like silts and clays have provided considerable insight into the dynamics of sedimentary and mass-movement processes. Time-series measurements taken along the coast of Surinam using pressure-sensitive instruments indicate that periodic density variations may range in frequency from that of waves (~10 sec) to that of the tide (~12.4 hour). The density fluctuations are the result of sediment suspension, loss and gain of pore waters, and subaerial and subaqueous mass-movement processes.

In muds where density is less than 1.20 g/cc and water depth is less than 5 m, clouds of sediment are suspended as shallow-water waves propagate shoreward. Although suspended-sediment concentrations may reach 50,000 ppm under wave crests, rapid settling takes place before the next wave arrives. Wave-by-wave suspension is superimposed on a lower frequency process whereby accumulations of fluid mud up to 80 cm thick are suspended and redeposited during a tidal cycle.

In muds where density exceeds 1.20 g/cc, less than 1 cm of the bottom is suspended by incoming waves or by tidal currents. Measurements indicate that cyclic density variations result from pore-water loss during a falling tide followed by pore-water gains during a rising tide.

Spectral analysis shows the presence of a third frequency of density perturbation, typically 1 to 5 minutes, which we hypothesize to be the result of mass movement of fluid mud offshore. Observations on mud flats at low tide reveal well-formed shear planes bounding linear mudflow failure chutes. Sediment-flux determinations indicate that most of the estimated 2×10^8 m^3/year of sediment moved onshore by waves can be roughly balanced by a slow, periodic mass-movement offshore. The result may be a sawtoothed pattern of sediment movement to the northwest.

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Pore Systems in Jurassic Carbonate Reservoirs, United States Gulf Coast

Common pore types in Jurassic carbonate reservoirs in the Gulf Coast include lime grainstones of the Smackover Formation in southern Arkansas and northern Louisiana with interparticle and grain-moldic pore systems, dolomitized pelletal packstones, and grainstones from the Jay field in Alabama and Florida with mainly pelmoldic porosities, and Haynesville oolitic grainstones from east Texas with partial grain-moldic pores. Reservoir quality in all these examples is a function of both primary depositional and secondary diagenetic processes.

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Correlation of Subsurface Middle and Upper Devonian Rocks in Appalachian Basin

Widespread, highly radioactive Devonian shales in the Appalachian Basin contain abundant organic matter and commonly contain hydrocarbons that are sources of natural gas. The shales are gas-productive in eastern Kentucky and southwestern West Virginia. Correlation of subsurface shale units in the basin is difficult because of unconformities and complicated facies changes, but such correlation may lead to the location of additional amounts of gas.

A series of stratigraphic cross sections through the western half of the Appalachian Basin depicts the subsurface relations between tongues of dark shale on the east and massive thick shale units farther west.

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Effect of Biogenic Methane on Sediment Instability in Modern Delta Sediments

Biogenic methane is produced in rapidly deposited Mississippi delta sediments in concentrations sufficient to create excess pore pressures. These excess pressures, interacting with underconsolidated clays, can induce submarine mudslides and other phenomena which are hazardous to offshore platforms and pipelines. By utilizing a geochemical model for methane production, an estimate can be made of the total amount of gas that could be generated. Calculations of theoretical in-situ CH_4 were made on the basis of the concentrations of pressure-independent species, that is, dissolved SO_4^{2-} and dissolved inorganic carbon, in the pore waters of modern Mississippi delta sediments. The maximum theoretical CH_4 value was 4.65×10^5 ppm. Depth profiles of observed and theoretical CH_4 values were similar. From theoretical CH_4 concentrations and the pressure-solubility relationship, a maximum gas-pressure expression was developed. Gas pressures, P_o, attained a maximum value of 57.8×10^4 dynes cm^{-2} (8.5 psi) at the depth of 20.4 m below the sediment-water interface. Because of surface tension, in-situ P_o decreases with bubble size. However, near-maximum gas pressures may be released during storm waves, mudslides, or other changes in hydrostatic pressure, where bubble combination can occur. Gas pressures are important in decreasing the effective stress, especially in regions of rapid sediment deposition, and should be considered when implanting bottom-mounted structures.

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Early Pleistocene Submarine Canyon, Boso Peninsula, Japan

The Boso submarine canyon was one of the first "fossil" canyons to be described. It is also one of the best exposed, because careful quarrying of the economically useful gravel fill has exposed the noneconomic marly rocks into which the canyon was cut. These country rocks (Umegase Formation) are gently dipping, cream-colored siltstones and mudstones. In contrast, the canyon fill (Higashi-higasa Formation) consists of brown to yellow sandstones with marked lenses of polymodal and polymictic conglomerates (with small pebbles of granites, basalts, cherts, and basic tuffs from the Chichibu terrane and much larger clasts of marlstone up to 1 m in diameter). There are also some boulder beds and armored mud balls and many early Pleistocene shelly fossils. Within the canyon-fill sediments, there are some unusual water-escape structures.

