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High Resolution Sequence Stratigraphy on a Geologic Workstation: Hunting for Sub-Seismic Resolution Features in Mature Basins

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ABSTRACT

Sequence stratigraphy, pioneered in the 1950's, and revitalized with the seismic tool in the 1980's, represents a powerful approach to the interpretation of geologic systems. By applying the discipline of careful time-line correlations and unconformity recognition it becomes possible to identify genetically related packages of rock that are most appropriate for subsurface mapping exercises.

Sequence stratigraphy and time-stratigraphic correlations require the tracing of time lines from either outcrop, well log or seismic data. Continuous outcrop and seismic data offer opportunities to trace time lines and observe stratigraphic discordance directly. Well-log data requires the careful correlation of "marker events" in the log character, interpreted as time lines, over broad areas of the basin in order to reconstruct the time-stratigraphic, basin-fill geometries of the subsurface.

Well-log correlation work, and sequence stratigraphic methodology is enhanced through the use of computer workstations capable of working with a large number of well logs. By harnessing the power of well-designed software, geologists have the ability to correlate very detailed regional correlation frameworks established on the basis of log character.

Examples of high-resolution sequence stratigraphy are offered from the Almond, Lewis and Fox Hills Formations of the Eastern Green River Basin, where hundreds of well logs were correlated with as many as 50 correlations per five-hundred foot interval. The results delineate subtle unconformities, faults and basin-fill geometries that are below the resolution of seismic in the area. Techniques for overcoming computer screen-size limitations and for simulating paper-based log correlation techniques on a geologic workstation are illustrated in a live software demonstration.

While much of what is possible on the computer workstation is possible using paper wellogss the sheer volume of well logs and the inefficiencies of paper-based methodologies prohibit stratigraphic studies of this detail for most workers.

By leveraging the power of the computer and the established methodologies of sequence stratigraphy the industry has an opportunity to revisit mature basins to explore for "subseismic resolution geologic features. Such features may be the basis for a new wave of discoveries in old basins.