COMPARATIVE BIOLOGY AND ECOLOGY OF TROPICAL AND ANTARCTIC FORAMINIFERA

Studies of shallow-water benthonic Foraminifera are under way currently at Eniwetok Atoll in the equatorial Pacific and on the Antarctic Peninsula utilizing scuba gear for direct observation of natural situations and laboratory experimentation. On the atoll, species are distributed by microhabitat without regard for depth (to at least 150 ft), whereas in Antarctica, the benthic Foraminifera do not select specific microhabitats. Instead they are zoned according to depth, mostly in association with changing macrofaunal and floral changes. Because of ice abrasion in the Antarctic, few or no Foraminifera live between the intertidal zone and 18 ft in depth. Below that, a zone characterized by large kelps, sponges, tunicates, and brachiopods contains many Foraminifera, and at 120 ft the association is dominated by large glass sponges with about 25 species of Foraminifera.

Heavy predation on Foraminifera takes place on the atoll by fish and grazing invertebrates; in Antarctica, Foraminifera are fed on mostly by invertebrates. There are at least 3 nutritive strategies in reef Foraminifera, although they seem to feed largely on bacteria in Antarctica. Like some tropical species, some Antarctic ones seem to live a long time (years) before reproducing.

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URANIUM AND ITS FUTURE ROLE IN NATIONAL ENERGY REQUIREMENTS

This paper is addressed generally to the use of uranium as an energy source for our future national energy requirements. It deals in part with the problem areas of; recent and pending legislation in the fields of health and safety, environment, public land laws, exploration, production, lead time between start of exploration and production of yellow cake, industry slippage, intervenors, and the effect of all of these on planning for the future. Uranium will play an important role not only in our future national energy requirements, but also in our balance of payments and national security.

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STRATIGRAPHY AND SEDIMENTATION OF DEEP-SEA OCEANIC FORMATION ON BARBADOS, WEST INDIES

Detailed study of the Oceanic Formation on Barbados has revealed a record of pelagic sedimentation from earliest middle Eocene through latest Oligocene (20-50 m.y. ago). A succession of diverse lithologies and lateral facies changes within contemporaneous sediments is recognized. The succession consists of foraminiferal, radiolarian, and nannoplanktonic clays and marls, radiolarites, spiculites, diatomites, cherts, brown clays, and volcanic ash beds. All are eupelagic, deep-sea sediments. Of particular interest are (1) radiolarites and cherts which correlate with middle Eocene cherts shown by Deep Sea Drilling Projects to be widespread in both the Atlantic and Pacific; and (2) regular, periodic fluctuations of carbonate sedimentation rates and Foraminifera-nannoplankton ratios, in the upper Oligocene foraminiferal marls, which are similar to those frequently observed in Pleistocene foraminiferal oozes and attributed to climatic periodicities.

No evidence for progressive shallowing of the Barbados Ridge is apparent until after deposition of both the Oceanic Formation and the overlying Conset Marl. No *in situ* shallow-water sediments on Barbados are older than 10-15 m.y. This is consistent with the predicted arrival of the Caribbean plate into the present eastern Caribbean.

Middle and late Eocene sediments exhibit lateral facies changes. These are characterized by both a decrease and an increase in absolute sedimentation rates of carbonate and terrigeneous clay, respectively, from north to south. The paleoslope determined from sedimentary structures deepens from north to south and suggests that the observed facies change may be attributed to increasing carbonate dissolution with depth. However, the accompanying increase in absolute sedimentation rate of terrigenous clays indicates that dissolution alone is an inadequate explanation. Either dilution by terrigenous clays from the south, or local sediment redistribution by currents and slumping, must have occurred.

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ALTAMONT—A MAJOR FRACTURED AND OVERPRESSURED STRATIGRAPHIC TRAP

Altamont field in the Uinta basin of Utah is a much-overpressured accumulation of high pour-point crude, producing from multiple, thin, Tertiary reservoirs in a 40-mi long stratigraphic trap. Postdepositional shift of the structural axis of the basin created an updip pinchout of low-porosity sandstones into a lacustrine "oil shale" sequence. Reservoir performance is enhanced significantly by vertical fractures and initial pressure gradients which sometimes exceed 0.8 psi/ft.

Field limits in large part are undetermined, and few dry holes have been drilled. Average well drilling and completion costs approach $1 million. The initial potential of field wells ranges from 500 to 2,500 BOPD with an average GOR of about 1,000 cu ft/bbl. Matrix permeability generally is less than 0.2 md; therefore, high well performance is a function of fracture permeability. Inability to define reservoir parameters and oil in place causes individual well reserve estimates to depend mainly on pressure decline-cumulative relations.

Significant engineering problems are related to evaluation and completion of these thin, low-porosity, fractured and overpressured pay intervals, which span up to 2,000 ft of stratigraphic section in some wells. These problems are compounded by the problem of handling 110°F pour-point waxy crude. Inability to pipeline the crude conventionally from the relatively remote area has delayed full production of the field. About 40 drilling rigs are active in development of the trend, and a field potential is suggested of in excess of 250 million bbl with significant delineation of field limits yet to be accomplished.

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DOLOMITE, LIMESTONE FACIES, AND INSOLUBLE RESIDUE—A RELATIONSHIP?

Almost 600 insoluble-residue and quantitative X-ray analyses have been performed on samples collected from the Callville and Pakoon Formations (Pennsylvanian and Lower Permian) of southern Nevada. The gross lithologies present are limestone, dolostone, and carbonate-cemented sandstone. The insoluble residues range from 0.7 to 77.0% and consist of fine-sand size quartz with varying amounts of illite (clay).

Plots of the total insoluble residue against percent dolomite show that more than 500 of the samples fall into either limestone (greater than 90% calcite) or dolostone (greater than 90% dolomite) end members. Plots of the dolomite percentage in the 100 remaining, mixed-calcite-dolomite mineralogy specimens versus total insoluble residue showed no obvious trends. Plots of the mixed-mineralogy specimens versus the illitic clay content likewise showed no obvious trends.

Five limestone facies (micrite, sparse micrite, packed micrite, biopelsparite and oosparite) were recognized. No relation was found between limestone facies and percent total insoluble residue or between percent dolomite and limestone facies.

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