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HISTORICAL IMPLICATIONS OF A CHANGING EARTH-MOON RELATIONSHIP

For some time now, there has been broad agreement among astronomers that the distance from the earth to the moon is not a physical "constant," that it has been gradually increasing. The generally accepted *rate* of increase, however, has been so slow that during most of recorded *geologic* time, the moon could not have affected earth processes any more significantly than it does today.

Recent work by Munk of Scripps and MacDonald of NASA reopens the debate on the history of the earth-moon system. They have shown that earlier conclusions by Jeffreys and others may be in error. Extrapolation backward into geologic time, if a drastically increased rate of change in the distance to the moon is assumed, suggests a moon close enough to earth to produce major effects on geologic processes, perhaps of catastrophic proportions.

Investigations by Ewing in the South Atlantic, using seismic reflection techniques, have indicated a widespread surface below the present sea floor. Tentative interpretations of this surface by Heezen and others suggest it may represent a major event in the history of ocean sedimentation, perhaps a world-wide fall of volcanic ash or even cosmic dust.

The correlation of possible ancient earth-moon positions with known events in the geologic time table, as well as with such "uniformitarianistic" phenomena as tidal action, is thought-provoking. Recent research appears to be significant enough to warrant a closer coupling between historical geology and the "new" astronomy.

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THE EFFECT OF DECREASE IN POROSITY WITH DEPTH ON FUTURE DEVELOPMENT OF OIL AND GAS RESERVES IN SOUTH LOUISIANA

Geologists and engineers have frequently made the premise that the amount of gas in place per unit volume increases as greater depths are penetrated, because of the attendant higher reservoir pressures. In order to test the validity of this premise, a study was made of the effect of depth of burial upon the other variables in the standard formula used to calculate the amount of oil and gas in place.

Sandstone porosity data were obtained for more than 13,000 samples of conventional cores, including samples from 101 fields of South Louisiana. A curve constructed from these data demonstrates that the amount of void space per unit volume available for the accumulation of oil and gas decreases with increasing depth. This decrease in porosity, 1.265 per cent of total volume per 1,000 feet of burial, is the most important single factor controlling the amount of oil or gas in place per unit volume of sandstone reservoir rock. Exploration and development management should be conscious of the diminishing returns to be anticipated as greater depths are explored.

Porosities associated with abnormally pressured reservoirs were studied, as was the incidence of abnormally pressured reservoirs in South Louisiana as a function of depth of burial. The porosities of the abnormally pressured reservoirs, averaged by 1,000 foot depth-increments, fit a straight line plot of porosities from all reservoirs.

It appears to be a reasonable hypothesis that the observed decrease in sandstone porosities with depth provides the mechanism creating the abnormal pressures so frequently encountered in oil and gas reservoirs of South Louisiana.

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SAN PEDRO DE MATURÍN DIAPIR, VENEZUELA

The San Pedro de Maturín diapir, a structural culmination along the Tonoro anticline, appears to be ideally situated for the entrapment of oil and gas migrating updip on the north flank of the eastern Venezuela basin. It parallels, and is located a few miles south of, the highly productive Santa Barbara-Jusepín trend; reservoir rocks, stratigraphic equivalents of productive zones along the latter trend, occur in the San Pedro de Maturín area. Seismic data suggest structural development at least during later Tertiary time. Paleoenvironmental data corroborate this and indicate that the initiation of structural growth occurred during the deposition of deeper water sediments, continuing as the basin filled in later Tertiary time. Seemingly favorable geological characteristics have resulted in testing of the Tonoro anticline in many locations. Numerous oil and gas shows are known but no sustained commercial production has been found.

Diapiric intrusions in the core of the Tonoro anticline may be partly or entirely responsible for the absence of commercial oil accumulations in the San Pedro de Maturín structure. The core of the structure is almost certainly diapiric, as shown by the anomalous relationships of Foraminifera, the presence of high pressure, low volume pockets of hydrocarbons, the presence of heaving slickensided shales, and the limited lateral extent of the La Pica sands in the core of the structure.

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A RÉSUMÉ OF RIVER DELTA TYPES

Deltas and deltaic sediments are produced by the rapid deposition of stream-borne materials in relatively still-standing bodies of water. Notwithstanding the effects of subsidence and water level movements, most deltaic sediments are deposited off the delta shoreline in the proximity of the river's mouth. As these materials build upward to the level of the still-standing body of water, the remainder of deltaic sediments are deposited on shore, within the delta's flood plains, lakes, bays, and channels.

Nearly 2,500 years ago, Herodotus, using the Nile as an example, stated that the land area reclaimed from the sea by deposition of river sediments is generally deltoid in shape. The build-up and progradation of deltaic sediments produces a distinct change in stream gradient from the fluvial or alluvial plain to the deltaic plain. Near the point of gradient change the major courses of rivers generally begin to transport much finer materials, to bifurcate into major distributaries, and to form subaerial deltaic plains. The boundaries of the subaerial plain of an individual delta are the lateral-most distributaries, including their related sediments, and the coast line. Successively smaller distributaries form sub-deltas of progressively smaller magnitudes.

Deltas may be classified on the basis of the nature of their associated water bodies, such as lake, bay, inland