) thin (0.3 to 2.5 m) ripple-stratified, sheetlike fine sandstones, and (4) thick (maximum 11 m) fine-grained sandstones with large-scale foresets and syndepositional slumping.

Two fluvial facies models were developed on the basis of study of over 80 measured sections. Variations in the models are seen in the types of cross-bedded sandstones. Type 1 forms belts 80 to 130 m wide and up to 21 m thick. Major erosion surfaces delineate nearly symmetrical units 3 to 8 m thick. In contrast, type 2 lenticular sandstones belts are broader (600 m) and thinner (3 to 7 m). The component lenses are fewer in number, have a greater width to depth ratio, and commonly show evidence of lateral accretion. Individual units in type 1 belts show little vertical variation in grain size or scale of structures. Type 2 units commonly fine upward in both respects. The fine-grained sandstones flank the major belts and have paleocurrent indicators at high angles to the transport direction of the coarser lenses.

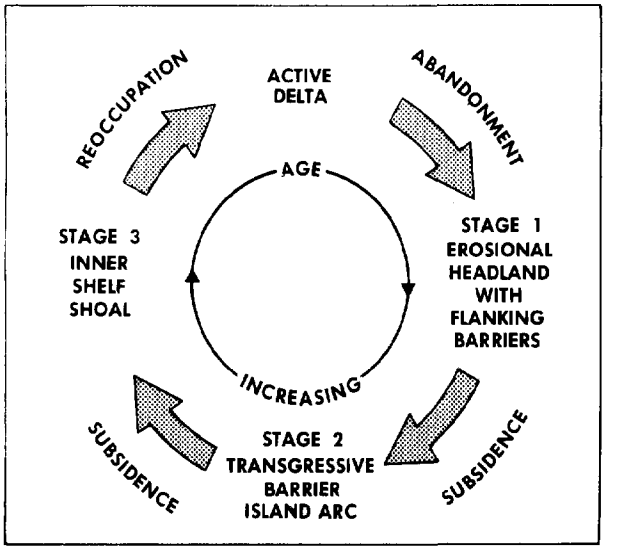
The coarse-grained sandstones were major channels and the fine-grained sandstones were crevasse splays. The thin splays were deposited along levees or in shallow flood basins. The thick splays with foresets are associated only with type 1 belts. They were Gilbert deltas which prograded into interfluvial lakes. The type 1 belts, major interfluvial lakes, and Gilbert splays were associated with greater subsidence rates. This model is comparable to recently described anastomosing fluvial systems. Our other model is similar to a low-sinuosity fluvial system.

PENLAND, SHEA, Louisiana State Univ., Baton Rouge, LA, and RON BOYD, Louisiana Geol. Survey, Baton Rouge, LA

Evolution of Transgressive Deltaic Environments on Louisiana Coast

Mississippi River sedimentation is dominated by the process of delta switching. Upstream distributary diversion during the Holocene Epoch periodically shifted the depocenter of Mississippi River sedimentation, producing a sequence of four abandoned shallow-water delta complexes on the Louisiana coast. Abandonment and the cessation of active distributary sedimentation result in subsidence, creating a rapid coastal transgression in each abandoned delta complex.

In its destructional phase, the delta evolves through a sequence of three stages, each associated with distinct transgressive sedimentary environments. This evolutionary sequence begins with an *erosional deltaic headland and flanking barrier stage,* backed by restricted interdistributary bays. In the following *transgressive barrier island arc stage,* the barrier island encloses an open intra-deltaic lagoon. Long-term sea-level transgression eventually causes the destruction of the subaerial barrier and the development of an *inner-shelf sand sheet and shoal.*



Coarse-grained sediment dispersal following delta abandonment is characterized by reworking of distributary sand bodies into transgressive coastal barrier systems. Barrier orientation to the dominant wave approach controls the pattern of longshore sediment dispersal. Sediment transported offshore during frontal and tropical cyclone passage forms the inner-shelf sheet sand. Fine-grained sediments accumulate in a variety of subsiding back-barrier environments and on the continental shelf.

If the validity of the model proposed for Louisiana holds true for older shallow-water Mississippi-type deltas, an idealized stratigraphic record for this category of transgressive deltaic environments should contain the following vertical sequence: a thin bay facies overlain by tidal inlet and/or recurved barrier sands that grade updip into a thickening lagoonal facies overlain by extensive washover sands. The uppermost unit would consist of shallow marine sands with an overlying cap of continental-shelf muds.

PERRIN, NANCY A., Univ. North Dakota, Grand Forks, ND

Environment of Deposition of Winnipegosis Formation (Middle Devonian), Williston Basin, North Dakota

The Winnipegosis Formation (Middle Devonian) is the major carbonate unit of the first transgressive-regressive pulse of the Kaskaskia sequence. The sea invaded the narrow, elongated Elk Point basin which extended from northern Alberta southeastward to North Dakota. The southeastern end of this basin corresponds to the present-day Williston basin.

In North Dakota, reworking of red beds and deposition of restricted argillaceous carbonates occurred (Ashern). Winnipegosis deposition began after a brief hiatus. Initially, there was a widespread establishment of a clear quiet shallow-marine environment. Subsequently, the basin differentiated into three distinct environments of deposition: (1) scattered pinnacle reefs, (2) a deeper interreef basin, and (3) an encompassing carbonate platform.

Carbonate production in the pinnacle-reef and platform en-