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Model for Interstitial Sulfate Reduction and Methane Production

Interstitial sulfate and methane profiles measured from a piston core taken near the Mississippi River mouth indicate that sulfate is reduced to near-zero concentrations between 1.5 and 2.0 m depth and that methane consequently increases. In the sulfate-reducing zone, $\delta^{13}C$ values of the methane decrease downward from -53 to -80 parts per thousand versus PDB. From these observations, a comprehensive kinetic model has been developed incorporating the effects of diffusion, the sediment accumulation, and the effects of bacteria on sulfate and methane. The model, in which isotopic variations of methane are considered to be the key, indicates that methane is microbially consumed in the sulfate-reducing zone and is extensively produced below the zero-sulfate depth. Rates of production and consumption of methane, as well as reduction rates of sulfate, can be estimated from the model.

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Environmental Geology of Continental Margin Off Central and South Texas in Atlas Format

Integrated environmental studies keyed to understanding fundamental processes and their interrelations were conducted from 1974 through 1977. Most of the aspects investigated were sampled seasonally to provide data on variations within each year and among the 3 years studied.

The geologic and related hydrographic, biologic, and chemical data have been compiled in an atlas format consisting of topical overlays so that interrelations are apparent. Three atlases, each covering a geographic area of $2° \times 1°$, have been completed: Port Isabel, Corpus Christi, and Beeville. Each, in addition to bathymetry and the lease-block grid, consists of seven topical maps: location of oil and gas fields and production installations; water circulation and rates of sedimentation; trace-metals content and texture of surficial bottom sediments (plus seasonal variations); nature of shallow subsurface sediments and biogeology; post-Wisconsin sedimentation patterns and tectonism; late Pleistocene and Holocene depositional environments; and structure of the continental terrace with emphasis on the chronology of faulting and seafloor stability.

Results of the study indicate that water circulation is strongly seasonal, but both local variations and differences in surface and bottom movement are evident. Sedimentation rates have been relatively high throughout the Holocene, averaging almost 1 m/1,000 years; rates now are as much as 9 mm/year locally, based on ^{210}Pb dating. Seasonal differences in both the texture and trace-metals content of surficial bottom sediments are characteristic and probably can be related to variations in infaunal activity and movement of bottom sediments. Faulting has migrated progressively seaward across the shelf with time; movement during the Holocene has been mainly near the shelf edge. Slumping has been extensive along parts of the outer shelf and on the upper continental slope.

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Lithofacies Analysis of Castile Formation, Delaware Basin, Texas and New Mexico

Walther's law of correlation of facies can be illustrated by the facies associations of the Castile Formation (Upper Permian) in the Delaware basin of Texas and New Mexico. Two major stratigraphic successions are represented by two lithofacies composed of calcite-anhydrite laminations in the western part of the basin intercalated with carbonate-laminated, anhydrite-halite bands in the eastern two-thirds of the basin. Organically rich layers are common to all the laminae types. The laminations were formed simultaneously over a large area of the basin at a relatively constant rate. The alternating laminae of the two components forming side by side in the two lithotopes (areas of uniform deposition) are interpreted as representing an annual layer of sedimentation, a varve. The lateral and vertical persistence of the varves provides the best model of rock correlation where time lines are well established by applying statistical-correlation techniques to stratigraphically correlated laminations. All the primary characteristics of the two lithofacies—their gross appearance, sonic and electric-log properties, trace-element contents, petrologic variations, and component associations—are significant in determining the depositional environment of the Delaware basin.

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Melamocyrillium—New Acritarch Genus from Kwagunt Formation (Late Precambrian), Chuar Group, Grand Canyon Supergroup, Arizona

Distinctive, well-preserved, and abundant microfossils of uncertain taxonomic and biologic affinity have been discovered in acid-resistant residues and thin sections from shales of the Walcott Member of the Kwagunt Formation (late Precambrian) of the eastern Grand Canyon, Arizona. These forms are referred to the new acritarch genus *Melamocyrillium*; however, these present forms are morphologically different from previously reported acritarch genera and do not comply with any existing, suprageneric, acritarch classification scheme. Melamocyrillids are organic-walled, opaque, unilocular and apparently unicellular, bulbous- to lachrymiform-shaped, vesicular, solitary microfossils. They range from 32 to 170 μm in length and have a length-to-width ratio ranging from 1.0:1 to 2.7:1 ($N = 600$). Symmetry is bilateral or, more rarely, radial (longitudinal axis of symmetry). Furrows, basal scars, and evidence of surficial processes are lacking; chain and colonial forms are absent. The wall is dense, thick (5 to 7 μm), apparently unilayered, and has a psilate to faintly microgranular texture. Excystment is by a pylome. Three species are recognized: *M. fimbriatum* is characterized by a fringe which skirts the oral end; *M. hexodiadema* has an ele-