LUNCHEON MEETING - SEPTEMBER 29. 1982

WILLIAM A. FOWLER, JR. — BIOGRAPHICAL SKETCH

Bill Fowler is visiting Houston after a too long absence. Bill is well known to our geological community for his many professional activities and publications, and of course for his numerous contributions to the HGS.

Born in California, Bill was raised and educated in Arkansas and Oklahoma. He earned his bachelor's degree from OU in 1950 and, after a year of graduate work there, joined Phillips Petroleum Company in 1951. He has remained with Phillips since and has enjoyed challenging the petroleum geology of California, Oklahoma, Mississippi, Louisiana and Texas.

During his stay in Houston (1968-1980) Bill was active in the Houston Geological Society, chairing an "Abnormal Pressure" study group and the Research and Study Committee. He also served the Society as Second Vice President, First Vice President and, during 1979-1980, as President. He was a Continuing Education Lecturer in "Exploration Applications of Subsurface Pressures" for the AAPG in 1975 and was chairman of the AAPG-OTC Program Committee in 1979. In addition to his many professional activities, Bill has published several articles on Gulf Coast geology. His professional society memberships include the HGS, AAPG, AGU, GSA, SPWLA and AAAS.

ABNORMAL PRESSURES AND PETROLEUM ACCUMULATIONS

Abnormal pressures affect regional patterns of petroleum accumulation, types of producing traps and composition of trapped oil and gas. Abnormal pressures and fluid potentials commonly increase with depth in basins where they have been generated by geologically recent depth-related processes. These sections commonly do not have major continuous deep aquifers. In such areas, typified by Tertiary deltas, the deep section is a mass of tight rocks with formation pressures approaching overburden pressures. This deep section, where migration rather than entrapment appears to be favored, commonly contains source beds and shows, but is generally without significant accumulations of hydrocarbons. Most major reservoir rocks with high pressure-depth ratios occur in the interval above this deep section and below the transition zone. Few major hydrocarbon accumulations occur in the transition zone because the strong upward potentiometric gradient there augments the upward, buoyant movement of the petroleum. This circumstance favors migration, not entrapment.

The most favorable depth for trapping hydrocarbons overlies the transition zone in the basal, normally pressured beds. This zone is immediately above and downstream from abnormally pressured source beds. Continuous aquifers overlain by competent seals favor lateral migration into larger accumulations. Nearby, abnormal pressures can provide local hydrodynamic conditions favoring entrapment. Areas having thick, normally pressured sedimentary columns surrounded by abnormal pressures are especially favorable in such provinces, because the abnormal pressures block the escape of laterally migrating hydrocarbons.

This regime of increasing pressure with depth favors vertical migration across formation boundaries, rather than lateral migration. Favored traps are anticlines with shale or evaporite cap rock, and stratigraphic or fault traps in locally favorable hydrodynamic settings. Traps are seldom filled to spill point. Petroleum composition appears more a function of geochemical than secondary migration processes, but the kind of petroleum trapped reflects the time-temperature setting of the optimum pressure environments.

When processes generating abnormal pressure are quiescent or unrelated to depth, and deep continous aquifers are present, pressures may decline to normal or lower abnormal pressures in deeper beds. Such areas, typified by Mesozoic or Paleozoic provinces with thick basal carbonates, are the sites of many of the world's largest oil and gas fields. The overlying high-pressured beds form a perfect seal for the deep lower-pressured aquifers, permitting entrapment by silts, carbonates and other lithologies with poor capillary trapping capacity. Long distance migration through the beds below this dynamic seal is favored. Anticlinal, fault, and unconformity traps produce, and are frequently filled to spill point. Source beds above, below and downdip can feed petroleum into the system. Potential long migration paths permit traps to draw from large catchment areas.