deposition of sand by low-concentration to high-concentration, submarine density currents and associated tractive currents.

The fine to very fine-grained sandstones are well-cemented quartz arenites with porosities commonly 10 to 15% and permeabilities commonly around 0.1 to 1.0 md. Abundant fractures in the brittle sandstone provide the necessary reservoir permeability to allow commercial gas production.

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Tertiary Sea-Level Movements Around Southern Africa

Sedimentologic, micropaleontologic, and seismic-profiling data elucidate the history of Tertiary sea-level movements around southern Africa. These new data show that landward movement of the sea began in early late Paleocene time and continued into the early Eocene. The sea probably reached its maximum Paleogene height during the early Eocene, and is today represented by outcrops up to at least 204 m, and probably as high as 360 m, above sea level. A brief regressive pulse occurred during the middle Eocene, and renewed transgression in the late Eocene. A major regression followed, spanning all of Oligocene and early Miocene times. This regression exposed much of the continental shelf. It is clearly represented on seismic-reflection profiles as a widespread unconformity.

The major Neogene transgression began in the middle Miocene but probably only reached the present coastline by late Miocene time. This transgression continued into the early Pliocene, but was interrupted by a brief regressive pulse in the earliest Pliocene. Seas withdrew again in the late Pliocene. Units deposited during the Miocene-Pliocene transgression are today found up to at least 300 m above sea level.

This scheme should be viewed as showing only the gross movements of the seas around southern Africa during the Tertiary. Local subsidence or uplift may have caused one area of the coast to submerge or emerge earlier than another area. Nevertheless, the timing of these southern African transgressions and regressions closely parallels the timing recently established for sea-level movements in other parts of the world.

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Sedimentology of Some Precambrian Iron Formations

Six of the best known Precambrian iron-formation basins of North America display consistent patterns of sedimentation. In three of the basins, the iron formations are almost exclusively lutaceous, contain few sedimentary structures other than lamination, and include representatives of all four of James' sedimentary facies. In the other three basins, the iron formations are predominantly arenitic and contain a much wider variety of sedimentary structures. All four of James' facies are represented among their lutaceous members, but the arenitic portions belong only to the oxide and silicate facies. The predominantly arenitic iron formations are underlain by coarsening-upward, quartzose shelf sandstones, whereas the predominantly lutaceous iron formations are underlain by slate-turbidite sequences and/or pillow lavas. Five of the iron formations are overlain by slate-turbidite sequences, and the sixth is truncated unconformably. Several conclusions can be made. (1) The iron formations vary considerably in their internal sedimentary character and lie conformably between siliciclastic rocks deposited in a variety of marine environments. Hypotheses that restrict the deposition of iron formation to a nonmarine or to a specific marine environment are not likely to have broad applicability. (2) The sedimentary structures and the stratigraphic settings show that the lutaceous iron formations are relatively deep-water sediments; yet some belong to James' oxide facies. The dominance of ferric iron is not sufficient to prove a shallow-water depositional environment. (3) The similarities between the character of a given iron formation and that of the siliciclastic unit beneath it suggest a close environmental relation between the two.

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Slumps on Upper Continental Slope, Northeastern United States—Observations from Submersible

Many large sediment slumps have been mapped along the eastern continental slope of North America. Most of these features have been observed on high-resolution seismic profiles, but few have been observed from submersibles. Although seismic profiling is an effective means for mapping slumps, it has limitations. For example, it cannot be used to resolve small-scale features, especially on slopes greater than 15 to 20°. To define such features, slump and interslump areas along the uppermost continental slope in Lease Area 49 in the Baltimore Canyon Trough area and south of Georges Bank were examined by in-situ observations during 24 submersible dives. These dives revealed slump scars characterized by slopes of 20 to 45°, clay outcrops, and borings and depressions inhabited by a diversity of megabenthic crustaceans and fish. Below the scars, step topography, reverse slopes, and hummocky seafloor were observed. Small slumps were observed at shallower depths (170 to 366 m) than previously had been resolved by seismic profiles. In contrast, areas with no slumps were characterized by smooth, gently dipping (5 to 8°) seafloor and sparse fauna.

Slumps are potential geologic hazards to the siting of exploration wells, production platforms, and pipelines. Thus, this study is particularly relevant in light of recent discoveries of gas on the mid-Atlantic continental shelf.

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Sealing and Nonsealing Faults in Gulf Coast Salt Basin

This study was undertaken to investigate (1) the dif-