and soft, but durable calcareous lithologies are selected by chemical borers requiring a carbonate substrate. Places with relatively stable environmental conditions, such as the upper walls of submarine canyons, exhibit a diverse community of bioeroders. Their activities are responsible for a system of borings penetrating several decimeters into the rocks.

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STABLE CARBON ISOTOPE INVESTIGATION OF NATURAL GASES FROM SACRAMENTO AND DELAWARE-VAL VERDE BASINS—POSSIBLE IGNEOUS ORIGIN

Investigations of chemical and stable carbon isotopic character of gases from major fields in the Sacramento basin, California, and the Delaware–Val Verde basins of West Texas and New Mexico indicate a strong possibility of a high-temperature, igneous-type origin for some of these gases.

Geomagnetic surveys of the Sacramento basin indicate the occurrence of 2 types of volcanics. Thin, near surface flows and deep-seated basalt plugs are observed which appear to be related to the occurrence of gas in the basin.

Analysis of coproduced methane and carbon dioxide from a given well yields information concerning the thermal history of the gas. Isotopic equilibrium or quenching temperatures were determined and interpreted on a regional basis.

Gases from the Sacramento Valley are produced from sandstone lenses in alluvial fan-type deposits from Late Cretaceous to Eocene in age. In the south-central part of the basin, the Marysville Buttes constitute a topographic break which has a volcanic plug jutting about 2,000 ft above the surrounding country. Considerable amounts of gas have been produced from sandstone bordering this feature. Secondary folds and faults attending the intrusion exist at a radius of several miles from the core. Gases produced in wells surrounding this cylindrical shaft of igneous rock exhibit a temperature dependence as a function of the distance of production from the central core.

Delaware and Val Verde basin gases from the deep Ellenburger and Devonian formations are dry and composed almost entirely of methane and carbon dioxide. The basin gas data suggest a possible igneous origin, centered about the Marathon thrust zone of the Ouachita structural belt to the southwest.

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GEOCHEMISTRY OF CAYMAN TRENCH SEDIMENTS

The petrology of deep-sea sediments north of Jamaica and in the central Cayman Trench may be interpreted in terms of 2 basic sediment components, namely, the carbonate and terrigenous fractions.

On the basis of trace-metal concentrations, the carbonate fraction shows considerable variability both laterally and vertically. Evidence suggests that the carbonates were derived from shallow-water, benthic environments as well as pelagic organisms. Both geochemical and sedimentologic characteristics indicate that the carbonate fraction has undergone resedimentation. Foraminifera make up a significant percentage of many of the graded, turbidite sand layers.

The terrigenous component of the central Cayman Trench shows higher concentrations of cobalt, copper, chromium, lithium, manganese, nickel, and rubidium than those in the trench north of Jamaica. Lead concentrations, however, are higher in the terrigenous component of the latter area. This suggests that at least 2 sources of terrigenous sediment of distinctly different trace element chemistry supply the Cayman Trench in these different regions.

The overall chemistry is indicative of variable sources for both the carbonate and terrigenous fractions. This is supported by the general petrology and sedimentologic evidence of mixing and resedimentation.

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MICROBIOLOGIC ALTERATION OF CRUDE OIL IN MUDDY SANDSTONE AND OTHER RESERVOIRS

Loss of paraffin wax constituents from crude oil has been attributed by some investigators to microbiologic activity in the reservoir, but until now no significant evidence supporting this hypothesis has been reported. Gas chromatographic and mass spectral data now indicate that a highly selective loss of n-paraffins has occurred in some oils. A classic example of selective n-paraffin removal is found in the Cretaceous Muddy reservoir at Bell Creek field, Montana. Occurring within the same reservoir system are (1) oil showing no loss of n-paraffins, (2) oil with all n-paraffins missing up to about n-C_{17}, but unaffected above n-C_{17}, and (3) oil with the entire range of n-paraffins missing. A microbiologic process seems to be the only logical explanation for such high selectivity. Surface recharge waters apparently transport aerobic microorganisms along with the necessary oxygen to accessible reservoirs. Other evidence for microbial activity at Bell Creek includes increase in nitrogen content and optical rotation disproportionate to n-paraffin loss, suggestive of addition of microbially produced materials to an altered oil. Optical rotation, carbon isotope, and mass spectral data obtained on distillation fractions of Muddy oil from Whitetail field, near Bell Creek, provide direct evidence that components are being added to the oil by microbial activity. In East and West Hackberry fields, Louisiana, there is evidence that some branched as well as straight-chain hydrocarbons have been microbially destroyed. Examples of microbial alteration have been found in most oil-producing areas of the world.

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PLIO-PLEISTOCENE GEOLOGY, OUTER CONTINENTAL SHELF, LOUISIANA AND TEXAS

Pliocene and Pleistocene deposition on the outer continental shelf and upper continental slope offshore from Louisiana and Texas was a continuation of the process of prograding deltaic sedimentation with associated hydrocarbon accumulation that has been active in the northern Gulf of Mexico since the end of the Cretaceous. However, this more recent phase of the geologic history of the northern Gulf of Mexico basin differs from the earlier Tertiary history of the area in several significant aspects.