# Toward a Standard System for Sequence Stratigraphic Analysis

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## Summary

Sequence stratigraphy is a modern method of stratigraphic analysis, whereby sedimentary stratal architecture and facies relationships are studied within a time framework. In spite of its popularity among all groups involved in the analysis of sedimentary-basin fills, sequence stratigraphy remains the only type of stratigraphy that is not yet standardized in stratigraphic codes. This paradox is explained by the existence of several competing approaches (or models) as to how sequence stratigraphy should be applied to the rock record, and by the dissemination of confusing or even conflicting terminology. The key to the standardization of sequence stratigraphy is the definition of model-independent concepts, which outline the fundamental platform of the method, as opposed to model-dependent choices that may be left to the discretion of the practicing geoscientist.

Model-independent aspects of sequence stratigraphy include (1) the three types of genetic units that may result from the interplay of accommodation and sedimentation, i.e., forced regressive, normal regressive and transgressive; and (2) the seven sequence stratigraphic surfaces that can potentially be mapped in each case study, depending on depositional setting and the types of available data. The genetic units are generic from an environmental perspective, and may include tracts of age-equivalent depositional systems (i.e., systems tracts). Surfaces that separate these genetic units are sequence stratigraphic surfaces, and include subaerial unconformities, correlative conformities, maximum flooding surfaces, maximum regressive surfaces, transgressive ravinement surfaces and regressive surfaces of marine erosion.

The core workflow of sequence stratigraphic analysis requires the identification of all genetic units and surfaces that are present in the sedimentary record, irrespective of the model of choice. The construction of this fundamental framework of genetic units and surfaces ensures the success of the sequence stratigraphic method. Beyond this, model-dependent choices include (1) the nomenclature of systems tracts and sequence stratigraphic surfaces; and (2) the choice of what set of sequence stratigraphic surfaces should be elevated in importance and be selected as sequence boundaries.

The optimal approach to the application of sequence stratigraphy relies on the integration of outcrop, core, well-log and seismic data. Each data set provides different insights toward the

identification of stratal stacking patterns and the identification of bounding surfaces, and mutual corroboration is important to reduce the error margin of interpretations. Not all data sets may be available in every case study, a factor which may limit the 'resolution' of the sequence stratigraphic interpretation. At the same time, not all types of data afford the recognition of all sequence stratigraphic surfaces. The situation is further exacerbated by the fact that not all sequence stratigraphic surfaces are present in every depositional setting. The area of transition between fluvial and shallow-water systems affords the formation of the entire array of sequence stratigraphic surfaces. In contrast, within fluvial and deep-water systems, conditions are favorable for the formation of fewer key bounding surfaces.

In analyses that involve both nonmarine and marine systems, it is preferable that the two segments of the 'sequence boundary' be age-equivalent, so that they always form a through-going physical surface from the basin margin to the depocenter. Two types of sequences comply with this requirement: (1) depositional sequences, bounded by subaerial unconformities and their marine correlative surfaces; and (2) genetic stratigraphic sequences, bounded by maximum flooding surfaces and their nonmarine correlative surfaces. The former are consistent with the historical usage of Sloss, although at potentially different scales. The latter may provide a more pragmatic approach in light of ease of interpretation of maximum flooding surfaces over subaerial unconformities.