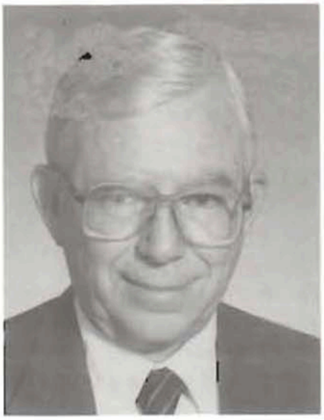
EVENING MEETING—MAY 13, 1985

ROBERT M. MITCHUM, JR.—Biographical Sketch



Robert M. Mitchum, Jr. is a Senior Research Advisor with Exxon Production Research Company in Houston. He has been involved in petroleum exploration research and applications with Exxon Corporation affiliates since 1954. His best known publications are in the field of seismic stratigraphic exploration methods. His participation in writing the best-selling AAPG Memoir 26 on seismic stratigraphy led to his being a co-recipient of the 1979 AAPG President's Award for outstanding paper. He also taught several sessions of AAPG's continuing education school on seismic stratigraphy.

Dr. Mitchum graduated from Vanderbilt University, where he also received his Master's degree. His Ph.D. was from Northwestern University. He joined Jersey Production Research Company in 1954 in Tulsa, Oklahoma, where he worked on carbonate facies, with emphasis on western Canada and the Delaware Basin. After his move to Exxon Research in Houston in 1965, he became a part of the group led by Peter Vail, developing concepts of stratigraphic sequences and eustatic cycles of sea-level change. He has applied these concepts to seismic interpretation on a world-wide basis with Exxon affiliates in the U.S., Canada, North Sea, Africa, South America, and Australia.

During this time, he has maintained an interest in the seismic recognition and interpretation of submarine fans, and their relationship to changes in sea level. His talk is a synthesis compiled from many of his previous studies.

Dr. Mitchum is a member of the AAPG, the SEPM, and the Houston Geological Society.

SEISMIC STRATIGRAPHIC EXPRESSION OF SUBMARINE FANS

This paper presents criteria for recognizing ancient submarine fans from seismic data, and illustrates examples of seismically defined fans as well as common "pitfalls" of fan interpretation. Submarine fans usually can be recognized seismically by morphology and by position in the overall paleogeographic setting. Submarine fans are commonly related genetically and spatially to canyons or other sediment transport paths across the outer shelf and slope, although some "canyons" may be poorly developed or far removed from the fan. Most sands in fans are deposited as turbidites, although grain-flow, inertia-flow, slump, and other mass-transport processes probably contribute to the fan. The mounded fan shape is due to concentration of material by the funneling action of the canyon system, and to changes in gradient within the canyon. Differential compaction may accentuate mounding. Bathymetry of the depositional site strongly controls fan shape.

On seismic reflection profiles, the canyon-fan system can be separated into the canyon, lower fan, upper fan, and later canyon fill. The canyon is an elongate, commonly erosional, notch that serves as a sediment transport path across the shelf edge. After fan deposition, the canyon is filled with a prograding shale-prone configuration that has an onlap-fill transverse profile. The seismic character of the sand-prone **lower fan** is a mound shape with a convex-upward upper surface. The internal reflection pattern is basically that of convex-upward reflections that downlap and terminate toward the fan edge, and define internal lobes and depositional axes within the fan. The **upper fan** consists of one or a few thick, sand-prone channels flanked by large, mostly silt- and shale-prone levees that become smaller downdip. Upper fan seismic criteria include concave-upward upper surfaces of levees sloping from the central channel, bidirectional downlap of concave-upward internal reflections, and "bow-tie" diffractions at channel edges. An irregular moundy reflection pattern is commonly interpreted as a complex of leveed channels. Although current modern sedimentological models assume contemporaneity of upper and lower fans, much of the upper fan commonly appears seismically to be younger than the main part of the lower fan. The surface separating upper and lower fans is commonly characterized by downlap or onlap of the upper fan onto the lower fan. This superposition probably occurs because early phases of fan deposition are most likely to be dominated by coarse clastics deposited in the lower-fan facies, while later phases are likely to be characterized by silty to shaly clastics deposited in upper fan levees.

Eustatic falls and lowstands of sea level are times of preferential deposition of submarine fans. During eustatic falls, canyons are cut, shelf areas are bypassed by sediments, and coarse clastics are depositied in sand-prone lower fans at canyon mouths or directly on the slope or basin plain. During lowstands, upper fans and other slope-fill sequences follow. With rise of sea level, canyons are filled predominantly with fine-grained material.