POSSIBLE GROUNDWATER INFLUENCE ON HABITAT OF OIL IN GULF COAST

Within the geologic setting of the Gulf Coast the regional movement seaward of groundwater has a significant effect on some phases of oil and gas movement and concentration. Evidence indicates that the beginning of hydrocarbon formation comes fairly soon after deposition of the sediments.

The effects of groundwater on oil or gas accumulation may be separated into two categories: (1) accumulation in shallow, relatively unconsolidated sediments with a high water content, and (2) accumulation at greater depths where shale is at least moderately compacted and where fluid movement is mainly through sandstone, siltstone or permeable carbonate rocks. Evidence of the effects of groundwater in the first case must come mainly from studies of modern sediments and from groundwater hydrology and geochemistry. In the second case, the evidence rests on data from all phases of subsurface geology and from the history as well as the distribution of hydrocarbon reservoirs, both structural and stratigraphic.

An increased understanding of both of these categories of groundwater effects on oil or gas concentration should result in a concomitant increase in exploration efficiency and success.

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ORGANIC CARBON δ C^{13} VALUES FROM QUATERNARY MARINE SEQUENCES IN GULF OF MEXICO: A REFLECTION OF PALEOTEMPERATURE CHANGES

Variations in stable carbon isotope ratio values on combustible organic matter in Gulf of Mexico sediments correlate with Pleistocene warm and cold climates. Warm stages are characterized by C^{13}/C^{12} isotopic ratios of -20 to -22°/oo, compared with the PDB standard, whereas colder stages are characterized by -24 to -26°/oo.

Piston core samples from the present bottom show similar δ C^{13} values (-20 to -22°/oo) characterizing the warm post-glacial period regardless of bathymetric environment (shelf, slope, or abyss) except where relict Pleistocene sediments crop out (-24 to -26°/oo). Sedimentation patterns and paleontology confirm the relict nature of the latter. Samples from 1,000-ft cores on the present slope represent post-Pliocene sequences; δ C^{13} values alternate from more positive to more negative. These alternations from about -21°/oo to -25°/oo coincide with the glacial-inter-glacial stages which are independently identified by planktonic Foraminifera.

Interpretations of the data lead to the conclusion that the principal reason for the observed correlations is variation of water temperatures in the photosynthetic zone during warm interglacial climates and during cooler glacial climates. There are other alternative processes which could affect the data, one of which, the relative contribution of terrestrially-derived organic matter versus marine-derived organic matter, would change the δ C^{13} values in the same relative direction as the water-temperature variation. Thus, it is not possible to unequivocally interpret the contributions of different processes for individual samples.

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GEOCHEMISTRY OF URANIUM IN CARIACO TRENCH

The geochemistry of uranium and thorium isotopes and of protactinium was investigated in cores from the Cariaco Trench. Though the sediments could not be dated, they showed some features characteristic to anoxic basins. Uranium is a very valuable marker for geologic events.

Core P6603-2, taken at a depth of 940 m, at 10°25′N long., 64°38′W lat., spans the upper Pleistocene. At 356 cm there is a sharp break between the laminated sediments above and a homogeneous clay below. The uranium content shows a significant change at the 354–359 cm interval. The uranium present in this narrow band is only a third to a quarter of that found in the sediments above and below, whereas the thorium and protactinium contents remain constant.

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URANIUM GEOCHEMISTRY OF GULF OF MEXICO

The economic importance, the dissimilarity in chemical behavior of its two oxidation states, and the unique usefulness of its radioactive daughter products make uranium and its geochemistry extremely interesting to earth scientists. The Gulf of Mexico has the attractive feature of being a semi-closed system that offers the possibility of complete monitoring of all input and removal processes for trace elements such as uranium. Experimental values obtained in this study of the geochemical cycle of uranium in the Gulf of Mexico are as follows:

Ranges of Amounts and Isotopic Composition of Uranium

Type of Sample	*Uranium Concentration* $\times 10^{-6}$ g l	*Isotopic Composition* A_U^{235}/A_U^{238}
Gulf of Mexico profiles of surface to 3,600 m	3.4 → 3.6 ± 0.2	1.14 → 1.18 ± .03
Estuaries and bays along Gulf Coast	2.1 → 17.3 ± 0.2	1.12 → 1.54 ± .04
Midwest rivers	0.6 → 3.0 ± 0.2	1.01 → 1.44 ± .04

High uranium concentrations in midwest USA rivers relative to other rivers of the world can be explained by solubilization of the uranium in phosphate fertilizers applied to the land surface. Estimated pre-fertilizer uranium input to the Gulf of Mexico is nearly balanced by uranium co-deposition with carbonates on the Yucatan shelf.

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PLEISTOCENE DISCOASTERS FROM STRATOTYPE OF CALABRIAN STAGE (SANTA MARIA DI CATANZARO) AND SECTION AT LE CASTELLA, ITALY

Strata exposed near the town of Santa Maria di Catanzaro in southern Italy is the accepted stratotype for the Calabrian Stage (earliest Pleistocene). Although a Pliocene-Pleistocene boundary has been discussed as

occurring in the section at nearby Le Castella, the results of the present study indicate that none of the earliest Calabrian is exposed at that locality. Most of the Quaternary section exposed at Le Castella is younger than the youngest sediment exposed at Santa Maria di Catanzaro.

