offshore shelf sand-ridge deposits, appears as "railroad tracks" on seismic sections. Ninety-seven seismic lines were examined over a 10,000 km² area. Here, the Cardium is divided into the Cardium Sand and the overlying Cardium Zone, both of which are 15-50 m thick. The Cardium Sand systematically grades eastward from (a) shoreface-strandplain massive sandstones to (b) inner-shelf sandstones encased in shale. The Cardium Zone grades eastward from (a) marginal marine/inner-shelf sandstones (< 10 m thick) encased in shale to (b) shelf shales.

Two major reflection patterns characterize the Cardium Formation. One consists of two high-amplitude reflections spaced 20-30 m apart, and the other consists of a single reflection; further subdivision is possible on the basis of reflection amplitude. Areally, these patterns correlate with the regional distribution of sedimentary facies described above.

Reflection patterns of 26 1-D seismic models generated from sonic logs correlate with those of the field seismic data thus allowing interpretation of the field data in terms of sedimentary facies. Thickness of the Cardium Zone and number and thickness of sandstone beds in the Zone were found to control seismic reflection patterns. The double reflection pattern occurs where the Cardium Zone is more than 24 m thick and contains shelf sandstone beds encased in shale. A single reflection, generated from the Cardium Sand, occurs where the zone is less than 24 m thick and lacks sandstones. These relationships can be used to detect and map potential sandstone reservoirs on seismic records.

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Carbonate Cements in Sandstones—Mineralogy and Chemical Composition

The chemical compositions of carbonate cements in sandstones were analyzed with an energy dispersive analyzer (KEVEX) and a scanning electron microscope in order to provide a baseline data base for one of the most common authigenic phases in sandstones. A total of 205 spectra was analyzed with respect to mineral standards using ZAF corrections. These spectra were acquired from 35 Cambrian to Cretaceous carbonate-cemented sandstones from our sedimentary rock collections.

Only 19% of the analyses were pure calcite (i.e., no Mg, Mn, or Fe were detected). Impure calcites accounted for 54% of the analyses, and dolomites and ankerites accounted for 27%. When the calcites were treated as a single group, the distribution of the components was as follows: calcite 91.6-100%; magnesite, 0-8.4%; rhodochrosite, 0-2.3%; and siderite, 0-4%. The dolomites and ankerites showed a larger range: calcite, 47.8-60.6%; magnesite, 20-52.2%; rhodochrosite, 0-12%; and siderite, 0-28.6%. The values of the calcite component in the dolomites that were significantly higher than 50% probably resulted from the beam (spot mode) encountering dolomite plus some calcite. In most cases, the calcite component was nearly 50%.

Many of these compositions displayed a large variation within a sample, even at the micron-level scale. A series of closely spaced analyses—all within an area 200 × 100 μm—from a sample rich in dolomite and/or ankerite ranged between 20 and 43% magnesite and 6 and 29% siderite. The calcites normally only ranged a few percent for each component in analyses that were spaced at a similar scale.

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Decade of Exploration in Deep Lower Tuscaloosa Gas Trend in Southern Louisiana

The deep lower Tuscaloosa gas trend, now in a mature stage of exploration, was discovered in 1975. Production is from lower Tuscaloosa sandstones of Late Cretaceous age. During the past decade, the petroleum industry has drilled approximately 217 new-field wildcats and 232 development wells in the trend. This exploration effort has discovered 24 fields. Most of these fields produce from depths between 15,000 and 20,000 ft. In February 1984, the average daily production was 426.6 mmcf of gas and 18,350 bbl of liquid hydrocarbons from approximately 115 wells. Five fields, False River, Irene, Judge Digby, Moore-Sams, and Port Hudson, all discovered prior to 1980 and concentrated northwest of Baton Rouge, Louisiana, have produced about 72% of the cumulative gas and 80% of the cumulative liquids.

Reservoirs in deep lower Tuscaloosa occur in a terrigenous clastic sequence, which thickens rapidly downdip from a carbonate shelf of Early Cretaceous age. Occurrences of commercial hydrocarbons in the trend are primarily dependent on depositional environment, syndepositional tectonics, source rock, original sand mineralogy, and burial diagenesis. Salt diapirism is locally important.

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Petroleum Potential and Stratigraphy of Holitna Basin, Alaska

The Holitna basin, an interior Alaskan basin, is flanked by Cambrian to Cretaceous sedimentary rocks that have been highly folded and faulted. Gravity mapping and modeling indicate up to 15,000 ft of sedimentary section is present within the basin.

Cambrian rocks consist of trilobite-hash lime mudstone, red siltstone, and basinal chert. Ordovician through Devonian basinal facies rocks consist of platy limestone to graptolitic shale with minor interbeds of limestone turbidites and turbidite-channel debris flows. Ordovician through Middle Devonian shallow-water platform carbonate rocks prograde over the basinal rocks and are composed of algal boundstone buildups with associated inboard lagoonal, oolitic shoal, and tidal-channel deposits. Toward the interior of the platform, restricted subtidal and intertidal to supratidal carbonate rocks were deposited. Upper Devonian to Permian platform carbonate deposition occurred to the east of the older platform rocks and conformably(?) over basinal rocks. Minor mixed carbonate-clastic deposition occurred into Triassic time.

The Cretaceous Kuskokwim Group is in fault contact with and/or unconformably overlies the Paleozoic carbonates. This unit varies from lithic-rich conglomerates to marine turbidite deposits. Maturation values for Cretaceous and Paleozoic rocks are within the oil window, with most of the shales showing a thermal alteration index (TAI) from 2 to 3. Organic carbon content exceeds 3% in some samples, however, deep surface weathering has resulted in low hydrocarbon values. The lithic-rich Cretaceous sandstones are well indurated, poorly sorted, and are considered to have low reservoir potential. Partly dolomitized, shallow-water Ordovician to Devonian carbonate rocks are the best potential reservoir rocks exhibiting vuggy porosities greater than 10% and good intergranular porosity.

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Bottom Currents During Early Winter on South Texas Continental Shelf: Implications for Shelf Sediment Transport

During a 42-day period in the early winter of 1981, bottom currents and temperature were measured by a current meter moored 2 m off bottom in 130 m of water on the south Texas continental shelf. During this time, nine cold fronts passed over the area, bringing about substantial changes in the overlying wind field. Particularly significant were the strong southeasterly winds that preceded several of the frontal passages. These wind events appear to have indirectly affected the bottom current velocity structure.

During the early part of the record, bottom currents averaged 10 cm/sec, with bursts up to 32 cm/sec. Flow was generally along the shelf to the southwest until late in the time series when net water motion changed abruptly to become southeasterly (toward deeper water). Current speeds then averaged 13 cm/sec with peaks of up to 26 cm/sec.

The cause of this unusual offshore bottom water motion is believed to be best understood by study of the bottom water temperature record. It is hypothesized that during the latter part of the record, when southeasterly winds were strongest, surface water was driven toward the coast. However, bottom water was advected in the opposite direction, resulting in coriolis-deflected offshore flow. A noticeable rise in the bottom water temperature accompanying this motion suggests advection of warmer coastal waters into deep water. Hydrographic surveys show a slight deepening of the thermocline at this time.

This time series is significant for several reasons. First, data on the current velocity field of the south Texas continental shelf is sparse. Second, the current speeds measured are for some periods in excess of that which, theoretically, is necessary for the transport of fine (3 ϕ) sand. Third, the record shows an apparent interaction between bottom currents and the overlying wind field.