EVENING MEETING—APRIL 8, 1985

EARLE F. McBRIDE—Biographical Sketch

Earle F. McBride received a B.A. degree in 1954 from Augusta College, a M.A. degree in 1956 from the University of Missouri, and a Ph.D. degree in 1960 from Johns Hopkins University.

Dr. McBride worked for Shell Oil Company during the summers of 1955 and 1956. He became an Instructor at the University of Texas at Austin in 1959, was promoted to Assistant Professor in 1960, Associate Professor in 1963, and Professor in 1969. He served as Chairman of the Department of Geological Sciences from 1980 - 1984 and is currently the Wilton E. *Scott Professor* of Geology at U.T.

In the Spring of 1985, Dr. McBride was honored as a Merrill W. Haas Distinguished Professor at the University of Kansas. During the Spring of 1977, he was a NATO Visiting Professor at the University of Perugia in Italy. He also served as a consultant to the Federal Commission de Electricidad of Mexico for Coal Exploration Study from 1979 - 1981. He has been a lecturer, field trip leader, and consultant to a dozen oil companies.

Dr. McBride is a Fellow of the Geological Society of America and a member of the A.A.P.G., the West Texas Geological Society, and the Austin Geological Society. He is a member of the Gulf Coast and Permian Basin sections of the S.E.P.M., the International Association of Sedimentologists and the American Association for the Advancement of Science. He has served as Councilor (1967-68), Secretary-Treasurer (1972-74), President Elect (1978-79), and President (1979-80) of the S.E.PM.

Dr. McBride has supervised 26 Master's degree and 9 Ph.D. degree candidates. He has authored numerous publications dealing with sandstone petrology, diagenesis and reservoir quality of sandstones, origin of stratification, turbidites and flysch, sedimentary history of the Marathon Basin, origin of bedded chert in Texas and Italy, and deltaic deposits of northern Mexico.

RULES OF SANDSTONE DIAGENESIS RELATED TO RESERVOIR QUALITY

The reservoir quality of sandstone is almost entirely controlled by diagenetic events. The chemical and physical processes responsible for diagenesis are complex and they influence sand during all stages of burial and, in some basisn, during subsequent uplift. Petrographic studies by many workers in the past 10 years provide the basis for formulating rules of sandstone diagenesis that help in predicting reservoir quality in different formations. Most of the rules listed below are empirical, and causative factors are still poorly understood. The list is also not complete.

1. The detrital mineral composition of a sand predetermines 50-80% of its diagenetic history.

2. Porosity lost by compaction cannot be regenerated during subsequent diagenetic events. Sands with abundant ductile grains (clay clasts, fecal pellets, shale clasts, micaceous rock fragments) can lose much primary porosity from the mashing of these grains during compaction.

3. The loss of primary porosity through compactional deformation of clays and ductile grains takes place during burial of 8,000-10,000 ft. (2,450-3,050 m); loss of porosity by compaction at greater depths is by pressure solution of detrital grains.

4. Pressure solution of quartz grains is enhanced by the presence of grain coatings of illite and to a lesser degree by chlorite.

5. Quartz cement has an affinity for the coarser, more permeable sands in a formation. However, it rarely fills all pores in a sandstone except in some coarser grained laminae or in quartzarenites.

6. Carbonate cement may have a patchy distribution in a bed, but it fills all pores to produce a nonporous rock where it is present.

7. Carbonate cement is the dominant or only cement in sands with abundant carbonate fossil fragments or carbonate rock fragments; the carbonate cement is derived from the sand.

8. Poikilotopic calcite cement is the result of cementation that progressed from widely spaced nucleation sites.

9. Kaolinite forms by the replacement of feldspar and to a lesser degree of muscovite and also by free-standing growth in both primary and secondary pores.

10. Kaolinite should be expected as a diagenetic mineral in feldspar-rich sands (arkose and subarkose) that are poor in volcanic rock fragments.

11. Chlorite and/or mixed-layer clay should be expected as a diagenetic mineral in sandstone with more than 10% volcanic rock fragments.

12. Chlorite and mixed-layer clay, because of their tendency to bridge pores and produce baffles in pores, can seriously reduce permeability.

13. Early formed illite, typically present as grain coatings, does not seriously reduce permeability; late-formed illite tends to bridge pores and produce baffles and seriously reduce permeability.

14. Micrite cement is formed in continental sands above the water table.

15. Opal cement is formed in continental sands above the water table in stratigraphic sections where volcanic ash beds are intercalated with sands.

16. Some degree of secondary porosity is to be expected in a sandstone. However, there are few clues at present to predict the degree of secondary porosity or the cleanliness of secondary pores produced. Many secondary pores are micropores within incompletely dissolved feldspar or rock fragments. The best secondary pores are produced by dissolution of carbonate cement and evaporite cement.

17. Secondary porosity develops chiefly at depths greater than 6,000 ft. (1,830 m) in the Gulf Coast, but can persist to depths of 20,000 ft. (6,100 m). After their generation, secondary pores undergo some destruction during subsequent deeper burial by infilling with late-diagenetic ferroan carbonate and/or kaolinite.

18. Sands that had the greatest permeability at the time of deposition will develop the best secondary porosity. The best permeability will be in the coarsest, well-sorted sandstones (except in quartzarenites, where the coarsest beds selectively may undergo complete cementation by quartz).