EDITORIAL

Gerald M. Friedman
Editor
CARBONATES AND EVAPORITES

In the last issue of *Carbonates and Evaporites* we announced that volume 3, No. 1 would be a special issue featuring invited and voluntary papers dealing with the topic of petrophysics of carbonate reservoirs.

This topic is now being recognized as a critical one for Enhanced Hydrocarbon Recovery, and yet there are relatively few published papers on this subject. Estimated oil resources in the United States, as an example, range from 300 to 625 billion barrels. The uncertainty in this estimate is large and not all of the oil in the ground will, of course, ever be recovered. But even the lesser estimate would amount to 300 billion barrels. A significant amount of this resource potential (up to 100 billion barrels of oil) is an immediately available resource for economical infield re-exploration and development. Improving the efficiency of field development can add billions of barrels of oil to the now-declining reserves in a relatively short time.

Historically, field development has been based on the assumption that reservoirs and fluid behavior within them are homogeneous. Thus, field development commonly is based on uniform grid-spacing of wells rather than on geologically defined variations and heterogeneity of the reservoirs.

Carbonate reservoirs are generally heterogeneous and compartmentalized. They are divided into what may be called "flow units": the volume of a reservoir within which geological and petrophysical properties that affect flow of fluids are essentially constant. Deposition and diagenesis control pore geometry, pore geometry controls reservoir properties, and spatial variation in reservoir properties defines the flow units. Thus flow units are the building blocks of the refined reservoir models which are required for efficient reservoir exploitation at all stages of field development from initial discovery to tertiary recovery. The problem of reservoir heterogeneity was recently cited by ERAB, the Energy Research Advisory Board, as one of the most-pressing problems facing the petroleum industry today (Abelson, 1987). The 1987 ERAB report advocated a comprehensive approach to defining the origin and distribution of heterogeneity within petroleum reservoirs.

Although a number of factors may contribute to such heterogeneity in carbonate reservoirs the major control appears to be determined by the internal reservoir architecture, which is a product of sedimentation style and diagenetic history and governs mobile oil recovery efficiency. Detailed understanding of the internal reservoir framework is necessary to improve the knowledge of what to expect in heterogeneous reservoirs (Schroeder, 1988) and to provide a scientific basis for predicting well spacing and enhanced oil recovery potential. Carbonate reservoirs are the most complex of all reservoirs (Harris, 1988; Schroeder, 1988). Empirical models may be constructed relating reservoir performance both to physical fluid-flow parameters such as capillary-pressure data, and depositional and diagenetic process, which mainly determine the internal reservoir architecture.

The students, staff and resident scholars of Brooklyn college, the Graduate School and University Center of the City University of New York, and the Northeastern Science Foundation have been conducting research in the petrophysics of carbonate reservoirs for several years, and we felt that now was the appropriate time to present some of our results, as well as work by some of the foremost authorities on petrophysics in carbonate rocks. In this issue one of the pioneers of petrophysics in carbonate rocks, Norman C. Wardlaw, in co-authorship with students from Canada and China (Malcolm McKellar and Li Yu) discusses pore and throat-size distributions determined by mercury porosimetry and by direct observation. The research team of the University of South Carolina relates pores, throats and permeability to petrographic/physical characteristics of grainstones and packstones. Our research team reports on reservoir characterization of deeply buried Paleozoic carbonates in Oklahoma, Texas, and New Mexico as well as on the technique of very high-pressure mercury porosimetry.

This current issue of *Carbonates and Evaporites* concludes with two papers on *sabkhas*. The first paper is on a modern *sabkha* setting from the Middle East (Kuwait) and the second paper on an ancient *sabkha* analog from Canada. In addition a brief note in Spanish lets Spanish-speaking readers become familiar with a Spanish terminology for Dunham's carbonate rock classification.

REFERENCES

Abelson, P.H., 1987, Petroleum Research Centers: Science, v.237, p.117.

Harris, P.M., 1988, Carbonate facies and reservoir heterogeneity - the value of modern analogs: West Texas Geol. Soc. Bull., v.27, p.17.

Schroeder, J.H., 1988, Spatial variations in the porosity development of carbonate sediments and rocks: Facies, v.18, p.181-204.