Any interruption of our foreign energy supplies would have a dramatic effect on our economy and security and would show the dangerous results of the lack of a coherent and positive energy policy.

There are very few discovered but undeveloped oil reserves in the U.S. except on the North Slope, and those probably cannot be made available before 1976. Though the recent NPC-AAPG study indicates almost 200 billion bbl of undiscovered but expectable recoverable U.S. reserves, any large increase in exploratory effort to find them cannot have any great effect on our crude deficit before 1978 because of the necessary lead times. It is obvious, however, that certain steps can and should be taken immediately to encourage or to cause such an increase so that the period of danger to our economy and security will be as brief as possible.

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Consolidation Studies of Deltaic Sediments

The Texas Colorado River delta, which built across Matagorda Bay between 1929 and 1941, was selected for consolidation research. The objectives were to observe structural changes which occur when deltaic sediments undergo primary consolidation, and to correlate these consolidated sedimentary structures with those reported from ancient deltaic environments.

Double cores were collected along a traverse parallel with the main river channel in the southeast lobe of the delta. One core was split lengthwise, described, and radiographed. An analogous undisturbed section of the second core was then selected for consolidation.

Consolidation, through vertically compressing the sediments, partly creates new structures or makes poorly visible structures more discernible. It was noted in some cases that convolute laminations and recumbent folding formed after sections containing parallel laminations were consolidated. It was also observed that apparent homogeneous sections, after compaction, changed structurally to reveal parallel laminations.

Consequently, it should be realized that consolidation will affect unconsolidated sediments and that these changes should be considered when comparing recent and ancient environments.

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Drilling Funds and the Energy Crisis

(No abstract submitted)

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Significance of Reservoir Diagenetic Alteration for Petroleum Exploration, Gulf of Alaska Tertiary Basin

The Tertiary clastic section of the Gulf of Alaska sedimentary basin is considered an important potential future petroleum province. Considerable work in the onshore area has been carried out by industry preparatory to a projected sale of federal leases on the continental shelf. Examination of numerous samples collected from measured sections in Oligocene to Pleistocene strata has shown that the sandstones are mineralogically immature and unstable. Diagenetic alteration of these potential reservoir sands at shallow to intermediate depths of burial has resulted in the ubiquitous formation of authigenic clay rims and coats around detrital grains and of pore-filling zeolite cements. These diagenetic alterations adversely affect both porosity and permeability and will provide a major limitation on the thickness of the sedimentary section than can be considered prospective. A compaction versus depth gradient, which is related to the sandstone porosity gradient, can be determined in offshore areas by combination of seismically derived interval, velocity depth profiles, with a velocity-density calibration based on well data from the Hecate Strait (a geologically similar Pacific Margin basin lying off British Columbia). The resultant density configuration can be cross checked by gravity modeling along the same seismic line. Work on a line off Cape Yakataga shows that the prospective section is characterized by a high velocity and density gradient, indicating rapid loss of reservoir porosity with increasing depth of burial, as predicted by the onshore diagenetic model. Semiquantitative evaluation of the compaction profile using the onshore reservoir data suggests that even in the youngest sections porosity decreases to less than 20% at depths of 5,000 to 8,000 ft.

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Depositional Systems and Oil-Gas Reservoirs in Queen City Formation (Eocene), Texas

Regional surface and subsurface studies indicate that thick deltaic (Queen City Formation) and thin shelf (Reklaw and Weches Formations) sequences compose the stratigraphic interval between the top of the Wilcox Group and the base of the Sparta Formation. In East Texas, the Queen City Formation accumulated as part of a high-constructive, lobate delta system; and in South Texas, as part of a high-destructive, wave-dominated delta system. In South Texas, principal facies are meander-belt sand, lagoonal mud, stacked coastal barriers, and prodelta-shelf mud facies; in East Texas, delta plain, delta front, and prodelta facies are dominant; and in Central Texas, the principal facies are strandplain sands originated by southwestward longshore drift of sediments from the high-constructive delta system.

