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"Sticky" Muds—Viscosity of Estuarine Sediments

Many viscosity measurements were made on samples of "fluid mud" from the Rappahannock River of the Chesapeake Bay system with an eight-speed rotational viscometer. Measurements were made directly in the core liner immediately on retrieval aboard ship; in the laboratory under various conditions of salinity, concentration, and temperature; and under conditions of slow sedimentation where the changing sediment density was simultaneously monitored with a nuclear density sensor.

Rheograms developed over a broad range of shear showed that the mud exhibits non-Newtonian behavior, usually pseudoplastic but occasionally dilatant, depending on settling time, concentration, and interstitial water salinity. At times both pseudoplastic and dilatant behavior were observed in the same sample at differing rates of shear. During increasing shear the apparent viscosity profile usually exhibited its highest values and most variable behavior. During decreasing rates of shear, the profile generally showed a hysteresis effect, indicating the mud to be thixotropic.

Differences in rheological behavior were noted between samples from the fresh, intermediate, and highest salinity reaches of the estuary. A steep decrease, followed by an abrupt increase in apparent viscosity at low shear rates, seemed to be common in intermediate-salinity reaches (2 to 8 parts per thousand), but similar behavior was rare in samples from freshwater and high-salinity reaches. This "viscosity notch" may help to explain the sudden burst of suspended sediment that has been observed as occurring off the bottom, just after slack water in intermediate-salinity reaches in the Rappahannock.

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Carbon-Isotope Measurements of Hydrocarbons Adsorbed in Near-Surface Sediments

No abstract available.

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Recent Arthropod Lebensspuren as Indicators of Ancient Flood-Plain Deposition

Despite the relatively more rare occurrence of trace fossils in nonmarine than marine rocks, insect and spider-produced burrows may have considerable local importance in distinguishing between channel, flood-plain, and upland depositional environments. The recent North American insect and spider fauna includes members of 8 orders and 31 families that make subterranean shafts (vertical or inclined), tunnels (horizontal), or cells (chambers) capable of fossilization. Many of these lebensspuren show great morphologic similarity although they were produced by taxonomically dissimilar arthropods, thus severely limiting the ability of either geologists or entomologists to relate individual lebensspuren to their makers.

Nonetheless, the density and diversity of arthropod lebensspuren in moist flood-plain substrates appear to be much higher than in either channels or uplands. Furthermore, the probability of preservation of arthropod burrows in areas of deposition (flood plains) greatly exceeds the probability of their preservation in areas of erosion (channels and uplands). However, as yet we are unaware of any recent preservable insect or spider-produced burrow types that are confined to either flood plains on uplands; our investigation of lebensspuren in recent and ancient channel deposits is still preliminary. Conversely, we have numerous meniscate (backfilled) tunnels and shafts from an ash lens of presumed flood-plain origin in the Miocene of western Nebraska for which there appear to be no recent analogs.

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High-Resolution Seismic Work as Tool to Locate Stratigraphic Traps

The seismic reflection method is a well-established tool in the exploration for structures but is little used by the average geologist for stratigraphic analysis.

High-resolution stratigraphic profiling is a greatly scaled-down version of the technique employed in most exploration operations. A field crew consists of about six men, a small drill, a portable digital recording unit, cables, and downhole detectors. Very small dynamite shots are taken every 15 to 35 ft (5 to 10 m) along the traverse line. At each new shot point a new "pseudo" acoustic log is produced which subsequently will be correlated with borehole logs and other "pseudo" logs.

The digital recordings from each shot are then computer processed to enhance the high-frequency characteristics of the logs, compensate for variations in overlying rock velocity, and correct the logs for irregularities introduced by changes in near-surface geology and elevation along the traverse. The computer output data are integrated with borehole information prior to interpretation. Use of these seismic "pseudo" logs aids the geologists by defining more precisely the subsurface stratigraphy between boreholes and beyond wells.

The structural information derivable from the log displays includes, in addition to the location of very small faults, sand channels, and shale-outs, such information as the unique identification, thickness, and lateral persistence of particular reservoir beds.

Geologic identification of potential reservoir rock types using seismic wavelet characteristics or log-shape changes is an extremely useful supplement to the structural or purely correlative aspects of seismic-log profiling. Shape variations in the log traces can provide valuable information regarding localized depositional environments, pore-fluid characteristics, and even porosity and permeability variations across a given prospect area once a local reference has been established.

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Generation and Occlusion of Porosity in Chalk Reservoirs

Prolific hydrocarbon production from chalk reser-