

by Janok P. Bhattacharya

Applying Deltaic and Shallow Marine Outcrop Analogs to the Subsurface

A fundamental problem in subsurface reservoir characterization is determining the continuity of flow units and flow barriers. Flow units and barriers exist on a variety of scales from field-wide to interwell to wellbore.

Outcrop analog studies and databases are used to develop models for

- regional and field-scale reservoir and nonreservoir elements associated with shallow marine, deltaic reservoir types
- detailed 3D facies architecture of small-scale, intrawell heterogeneity (cements and “stochastic” shales) in specific depositional subenvironments (e.g., delta front facies) that may be incorporated into reservoir models
- conceptual reevaluations of shoreline and deltaic facies that may be applied by geologists interpreting or correlating seismic, well log or core data.

The subsurface geologist must use facies models and sequence stratigraphy concepts to correlate well data. Several examples of deltaic reservoirs that consist of horizontal layers are described. Outcrop examples suggest that delta front sandstones are not horizontal but dip seaward. This recognition challenges many current reservoir models that assume flat-lying beds and affects how we correlate core and well log data. On the regional scale, the analogs suggest very different exploration models are required to search for basin-distal reservoir sandstones.

From the perspective of general facies models, historically shorefaces have been assumed to form homogenous, uniform reservoirs that require little effort to produce. Production histories, however, show that this assumption is not valid for many so-called shoreface-type reservoirs. Many reservoir units identified as wave-dominated shorefaces are actually delta front deposits. This new model for wave-influenced coastlines suggests a distinct facies asymmetry, with homogenous beach and shoreface sands accumulating on the updrift side of the river mouth and significantly more heterogeneous facies on the down-drift side. The new model was used to reinterpret Cretaceous “shoreface” deposits in Wyoming, New Mexico and Utah and should be applicable to subsurface deltaic reservoirs elsewhere. ■

Biographical Sketch

JANOK P. BHATTACHARYA is the Robert E. Sheriff Professor of Sequence Stratigraphy at the University of Houston. His research interests include deltaic sedimentology and sequence stratigraphy, the local control of structure on stratigraphy and reservoir architecture of clastic depositional systems. He has most recently been involved in examining the sedimentology and stratigraphy of 3 billion year old Martian river deltas.



He received his BSc in 1981 from Memorial University of Newfoundland, Canada. Following his Bachelor's degree, he worked at ESSO Resources Calgary, before completing a PhD in 1989 from McMaster University in Hamilton, Ontario. Following a Natural Sciences and Engineering Research Council post-doc at the Alberta Geological Survey in Edmonton, Janok worked for the Bureau of Economic Geology at Austin, ARCO Research in Plano, Texas and the University of Texas at Dallas before joining the University of Houston this fall.

He is an AAPG Southwest Section Distinguished Educator, AAPG Distinguished Lecturer, the Technical Program Chairman for the 2004 AAPG Annual meeting in Dallas and the SEPM Field Trip Chairman at the 1999 AAPG conference in San Antonio. He has also led field trips for the AAPG 2004 annual meeting and 2003 AAPG Southwest Section meeting. He has been awarded the 2004 AAPG Certificate of Merit and the Dallas Geological Society Professional Service Award (2004), 2004 CSPG Best Oral Presentation award, 2002 Frank Kottowski Memorial Presentation Award, 2002 Houston Geological Society Best Oral Paper Award and 2001 AAPG Al Cox Award for best poster at the AAPG Southwest Section meeting.

He is an associate editor for both the *Journal of Sedimentary Research* and the *AAPG Bulletin* and has authored over 100 abstracts and over 40 technical papers. He recently co-edited SEPM Special Publication 83, *River Deltas: Concepts, Models and Examples*. He is an active member of AAPG, SEPM, GSA and IAS.