ENVIRONMENTAL/ENGINEERING GEOLOGISTS—DINNER MEETING FEBRUARY 9, 1988

ROBERT A. YOUNG—Biographical Sketch

Dr. Young received his B.S. degree in geology from Brooklyn College (1969), and his M.S. and Ph.D. degrees in oceanography and marine geology from the Massachusetts Institute of Technology-Woods Hole Oceanographic Institute Joint Program (1975).

Dr. Young formed Environmental Geo-Sciences, Inc. (EGS) after twelve years of diverse experience gained at Exxon Production Research Co., NOAA's Atlantic Oceanographic and Meterological Labs (AOML) and the University of Miami. As President, he is responsible for overall administrative and technical management at EGS.

Dr. Young's marine geological and geophysical experience includes supervision and technical participation in data collection and interpretation for numerous offshore geological engineering and geohazard studies. These studies include both regional and site specific assessments of such features as soil conditions, subbottom structure, seafloor stability and potential seismicity. Study areas include the shallow and deep Gulf of Mexico, west and east coasts of the U.S., and several overseas areas.

Dr. Young has been extensively involved in environmental geological and oceanographic studies on continental margins. Many were offshore engineering studies where bottom stability and shallow geologic structure and stratigraphy were important considerations. While at AOML, he led a particle-associated pollutant research program to determine dispersion pathways on the shelf, and was the principal U.S. investigator for a shelf sediment dynamics program run jointly with Spain. Research included studies of dredge spoil stability, sand mining effects, environmental impacts of solid waste disposal, and coastal development. Recent activities include coordination of geologic studies related to permitting activities for an onshore solid waste landfill, and facies analysis for oil exploitation prospects.

Dr. Young is a member of AAPG, HGS, SEG and Sigma Xi. He has authored numerous papers on sediment transport dynamics, shallow seafloor stability, and geologic features of the continental margins and has supervised graduate students and taught in universities.

SHALLOW GEOHAZARDS ON THE CONTINENTAL MARGIN

Oil exploration in the Gulf Coast began in the knee-deep bayous and coastal marshes of the southeastern U.S. earlier this century and has since moved steadily offshore. During this period geologists and soils engineers shared the challenging task of acquiring and interpreting near-surface geological and geotechnical data in increasingly remote and unfriendly seas. The geological complexity of the northern Gulf's continental margin adds another degree of difficulty to the problem of interpretation.

The federal government's Minerals Management Service requires specific types of geological surveys within all areas leased for oil exploration. These surveys identify and sometimes quantify geologic or manmade drilling hazards or constraints prior to issuance of an exploration drilling permit. Typical instruments used during the survey include depth sounder, magnetometer (to detect pipelines or other artifacts), side-scan sonar, shallow subbottom profiler, and a medium penetration, multi-channel (or analog) seismic profiler. In shallow waters, a separate report describing the potential for preservation of archaeological features is also required and uses some of the same data acquired for the geohazard survey.

Understandings between industry and regulatory agencies balance what is essential against the technically feasible. This helps avoid unnecessarily high survey costs and minimizes the environmental risks of drilling. Besides fulfilling government requirements, oil companies benefit from these studies in other ways; geologic and geotechnical information from geohazard studies are used in the design and placement of bottom-founded production structures.

Geologic settings for exploration on the U.S. continental margin in the Gulf of Mexico include the broad carbonate margin off Florida, the mixed carbonate/clastic area off northern Florida to Mississippi, the Mississippi Delta area, and the mainly clastic Louisiana-Texas margin. Geologic conditions in the east Texas to Louisiana shelf sector have been studied by government, industry and university researchers and are relatively well known. Other shelf areas such as those off Florida are not as well known; federally-funded studies to develop a regional geological picture will soon begin.

A variety of potential geohazards are recognized on the continental shelf in the Gulf. Features considered to be geohazards include: active faults, potentially and presently active zones of sediment failure such as mud slides and subsiding zones, brine seeps from shallowly buried salt domes, karst topography (sink holes) and gas and mud vents. In most cases, drilling cannot take place on or near these features because of seafloor instability. Other features that constrain drilling include reefs and certain other living biological communities, shallowly-buried human artifacts on the inner shelf, and areas with strong currents or waves.

Subsurface features that may constrain drilling include buried channels and shallow and deep accumulations of interstitial gas. Sediment-bearing capacity across buried channel boundaries can vary significantly because of changes in grain size or water content. Gas in shallow sediments can present other problems for rig stability. Near-surface gas, usually caused by decay of organic detritus, often results in local accumulations that appear as acoustically opaque zones on the profiler records that can induce cratering, or "pockmarks" where they vent to the seafloor. While sediment load-bearing capacity is reduced by interstitial gas, only qualitative estimates of gas concentration

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and sediment strength are obtained from geophysical data. In addition, upward migration from reservoir depths can produce overpressured accumulations of gas which must also be thoroughly described.

In deep water, far less is known about the type and distribution of potential geohazards. Depth sounders, sediment profilers and side-scan sonars used in shallow water are insufficient in deep water because of severe beam spreading and signal attenuation. A new generation of deep-towed and wider-swath side-scan sonar systems substantially overcomes the spreading and attenuation problems.

Pairing deep-towed side-scan sonars with subbottom profilers results in the recognition of potentially hazardous bottom and subbottom geological features in deep water not previously resolved by the more typical surface-towed instruments. Narrow-beam high-resolution depth sounders improve bathymetric mapping and allow recognition of potentially hazardous steep slopes on the deep seafloor.

In some parts of the Gulf sufficient knowledge exists to understand geohazards. Other areas are just now being leased and explored in detail and are not well characterized; deep water exploration is in a less advanced stage. Each time a significant advance is made in geophysical or geotechnical data acquisition, instrumentation or technique, new geological features are recognized.