EVENING MEETING—JANUARY 13, 1986

MARTHA O. WITHJACK—Biographical Sketch

Martha O. Withjack received her BA in Mathematics and Geology from Rutgers University in 1973. She attended Brown University where she received a MS in Geology in 1975 and a PhD in Geology in 1978.

From 1977-1983, Dr. Withjack was employed by Cities Service Oil and Gas Corporation in Tulsa, Oklahoma, as a Research Geologist and Senior Research Geologist. In 1983, she became Principal Research Geologist for Arco Exploration and Technology Company in Plano, Texas.

Dr. Withjack is a member of the A.A.P.G., the American Geophysical Union, and the Geological Society of America. She recently received the A.A.P.G. sproule Award for Best Publication in the bulletin by an author under the age of 35. She presented this talk as a Distinguished Lecturer during the 1984-1985 A.A.P.G. Distinguished Lecture Tour.

SEISMIC EXPRESSION OF NORMAL FAULTS AND ASSOCIATED STRUCTURES

Normal faults and associated secondary structures are common features in continental rifts. Fault dip and displacement stratal dip, and fold position and size vary considerably. Synthetic seismic-reflection profiles show that each of these structural variables, as well as rock velocity, influence the seismic expression of rift-related structures.

The observed dip and curvature of any fault on an unmigrated seismic section depend, not only on the dip and curvature of the actual fault surface, but also on the velocity and dip of the overlying strata. The observed dip of a fault decreases as the velocity of the strata directly overlying the fault increases. Thus, planar normal faults in rocks whose velocities increase with depth may appear to flatten with depth on seismic sections. The observed dip of a fault decreases as the acute angle between the fault surface and the overlying strata decreases. Consequently, on unmigrated seismic sections, normal faults dipping in the opposite direction as the strata may appear to have steeper dips than identical normal faults dipping in the same direction as the strata; planar normal faults active during deposition may appear to steepen with depth.

The appearance of secondary structures associated with normal faulting on unmigrated seismic sections depends on the position and size of the secondary structures. A greater thickness of low-velocity rocks on the downthrown side of a normal fault may disrupt and bend the reflections on the upthrown side. Depth, rock-velocity distribution, and fault displacement affect the severity of the distortion. This distortion may obscure secondary structures on the upthrown side of faults, and can be interpreted erroneously as secondary faulting and folding. Synclines produced by drag on the downthrown sides of normal faults generally have small radii of curvature relative to their burial depths. This relationship makes them difficult to identify on unmigrated seismic sections. In contrast, forced folds in rifts are gentle, shallow structures overlying normal faults. These folds are easier to identify because they are unaffected by the distortion beneath faults, and their synclines have large radii of curvature compared to their burial depths.