The Diachronous Sequence

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Sequence stratigraphy began as a way to conceptualize strata in both time and space, but the concept of the sequence has evolved considerably since. Initial views of the sequence showed major bounding surfaces as time lines, plotted flat in space vs. time Wheeler diagrams with sequence boundaries recording long hiatuses closing down dip. Direct testing of these original concepts with experiments and more precise field dating has resulted in significant modifications in the original slug diagram, showing that sequences are dissected by a series of hiatuses at finer scales than originally presented. Preservation is fractional and on orders as low as 10-6 vertically along any two-dimensional dip or strike section because of spatial irregularity in deposition. When time is considered in three-dimensional space, most of these gaps converge. Similarly, flume observations and field data have shown that fluvial sediment delivery is semi-continuous throughout the sequence cycle. Therefore, the sequence boundary is not a bypass surface, a time line, nor an unconformity. Instead it is a composite surface with continuous deposition at some point in three-dimensional space for its terrestrial duration. This results in the key understanding that discrete parts of this surface are equivalent to single/individual regressive marine surfaces. Particular surfaces commonly mapped in terminal regressive deposits, equivalent to the up-dip sequence boundary, include the basal surface of forced regression, the correlative conformity, scours below extending truck channels, surfaces below distributary channels, and the knickpoint valley surfaces sliced through the highstand and falling stage prisms. Each of these are traceable to and time equivalent with the composite subaerial unconformity/sequence boundary farther up dip. Consequently, the down-dip equivalent of the sequence boundary consists of several dispersive elements rather than one surface. This approach acknowledges the diachronous nature of surfaces and deposits in 3D. It also suggests a resolution to debates

about sequence stratigraphic nomenclature and the impossible quest for a single surface correlatable to the sequence boundary in the marine realm. Sequence boundaries in fact may be generated throughout the T-R cycle in the fluvial realm and are correlate to a series of divergent surfaces and intervening deposits down dip.