

## *Book Review*

*Marine Geology of the Gulf of California*. T. J. H. VAN ANDEL and G. G. SHOR JR. (Editors). American Association of Petroleum Geologists, Tulsa, Okla., Memoir 3, 1964, 408 pp., 228 illus., 52 tables, 1 separate cover with 6 charts, \$ 12.50.

That an investigation of a certain area made by one or a few scientists can never result in a complete paper is clearly demonstrated by this magnificent book. The combined program for study of the Gulf of California by all available methods, such as geology, oceanography, marine geology, geophysics and ecology makes this report highly interesting and useful (17 articles, 27 authors).

Field work in the Gulf began in 1958 and was supported by different funds. The American Petroleum Institute Project 51 strongly stimulated the original planning.

From seismic refraction studies it can be concluded that the northern portion of the Gulf has a structure similar to the continental borderland off southern California, and that the southern portion is similar to the East Pacific Rise. The magnetic anomaly pattern is northwest-southeast, the same as the pattern of the topographic features. The magnetic rock is the second crustal layer and it has considerable relief on its surface. The Gulf may be evolved as fractured plates of crust which moved northwestward and Pacific-ward by gravitational sliding under the influence of batholithic intrusions. En echelon faults diagonal to the general trend of the Gulf are apparently a southward extension of the San Andreas system. Displacements of the order of 160 miles appear to have taken place. One of the faults may be an extension of the San Jacinto fault.

Submarine canyons are cut in crystalline as well as in sedimentary rocks. Part of them seem to follow old, deeply submerged stream valleys, others may be the result of tectonism, slumping or submarine erosion.

The continental terrace of the Costa de Nayarit has been investigated by means of continuous acoustic reflection profiling. This terrace is composed of a sequence of wedges of deltaic, other paralic, open-shelf, and continental slope facies. The shelf break is very complex in origin, but is primarily controlled by Pleistocene deltas.

Modern sedimentation in the Gulf is restricted to the area of the Colorado River delta, to the coasts with sandy sediments and to somewhat diatomaceous clays in the deepest basin. Sediment supply is lateral and mainly from the east; the dispersal is essentially perpendicular to the basin axis. In the deeper parts turbidites have been found. Petrographical, mineral, grain size, lithological, and other analyses made it possible to obtain insight into the sedimentation aspects. The diatomaceous sediments are coarsely laminated. In the central parts of the basins enough oxygen is present to make the existence of burrowing animals possible.

Zoogeographical and ecological studies established eleven faunal assemblages which characterise various environments. Approximately 220 living species of benthonic Foraminifera have been identified. Also preliminary investigations have been car-

ried out on ostracodes and radiolarian. From the foraminiferal determinations twelve depth assemblages could be indicated.

The submarine topography of the Gulf of California is given on a separate colour map in two sheets with six depths zonations. The colour differences clearly demonstrate the complexity of the axial part, the broad shelf on the east side and the small shelf on the other side. The concentration of submarine canyons around the southern tip of Baja California is given separately on a more distinguishable scale. That the topography is based on many sounding lines can be seen on two separate charts.

This book cannot only be called a very complete marine geological (s.l.) description of a certain area of our planet, but it does clearly stipulate the need and advantage of co-operation.

ARNOLD H. BOUMA (Utrecht)