At Santa Maria di Catanzaro, the range of *Discoaster brouweri* Tan Sin Hok was found to be concurrent with the planktonic foraminiferal species *Globorotalia truncatulinoides* (d'Orbigny). Most of the section represents cooler water deposition.

At Le Castella, most of the exposed Quaternary sediments represent warmer water deposition (Emilian = "late warm Calabrian"), with cooler water deposition represented near the top (Sicilian). At Le Castella, the range of *Discoaster brouweri* Tan Sin Hok was found to be concurrent with *Gephyrocapsa caribbeanica* Boudreaux and Hay.

The Calabrian at Santa Maria di Catanzaro, with the presence of both *Discoaster brouweri* and *Globorotalia truncatulinoides* in section deposited in cooler water, correlates very well with the American marine Nebraskan. The Emilian at Le Castella, with the occurrence of both *Discoaster brouweri* and *Gephyrocapsa* in section deposited in warmer water, is equivalent to the American marine Aftonian.

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SURFACE AND SUBSURFACE MORPHOLOGY OF TWO SMALL AREAS OF BLAKE PLATEAU[1]

A detailed seismic profiler, bottom sampling, and bottom photographic study reveal considerable information about the surface and subsurface morphology of two small areas on the Blake Plateau. The northern area is a N-S-trending depression (32°N, 77°30'W) near the continental slope, and the southern area is defined by a narrow NE-SW linear depression (30°50'N, 78°30'W). Both of these topographic features are erosional in origin; subsurface strata crop out on the sides of the depressions. The north-south depression is flanked by numerous biohermal coral banks that have developed above the flat underlying strata. Sediments in the vicinity of these banks are dominated by coral fragments, particularly *Dendrophyllia*. With increasing distance from the banks the sediment becomes primarily a *Globigerina* sand and ooze, with varying amounts of pteropods. The distinctive sediment components in the southern depression area are manganese and phosphorite slabs and nodules; coral banks and coral sediment are practically absent. Indurated slabs of *Globigerina* "sandstone" are locally common in both depression areas, and are believed to be restricted to the uppermost sedimentary strata and to have been lithified at present depths.

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DIAGENETIC PATTERNS IN SUBSURFACE BAHAMAN ROCKS, SAN SALVADOR ISLAND

A 550-ft continuous core from San Salvador allows detailed study of depositional and diagenetic facies patterns with depth. From the surface to about 25 ft, the rocks are oölites and oölitically coated intraclasts, cleanly washed and bedded. Below, to about 80 ft, the rock is grain supported, less well sorted, unbedded, and contains no coating. The rock is vuggy, with drusy calcite lining vugs at certain intervals. Similar transitions from bedded oölite to vuggy lagoonal facies have been cited at roughly this depth from other islands. Allochems are intraclasts and skeletal material, mostly mollusks, miliolid and peneroplid foraminifers, red algae, and *Halimeda* plates. Burrowing is evident below 55 ft. The rocks are sparites, but some mud matrix is present sporadically. From 80 to 110 ft, the rock is micrite or pelmicrite, the few scattered fossils are foraminifers and red algae. Pelmicrites predominate through the rest of the core; below 110 ft extensive dolomitization has occurred.

Cementation, leaching of cryptocrystalline grains and infill by drusy calcite, neomorphism of cryptocrystalline grains to microspar, loss of aragonite, and concurrent loss of Sr increase with depth. Stable isotope analyses show δ O^{18} and δ C^{13} becoming progressively more negative with depth. Fe concentration shows a peak at 90 ft and is probably indicative of major pedogenesis.

Thin sections show some of the difficulties associated with attempting to differentiate pore-precipitated calcite spar from neomorphic spar in grain-supported rocks which contain some mud matrix. This difficulty is heightened by the "micritization" of allochems, diffusing into the spar cement.

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VIRTUES AND VICES OF PALEOMAGNETIC METHOD AS APPLIED TO MARINE SEDIMENTARY CORES

The geomagnetic polarity has changed irregularly at least 20 times during the last 5 m.y. These polarity changes are worldwide synchronous events and are readily recorded by most sediments of fine silt or smaller size. For reasons which are not clearly understood, polarity and faunal changes sometimes occurred simultaneously. It follows that the paleomagnetic method is a very powerful technique for resolution of Plio-Pleistocene stratigraphic problems.

Like many new techniques, the method is susceptible to misapplication. The misapplication may result from lack of consideration of (a) variable deposition rates, (b) disconformities and unconformities, (c) faunal redeposition, (d) magnetic recording lag of consolidating sediment, (e) imperfectly defined polarity history, (f) limitations of unoriented cores in low latitudes, and (g) experimental difficulties. Results from continuing studies of deep-sea sedimentary cores from the South Pacific illustrate some of the difficulties.

It is concluded that the study of paleomagnetism in marine sedimentary cores parallels the earliest conventional stratigraphic methods, in that integration of several disciplines is required for efficient and reliable exploitation of the technique.

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STRUCTURAL RELATIONS BETWEEN LESSER ANTILLES, VENEZUELA, AND TRINIDAD-TOBAGO

More than 2,500 nautical mi of seismic-reflection profiling, gravity, magnetic and bathymetric data were collected in 1968 by the ESSA Coast & Geodetic Survey ship *Discoverer*.

[1] Contribution No. 2347 of the Woods Hole Oceanographic Institution.