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Allocyclic and Autocyclic Controls During Deposition of the Ferron Sandstone: Using Depositional Environments and Architecture Analysis to Understand Sea Level and Facies Distributions

Three-dimensional outcrop exposures of the Ferron Sandstone in the Willow Springs Wash area of east-central Utah illustrate the importance of recognizing allocyclic and autocyclic processes in marginal marine settings. Detailed facies analysis allows recognition of wave-dominated shorefaces and fluvial-dominated deltaic deposits. Photomosaic mapping of the spatial relationships of the landward pinch-outs of parasequence-scale depositional units allow these deposits to be evaluated in terms of relative sea level.

Within the study area, the lower portion of the Ferron comprises three upward coarsening, wave-dominated shorefaces. The landward pinch-outs of these shorefaces display vertical offset between adjacent shorefaces, suggesting that some change in relative sea level was involved in their formation. Overlying the uppermost shoreface is a coarsening-upward succession of interdistributary bay and crevasse splay deposits. A grain-size profile and a hypothetical gamma ray response might superficially imply a repetition of the same wave-dominated facies in response to another change in sea level. Nevertheless, recognition of the change to deltaic deposition and the interfingering of the uppermost shoreface deposits with the interdistributary bay deposits suggest that there has been no allocyclic change in relative sea level. Instead the change in the style of deposition is best interpreted as the result of an autocyclic deltaic avulsion event.

Correct interpretation of depositional environments and facies architectures and subsequent inferences of mechanisms controlling deposition can be critical in predicting the distribution of between wells and the continuity or connectivity of reservoir successions.