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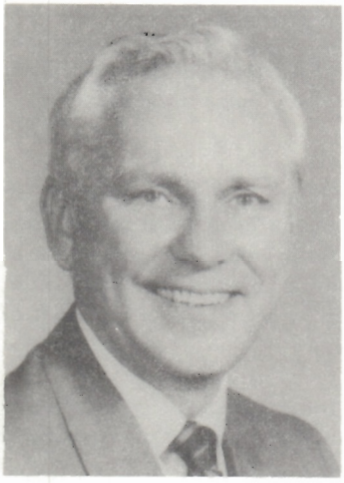
Pressured Shale and Related Sediment Deformation - Mechanism for Development of Regional Contemporaneous Faults

by

Clemont H. Bruce



BIOGRAPHICAL REVIEW:

Clemant H. Bruce was born Sept. 5, 1921, near Central City, Muhlenberg County, Kentucky. He was awarded a B.S. degree in Geology in 1948 and an M.S. degree in Geology in 1949 from the University of Kentucky. He is a member of Sigma Gamma Epsilon and Sigma Xi. His biography is included in Who's Who of the South and Southwest and in Personalities of the South.

His professional career has been with Mobil Oil Corp. (and its predecessor, Magnolia Petroleum Co.). From 1949 to 1953 he was in the Mt. Vernon, Illinois office as an exploration and development geologist. In 1954 he was sent to the Dallas office where he studied Paleozoic problems of the eastern United States with special emphasis on the Mississippi embayment area. The years 1956-1965 were spent in the Jackson, Mississippi office where his work related to the problems of Mesozoic sediments in the northern Gulf of Mexico and the southern Atlantic seaboard.

Mr. Bruce investigated regional problems relating to Tertiary and Quaternary deposition in the northern Gulf of Mexico basin from 1965 to 1972. He presently is in Houston where he is a geological specialist in the onshore portion of Mobil's southern region.

Mr. Bruce holds membership in the Geological Society of America, the American Association of Petroleum Geologists and the Houston Geological Society.

ABSTRACT

Regional contemporaneous faults of the Texas coastal area are formed on the seaward flanks of deeply buried linear shale masses characterized by low bulk density and high fluid pressure. From seismic data these masses, commonly tens of miles in length, have been observed to range in size up to 25 miles in width and 10,000 feet vertically. These features, aligned subparallel with the coast, represent residual masses of undercompacted sediment between sand-shale depo-axes in which greater compaction has occurred. Most regional contemporaneous fault systems in the Texas coastal area were formed during times of shoreline regression when periods of fault development were relatively short, and where comparatively simple down-to-the-basin fault patterns were formed. In cross-sectional view, faults in these systems flatten and converge at depth to planes related to fluid pressure and form the seaward flanks of underlying shale masses. Data indicate that faults formed during times of shoreline regression were developed primarily through differential compaction of adjacent sedimentary masses. These faults die out at depth near the depo-axes of the sand-shale section.

Where subsidence exceeded the rate of deposition, gravitational faults developed where basinward sea-floor inclination was established in the immediate area of deposition. Some of these faults became bedding-plane type when the inclination of basinward-dipping beds equaled the critical slope angle for gravitational slide. Fault patterns developed in this manner are comparatively complex and consist of numerous antithetic faults and related rotational blocks.

Conclusions derived from these observations support the concept of regional contemporaneous fault development through sedimentary processes where thick masses of shale are present and where deep-seated tectonic effects are minimal.

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