eas where positive changes to the limits might be expected, and (4) obtain "directionality" from the forecast.

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Effects of an Offshore Drilling Mud on Selected Corals

Seven species of coral—*Dichocoenia stokesii, Montastrea annularis, Agaricia agaricites, Acropora cervicornis, Porites furcata, P. astreodes,* and *P. divercata*—were experimentally exposed to three concentrations of drilling mud obtained from an offshore oil well in the Gulf of Mexico. The whole mud, collected from the mud pit of a well at a drilling depth of 4,000 m, was diluted with seawater to produce concentrations of 100, 316, and 1,000 μL/L. Corals were exposed to each of the three concentrations and control seawater for 96 hours to observe behavioral response. Response to drilling-mud concentrations was measured as percent of polyps retracted. Some experiments were conducted in laboratory aquaria with Gulf Stream water, but the most significant experiments were conducted at Carysfort Reef, Florida Keys, using similar aquaria located in 3 m of water. Polyp behavior was determined with serial close-up photography which allowed counting of retracted, partially retracted, and nonretracted polyps in each colony.

All species except *Montastrea annularis* and *Agaricia agaricites* survived exposure to 1,000-μL/L mud during the period of testing. In two tests with *Acropora cervicornis,* one group survived exposure to the mud and the other died. All other corals except *Dichocoenia stokesii* and *Porites divercata* showed significant ($p<0.05$) polyp retraction during exposure to 100-μL/L mud concentration, whereas 316-μL/L mud was the minimum concentration which induced significant polyp retraction in *Porites divercata.* Polyps of *Dichocoenia stokesii* did not react to any of the three concentrations.

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Light Hydrocarbons of Petroleum; Internal Evidence of Thermal History

A diverse suite of 76 oils was analyzed for light $C_4$ to $C_7$ hydrocarbons (LHC). Indices of paraffinicity, termed the "heptane value" (HV) and "isoheptane value" (IV) were examined. These paraffin-to-naphthene concentration ratios had provided reliable measures of the catagenetic grade of sedimentary rocks, also a means of determining paleotemperatures, employing autochthonous LHC. The goal of the present study was an assessment of the conditions of generation of oil.

Heptane values in the sampled oils range from 0.5 to 60.9, but possess a near-normal distribution. The principal group (31 samples, 41%) is within the range 18.0 to 22.0. The modal class (HV 19.0 to 20.0) comprises 14%. The isoheptane value is similarly distributed about a modal class (18%) of 0.90 to 1.0. It is concluded that most oils retain evidence of generation in an extremely limited range of subsurface temperatures. The temperatures are of the order of 280 to 300°F (138 to 149°C), assessed from curves relating HV and IV to maximum-attained subsurface temperature for sediments bearing aliphatic, petroleum-source kerogens.

The oils of the principal group (HV 18.0 to 22.0) are termed "normal, paraffinic." Twenty percent of the analyzed oils are naphthenic (HV 0.0 to 18.0). Their compositions differ from those of low-temperature sediment extracts: they are identified as biodegraded, not immature, oils. Forty percent of the oils have an HV exceeding 22.0 (mature oils); some exceed 30.0 (supermature oils). Both classes have undergone protracted heating. The analytic methods and parameters provide a scheme of oil classification containing substantial geologic information. In addition, the plot of HV versus IV for sediment extracts provides clear distinction between aromatic, coaly kerogens and aliphatic, sapropelic kerogens.

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Exploration Research Along Ardmore-Anadarko Basin Trend

Consideration of southern Oklahoma geologic history in the context of plate-tectonic analogies to present continental margins suggests several avenues of investigation that help explain some oil and gas accumulations and could lead to more discoveries. Postulated origin as the abandoned arm (aulacogen) of a rift triple junction in the late Precambrian and early Paleozoic suggests the potential for fault-controlled sedimentation and early generation of oil and gas by magmatic heating. Collision-related late Paleozoic deformation suggests displacement of early Paleozoic reservoirs by wrench faulting and the formation of traps by wrench-controlled thrust faulting. The search for fracture reservoirs involves facies relationships to the precollision continental margin, fracturing during collision, and prediction of open fractures based on stress orientation related to formation of the Gulf of Mexico. Position of the early Paleozoic continental margin with its unrealized potential for oil and gas accumulation remains an enigma concealed by late Paleozoic emplacement of the Ouachita thrust complex unknown distances over the edge of the early Paleozoic continental edge and subsequent burial by Mesozoic sediment during formation of the Gulf of Mexico.

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Oil and Gas Resource Appraisal—State of the Art

The art of appraising oil and gas resources has been maturing rapidly during the past few years. This welcome development has come about because of a growing awareness that petroleum resource estimates are required for the development of reasonable energy policies and long-range plans.

Published appraisals of oil and gas resources in the United States date back at least 70 years. Since that time many estimates have been made available to the public. In the 20-year period following 1955 the amounts resulting from these appraisals varied widely,