Tuesday, February 17, 2003

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by ***Charles Kerans***
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Prediction of Reservoir Architecture in Carbonate Systems

Carbonate reservoirs hold more than half of the world's remaining hydrocarbon resource base. Much of this resource is well delineated in terms of in-place volumetrics, but major hurdles still exist in terms of maximizing the recovery efficiency of this resource. With more than 70 years of carbonate reservoir development in basins like the Permian basin of West Texas, both major and independent oil producers have arrived at an important conclusion—carbonate reservoirs are complex! Recovery efficiencies rarely exceed 30 percent through secondary recovery. Tertiary recovery can be effective in many fields, but an equal number are probably unsuited. The additive effect of depositional, diagenetic and structural heterogeneities contribute to the mystique that is carbonate reservoir development and the through-going message is that these systems must be unraveled one reservoir at a time. Notwithstanding this complexity, observations from a wide range of reservoirs have led to important generalizations regarding our ability to predict reservoir style and substantially improve static reservoir model construction.

Reservoir architectures can be predicted, analyzed and converted into 3D models

Prediction of stratigraphic architecture and heterogeneity style in carbonate reservoirs has advanced greatly over the past decade. Integration of core, log and seismic data, aided by outcrop analogs, has proved to be the most successful approach to unraveling the stratigraphic or "matrix" plumbing systems of carbonate fields. Sequence concepts such as accommodation history and Milankovitch setting are important, but geologically oriented petrophysical analysis and seismic processing are both critical for proper delineation of the 3D reservoir model. Examples of heterogeneity styles and reservoir architectures found in greenhouse, transitional and icehouse settings, with examples from the Middle East, U.S., and other areas will provide examples of how reservoir architectures can be predicted, analyzed and converted into 3D models. ■

Biographical Sketch

Charlie Kerans is a senior research scientist at the Bureau of Economic Geology, the University of Texas at Austin, where he has worked since 1985. His areas of focus are in carbonate sequence stratigraphy and reservoir characterization, with an emphasis on integrating outcrop analog information for improved understanding of the subsurface.

Kerans received his PhD from Carleton University in Ottawa, Canada, in 1982 where he studied basin analysis and origin of Precambrian carbonates. While completing his PhD he held a lectureship at the University of Kansas geology department. From Kansas, Kerans moved to a two-year post-doc posting, studying Devonian reef complexes of the Canning Basin working with Dr. P.E. Playford of the Western Australian Geological Survey. In 1985 Kerans took a position at the Bureau of Economic Geology where he has worked on Paleozoic carbonate reservoirs of the Permian basin. In 1988 Kerans initiated the Carbonate Reservoir Characterization Research Laboratory (RCRL) at the Bureau and has co-directed this research effort with Jerry Lucia of the Bureau up to the present. Work with the RCRL has involved linked outcrop and subsurface studies of the Ordovician, Pennsylvanian and Permian of the Permian basin and Cretaceous reservoirs of the Middle East.

Kerans has been both a domestic and international AAPG distinguished lecturer. He also won the Pratt award from AAPG for best paper in the *AAPG Bulletin* for 1994 and has received best paper or poster for 8 other regional meetings for work on aspects of carbonate sequence stratigraphy and reservoir studies. He has authored or coauthored 60 papers, 6 field trip guides, 46 abstracts, and 1 regional geologic map.