AMBs ranged from 5 to 90 cm in diameter and were spherical to ovoid with alternating internal layers of clay and limestone clasts (lithologically identical to stream gravels). AMBs were most commonly found lodged in the upper 1-3 cm of the mudflow; a few lay in the stream bed adjacent to or downslope from the flow. The majority of AMBs were concentrated near the toe of the mudflow. AMBs appeared to have been produced by a combination of rolling along the stream channel and "rafting" by the mudflow.

Observation of the mudflow and AMBs after 10 hr of steady rainfall revealed the mudflow to be intact, but all except the largest AMBs were reduced to piles of limestone clasts lying on top of the mudflow.

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Hydrodynamic Systems of Orthoconic Nautiloid Cephalopods: Independent Check on Phylogeny

Seldom is it possible to use direct evidence of the physiology of extinct marine organisms as a means of investigating the phylogenetic relationships at any taxonomic level. Hydrodynamic mechanisms of orthoconic cephalopods are an exception because the form and structure of aragonite deposits used as hydrodynamic devices reflect the genetically controlled physiology of the animal. Data on cameral and siphuncular deposits (hydrodynamic devices) of Pennsylvanian (Desmoinesian/ Westphalian C) orthocones from the Boggy Formation (= Buckhorn asphalt) of southern Oklahoma provide a test of existing phylogenetic relationships established by standard paleontological methods. The analysis reveals that early growth stages of many taxa considered to be related at the family level have similar to identical morphologies of cameral deposits, while some do not. In all cases, the form of the cameral deposits changes among taxa during later growth stages. In one case, congeneric taxa are shown to belong to different genera on the basis of gross differences in deposits designed to function hydrodynamically.

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Depositional Facies, Diagenesis, and Reservoir Quality of Ivishak Sandstone (Sadlerochit Group), Prudhoe Bay Field

The Sadlerochit Group is a large fan-delta system comparable in size to the modern Kosi River wet alluvial fan of Nepal and India. Braided-stream processes distributed chert gravel and quartz and chert sand in radial fashion to construct the subaerial part of the fan delta. Fluvial energy, slope of the fan surface, and grain size decrease in a north to south basinward direction. There is also a decrease in scale of sedimentation units from source area seaward. Facies of the subaerial fan delta can be broadly categorized as midfan delta (alternating conglomerate and sandstone), distal fan-delta (chiefly sandstone), and abandoned channel-fill, overbank, and pond facies (mudstone, siltstone, fine-grained sandstone). Seaward of the subaerial fan delta are the delta-front and prodelta facies. Subaerial fan-delta and delta-front facies compose the Ivishak sandstone, which grades basinward into the Kavik shale, a prodelta facies. Diagenetic effects were gradually superimposed on the sediments deposited in the Sadlerochit fan-delta system. The sedimentary facies, and in particular their textural characteristics, seem to control the side and degree of diagenesis, including enhancement of porosity and permeability. Comparison of permeability trends among the facies of the Ivishak sandstone with permeability patterns displayed by unconsolidated sands with analogous grain size and texture, indicates that the general trends that existed in the Ivishak sediments are still recognizable in spite of the diagenetic overprint.

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Continental Slope Morphology in Northern Gulf of Mexico Mapped with Long-Range (GLORIA) Side-Scan Data

GLORIA II long-range side-scan data provide a mosaic of the continental slope in the northern Gulf of Mexico, seaward of the Texas-Louisiana coast. A swath as wide as 30 km and a 10% overlap of the data between parallel track lines provide a continuous picture of the complex slope morphology, which is largely controlled by salt deformation. Morphologic features range from piercement structures approximately 2 km in diameter to basins as much as 30 km across. The GLORIA data delineate the East Breaks submarine slide, where surface lineations are suggestive of deformation features. High-resolution 10 kHz seismic-reflection profiles indicate that the very irregular surface on the slide has a relief of 10 m. The 3 types of intraslope basins (blocked canyon, interdomal, and collapse) described by A. H. Bouma can be identified on the GLORIA data. The walls of Gyre basin, an example of a blocked canyon, have what are interpreted to be gullies, which are commonly associated with submarine canyons. Another basin downslope has similar gully-like features on the walls, which suggest that it may have been part of the original canyon system. Although many canyonlike features direct the movement of sediment downslope, the present data show that all conduits end in closed basins. No system of basins can be shown to transport sediment across the entire slope between the Mississippi Canyon and the East Breaks slide. Small-scale slumps, which can be identified on the flanks of some of the diapiric structures, also contribute sediments to basins such as Gyre basin.

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Near-Surface Methane Anomaly over Shallow Foley Gas Field, Baldwin County, Alabama

The shallow Miocene stratigraphic gas field discovered near Foley, Alabama, in late 1979, afforded an excellent opportunity to test whether gas from an accumulation seeps upward through overlying "impermeable" beds in adequate concentrations for detection in the near surface. In mid-1980, when this survey was done, several confirmation wells had been drilled, but the field was not yet producing.

Samples were collected from the bottom of 10-ft holes drilled on a rough 0.5 mi grid and were quickly sealed in gas-tight containers for later analysis. At several sites, sampling was done from grass roots down to 15-20 ft. At sites where the deeper samples had anomalous concentrations of gas, there was virtually no gas from the surface down to 6-8 ft. Below this, where anomalous gas concentrations were encountered, they tended to increase gradually downward. This confirmed previous conclusions that sampling for near-surface surveys should generally be done at 10 ft.

Gas contents of survey samples ranged from 3 to 87 parts per million by volume, and it was virtually all methane (i.e., identical with the gas at Foley). Probability plots revealed a background population with a mean of 10 parts per million, with values above 20 ppm being anomalous. The mapped and contoured anomaly has a striking correspondence to the outline of the field determined by later drilling. These results show that near-surface hydrocarbon surveys can sometimes detect microseepage from petroleum reservoirs and that such surveys can be valuable in exploration.

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Migration and Maturation of Hydrocarbons—Evidence from Fluid Inclusions

Oil-filled fluid inclusions occur in cements in petroleum reservoirs and are evidence for the generation and migration of hydrocarbons in a basin. Generally, oil-filled inclusions occur together with aqueous inclusions in the same cement crystal. Geothermetric studies of the aqueous inclusions provide thermal and compositional data pertinent to interpreting the time of cementation and hydrocarbon migration relative to source rock maturation.

Oil-filled inclusions occur both in random locations and in alignment with crystal cleavages or fractures. Random distributions of fluid inclusions suggest oil entrapment during growth of the cement crystal into primary porosity whereas the occurrence of fluid inclusions along sealed fractures suggests migration through secondary porosity. Generally, the oil-filled inclusions consist of liquid hydrocarbon and a gas phase, but inclusions containing oil, water, and gas also occur. Those different compositions suggest differences in the migration and mechanism of petroleum.