

## SOUTHERN CALIFORNIA BASINS - AN IN DEPTH VIEW BY MANNED SUBMERSIBLE

### ABSTRACT

by JOHN E. WARME

Marine basins of the Continental Borderland off Southern California have long been regarded as oil fields in-the-making. They provide models for understanding adjacent producing areas such as the Los Angeles and Ventura Basins. The varied water depths and submarine geology of the Borderland also provide a spectrum of natural conditions for investigating many problems in marine geology and paleoecology that directly bear on resource exploration.

Studies now being conducted at Rice University are concerned with bottom conditions across the Borderland--particularly water depth, bottom topography, sediment type and organic content--as they relate to the distribution of larger sea bottom-dwelling animals. Life on the bottom is a measure of physical conditions there, and such conditions also determine the fate of organic matter in the surface sediments. The interrelationships between the organisms and the organic matter on which they feed are, however, only poorly understood.

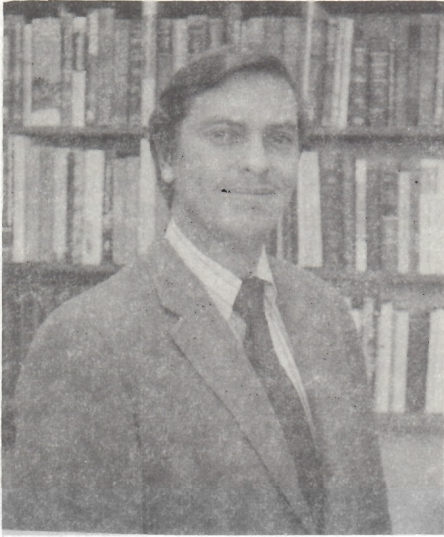
The purpose of this work is (1) to determine the usefulness of bottom animals as signatures of present conditions in the basins, which include oxygen, organic contents and pollution levels; and, (2) to evaluate the potential of the faunas as paleoecological indicators. Determination of some faunal indicators is an important step in identifying ancient deep water strata: because they rarely include larger shelled animals capable of fossilization. But deep water strata does exhibit assemblages of distinctive biogenic sedimentary structures (trace fossils) left behind by burrowers. The burrowing organisms are dominated by soft-bodied animals such as worms and crustaceans, but little is known about their burrow patterns. The widely used paleobathymetric trace fossil zonation of Seilacher and other workers were devised from land-based stratigraphic sections and never have been tested in modern deep-sea sediments. It is important to couple modern-ancient deep water investigations while resource exploration is moving into deeper water and at a time when the Deep Sea Drilling Project is providing true oceanic samples for study.

In order to explore the presently developing geological record in the California basins large volume box cores that recover undisturbed portions of the seabed are used. The box cores can be cut on shipboard, yielding undisturbed slices that are sealed and stored for sedimentary analyses and radiographic inspection. Use of manned submersibles allows *in situ* selection of core sites and rock samples, as well as providing high-resolution visual observation and photography. Motion pictures are a primary tool by which to record submarine data.

Submersible dives using Lockheed's Deep Quest provide direct observation and sampling from depths of 1000 to 6700 feet. Motion pictures document conditions on the Coronado Escarpment and Fan Valley, the San Diego Trough, the San Clemente Basin, and the western escarpment of Forty-mile Bank. Although basin floors vary in depth, the San Diego Trough (4000') and San Clemente (6900') harbor abundant large animals. The San Clemente Basin is silled at 6000', but contains prolific life to the bottom. In contrast, other studies in the San Pedro (3000') and Santa Barbara (2000') basins show them to be faunally poor or lifeless in some areas. Judging from the distribution and density of animal life it appears that neither depth nor distance from shore controls critical oxygen levels or food resources.

## DR. JOHN E. WARME

## Biographical Review



John E. Warne is a native of California. He received his early education in Los Angeles and then went to Augustana College, Rock Island, Ill., where he earned a B.A. Degree in Geology in 1959. During the following seven years while he was working towards his Doctorate Degree at the U. of California at Los Angeles, John Warne taught geology at U.C.L.A., California Lutheran College and the U. of California at Riverside. He worked as an exploration geologist for three summers with Shell Oil Company in the Basin and Range, the Alaska Peninsula, and the San Juan Basin. His work on deep sea cores from the Pacific Basin while at the Naval Civil Engineering

Laboratory, Port Hueneme, and on sediments and invertebrates of Mugu Lagoon while he was at Pt. Mugu Naval Missile Test Center led to his doctorate dissertation entitled, "Paleoecologic aspects of the Recent Ecology of Mugu Lagoon, California." Dr. Warne was a Fulbright Scholar at the University of Edinburgh, Scotland, 1966-1967. He joined the Rice University Department of Geology in 1968 where he is now an Associate Professor.

Dr. Warne has published more than thirty papers on invertebrate paleontology, paleoecology, and recent marine sedimentation. He is an expert on trace fossils and bioerosion. His current research programs have kept him traveling from oceanographic cruises and submersible work off the coast of California where he is investigating bioerosion of submarine outcrops to Morocco where he is studying the sedimentary history of the High Atlas Mountains.

Dr. Warne is a Fellow of the Geological Society of America and holds memberships in the American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, The Paleontological Society, International Association of Sedimentologists, A.A.A.S., and Ecological Society of America.