The southern wall of the canyon is well exposed in a large quarry, where four "steps" occur in a vertical height of about 60 m. Upcanyon, these pass into fewer but higher "steps." Small overhangs caused by protruding bedding surfaces are original features, as gravel fill still adheres to the marly walls. Canyon downcutting toward the east is shown by widening of the present outcrop of the fill in that direction, and eastward-moving paleocurrents are indicated by boulder imbrication. Rapid downcutting and filling is suggested by the well-preserved wall overhangs, and channeling within the fill sediments suggests that the deeply cut canyon was filled by several successive influxes of sediment.

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Hydrocarbon Prospects in Basins West of United Kingdom and Eire

No abstract available.

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Assessing Oil and Gas Plays in Facies-Cycle Wedges

Oil and gas potentials of formations in frontier areas can be assessed by reference to formations in corresponding parts of facies-cycle wedges documented in producing areas. The transgressive-regressive facies-cycle wedge is a body of rock bounded above and below by regional unconformities or the tops of major nonmarine tongues. The ideal wedge includes, from base to top, facies successions from nonmarine, to coarse (sandstone or grain carbonate), to fine (shale or micrite), to coarse, and back to nonmarine. Different types of potential coarse reservoir formations (plays) are identified by their distinctive vertical facies successions within this cycle: *wedge base*, fine over coarse (potential reservoir) over nonmarine; *wedge middle*, fine over coarse over fine; *wedge top*, nonmarine over coarse over fine; *wedge edge*, nonmarine over coarse over nonmarine; and a special category, *subunconformity*, which includes any truncated part of a wedge unconformably underlying another wedge. These play types have distinctively different spatial relations between their coarse reservoir facies and their fine oil-source and seal facies. Different wedge positions thus typically have different hydrocarbon potentials; within each position, however, there are also large ranges of potentials related to variations in source richness, reservoir quality, or trap capacity. As a result, the assessment procedures for new plays have three critical steps: (1) selecting look-alike productive plays of the same wedge position; (2) scaling the potential hydrocarbon yield to compensate for obvious differences in thickness, areal extent, etc; and (3) risking the results for other factors that might render the new plays nonproductive.

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Braided-Stream Processes and Facies in Modern Arc-Trench Gap, Southwestern Guatemala

Modern fluvial processes and facies in arc-trench gaps have been little studied even though prograding coastal-plain sequences may be the dominant facies in parts of ancient arc-trench gaps underlain by continental crust. The Pacific coastal plain in Guatemala is abruptly terminated 25 to 60 km inland from the Pacific shoreline by the steep slopes of an active Quaternary volcanic arc. The volcanic slopes are locally bare of vegetation and, in response to strongly seasonal torrential rainfall, provide abundant bed load to high-gradient, low-sinuosity braided streams that discharge onto the coastal plain and flow, in a roughly parallel pattern, into the Pacific.

Studies of the Rio Samala reveal systematic downstream changes in cross-channel bed-relief index (from 8.2 to 1.3), maximum particle size (from 180 cm to 6.4 cm), and facies composition. The dominant facies, in a tract from proximal to distal, are: proximal (0 to 17 km)—crudely bedded gravel that records flood-event processes associated with longitudinal-bar and boulder-string formation, as well as channel scour and plugging; mid-distal (17 to 40 km)—horizontally stratified sand deposited by flat-bed accretion in channels and on bars; and distal (40 to 53 km)—trough and tabular cross-stratified sand produced by migration of dunes and foreset bars. These facies characterize, respectively, the Scott-, Bijou-, and Platte-type braided-stream vertical sequences described by Miall.

Recognition of similar downslope changes in braided-stream sequences deposited in ancient arc-trench gaps should enhance interpretation of proximity to source, direction of paleoslope, shoreline trend, and trench orientation.

WHITE, WILLIAM A., THOMAS C. GUSTAVSON, J. H. MCGOWEN, and ROBERT A. MORTON, Bur. Econ. Geol., Austin, Tex.

Map Display Formats for Environmental Geologic and Related Data

A variety of map formats can display basic geologic and related environmental data derived from aerial photographs, detailed field investigations, and published and unpublished studies. These depictions provide information on natural environments for various types of environmental maps directed toward selected uses and audiences. Examples include:

1. Geology and Natural Environments of Padre Island National Seashore, Texas, which employs a typical map format of colors, symbols, and written descriptions to show the location and distribution of barrier-island and lagoon environments. Color photographs of each mapped environment provide visual reference for the intended popular audience composed of National Seashore visitors.

2. Sediment Distribution, Bathymetry, Faults, and Salt Diapirs: Submerged Lands of Texas, Galveston-Houston Sheet, which displays surficial sediments, water depth, and structural features using contours, colors, and symbols, with colors keyed to a unique color-coded