AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

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The Physical Stratigraphy of Fluvial Strata: A Hierarchical Approach to the Analysis of Genetically Related Stratigraphic Elements for Improved Reservoir Prediction

Fluvial reservoirs occur in a wide variety of tectonic settings and basin types, are deposited under various climatic conditions, and have a broad range of architectural styles. They also occur at a variety of temporal and spatial scales, and, in fully non-marine basins, can have complex distributions that are difficult to unravel. Despite these challenges, fluvial strata demonstrate systematic hierarchical relationships at all scales. This helps to reduce uncertainty and promote more accurate prediction.

A hierarchical framework is proposed based solely on the physical stratigraphy of the strata. This framework comprises both genetically related stratigraphic elements and their associated bounding surfaces. These hierarchical elements are thickness and time independent. They show a progressive increase in scale from the deposit of a single migrating bedform to the accumulated deposits that comprise the fill of entire alluvial valleys. These hierarchical elements also relate directly to stratal units defined on the basis of sequence stratigraphy. Direct comparison can therefore be made to sequences and related units recognized and defined in shallow-marine settings.

The description of fluvial sedimentary rocks utilizing such an approach provides a powerful means to directly compare similar stratigraphic elements, regardless of data type, basin type, basin location, or age. This hierarchical approach also provides a framework within which fluvial strata can be correlated and mapped. Geoscientists concerned with reservoir prediction, architecture, producibility, and geologic modeling can use such a hierarchy to more effectively integrate all the subsurface data available, and more confidently select appropriate outcrop and subsurface analogs.