Facies distribution, composition, and size of the deltas in East Texas are similar to lobes of the Holocene high-constructive Mississippi delta system and to ancient deltas in the lower part of the Wilcox and in the Jackson Groups of the Gulf Coast basin. Fluvial-deltaic sediments of South Texas are comparable to Pleistocene high-destructive wave-dominated facies on the Surinam coast, to the Holocene Rhone delta system, and to ancient deltas in the upper part of the Wilcox Group.

Queen City deltas prograded gulfward over shelf muds and glauconites of the Reklaw Formation; they are overlain by comparable shelf facies of the Weches Formation. In East Texas, deltaic facies wedge out eastward; terrigenous clastics of the high-destructive deltas extend southward into Mexico.

Hydrocarbons are produced from thin strike-oriented sands downdip from the belt of maximum sand thickness of the high-destructive deltas in South Texas; only a minor amount of oil and gas has been obtained from delta front and distributary channel sands of the high-constructive deltas in East Texas.

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Petroleum Exploration and Environmental Conservation

U. S. faces energy crisis.—U. S. energy demands will nearly double by 1985. All our principal sources of fuel will be needed to meet the demand; if domestic supplies cannot keep pace, we face increasing reliance on foreign oil.

Energy and public lands.—Much of U. S. energy potential, including offshore oil and gas reserves, is on publicly owned lands. Potentially productive acreage in the federal and state domain should be made available to industry in a manner designed to maximize timely development.

Environmental delays.—A principal factor in delaying exploration of frontier areas is environmental concern. Many environmental objections are founded on the argument that oil and gas development is incompatible with other uses of the same land or water area.

Compatible use.—If exploration is to proceed at a pace consistent with national needs in the future, the concept of compatible multiple use of lands must be established as national policy. Industry must demonstrate from available examples that this concept is sound and results in maximum benefits to public and private interests.

Geologists must contribute.—Petroleum geologists should bring their knowledge to bear on public environmental issues and work for reasoned solutions based on scientific fact. Much exploration today awaits public consent; geologists must aid in showing public that energy-environmental problems can be

solved at the same time, without denying the nation the benefits of adequate, low-cost energy and an environment of acceptable quality.

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OIL IS FOUND IN THE MINDS OF MEN

Wallace Pratt, one of the great and most eminent petroleum geologists of our time, stated that "oil is found in the minds of men."

It seems that in the decades from 1930 to 1970, a span of more than 40 years, the explorationists have forgotten this one fact. We have depended on black boxes, green boxes, small computers, big computers, and first-dimensional, second-dimensional, and third-dimensional processes and techniques to tell us where to drill a well.

This dependence on instruments has been our profession's greatest mistake and one which was compounded by the petroleum industry which supported and perpetuated this practice. In fact, petroleum management forced our profession to cease thinking about petroleum being found in the minds of men and told us that it could be better found in the transistors of the black boxes and the computers.

A point has been reached where we cannot find the so-called structures on land with these gadgets. Therefore, we have said to ourselves, and industry has said to itself, "A new breakthrough is needed." Unfortunately, in reference to this need, geologists and industry are still thinking of new gadgets for the "breakthrough." The breakthrough should be in the minds of the explorationist. This should be the paramount tool. All of the other gadgets, old and new, will have to be supplements to the minds of men.

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NANNOPLANKTON BIOSTRATIGRAPHY AND SEDIMENTARY PETROLOGY OF A VERTICAL FACIES SEQUENCE CROSSING THE CAMPANIAN-MAESTRICHTIAN BOUNDARY IN CENTRAL ALABAMA

On the basis of the occurrence of calcareous nannoplankton in Upper Cretaceous sediments, exposed in a series of road cuts near Pine Level, Alabama, the sequence is placed in the uppermost *Kamptnerius magnificus* zone, the *Tetralithus aculeus* zone, and the lower *Chiastozygus initialis* zone (Campanian-lower Maestrichtian). The Cusseta Sand lithology, which is considered to be of Campanian age in western Georgia and eastern Alabama, is shown to be basal Ripley or Maestrichtian at this locality, based on the occurrence of *Chiastozygus initialis*. This age difference suggests that the clastic wedge, building southeastward from central Georgia and represented by the Cusseta Sand in east and central Alabama, is time-transgressive as the unit progrades from east to west.

Although a Demopolis Chalk lithology (calcareous clay) appears above the basal Ripley Sand (Cusseta Sand), it is not Campanian as suggested by previous workers, but is instead lower Maestrichtian.

Through the use of planktonic-benthonic foraminiferal ratios, textural analyses, clay mineral ratios, and stratigraphic and biogenic structures, the following 5 sedimentary environments, in vertical sequence, were established: (1) delta-front silts and sands (regressive), (2) offshore clay (transgressive), (3) marginal-shelf sands (basal Ripley), (4) offshore clays (transgressive), and (5) barrier bar-shoal sand complex (regressive).

The gradational boundaries between the various facies produced by a fluctuating strand demonstrates that there is no major break in the sedimentary record in crossing the Campanian-Maestrichtian boundary.

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GULF COAST PHOTOGEOLOGIC APPLICATIONS

The Gulf Coast is an important province for photogeologic applications even though much of it is of low dip and low relief and commonly covered by Pleistocene terrace deposits.

The Gulf Coast is a very active and dynamic province, characterized by clastic sediments that were laid down very rapidly. As a result the sediments are out of equilibrium and considerable compaction and settling have occurred, and many structures have formed. It is this movement and adjustment, acting throughout geologic time, that allow a subsurface structure to continually extend toward the surface, where it can be detected by subtle photogeologic techniques.

Photogeologic or photogeomorphic techniques, including analyses of drainage, topography, vegetation, deposition, and lineation, can definitively locate surface structures. Many of the Gulf Coast oil and gas fields have surface expression. Fields with good expression include those located in areas of current exploration interest, such as Sunniland and Felda in South Florida, Flomaton and Blackjack Creek in the Alabama-Florida Jurassic play, Edgewood and Fruitvale in East Texas, and Big Wells and Los Tiendos in Southwest Texas. Many other fields have good expression including Citronelle, Blacklake, Neale, Reyes, Mathis, and North Government Wells.

Normally, photogeologic interpretation must terminate at the coastlines, but a relatively new sonar-subsea mapping device allows exploration to continue onto the shelf areas. The Institut Français du Pétrole has developed a wide-range scanning sonar that can provide sea-bottom sonar images that rival aerial photographs.

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DISTRIBUTION AND ISOTOPIC COMPOSITION OF URANIUM IN A LOWER SOUTH TEXAS RIVER AND ESTUARY

The uranium concentration and isotopic composition of water and suspended sediment from a South Texas river and estuary were determined by alpha-spectroscopy. The average dissolved uranium concentration and radioactivity ratio (U^{234}/U^{238}) of the river water were determined to be 2.44 ug/l and 1.15, respectively. Water from a tributary of the river was found to contain an average dissolved uranium concentration of 42.8 ug/l with an isotopic radioactivity ratio of 1.56. Close inspection of the lateral concentration and isotopic activity ratio of uranium revealed an increase below the confluence of a tributary and the river. A model was derived based on equations used in isotopic dilution analysis, which predicts these increases within analytical error. This model may be useful in future studies to locate extraneous uranium within the hydrologic environment.

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BOTTOM CHARACTERISTICS OF NORTHERN GULF OF MEXICO CONTINENTAL SHELF

Photographs of the Gulf of Mexico continental shelf floor between Panama City, Florida, and Galveston, Texas, were examined for evidence of sediment texture, structure, and biologic activity. Sediment size is distinctively coarser in areas of reef growth near the continental slope. Bioturbation was recognized by the presence of burrows, mounds, furrows, tracks, and excrements. Water turbidity of varying degrees at times obscured the real water-sediment interface. Current direction and inferred velocity were indicated by compass and sediment cloud. A program of extensive photography, complemented by shallow cores, grab samples, and box samples, is needed to understand fully the different physiographic provinces of the Gulf of Mexico and their local variations.

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USE OF DOWNHOLE GRAVITY DATA IN FORMATION EVALUATION

It has been shown by several workers that the downhole