Autostratigraphy: key notions and experimental basics

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The fourth quarter of last century saw a giant leap in genetic stratigraphy with the development of sequence-stratigraphic models. Now, in the first decade of the new century, it looks like genetic stratigraphy stands at the crossroads for further, discrete advance. The rationale is that the conventional framework of genetic stratigraphy has been based on (1) the idea that there exists an equilibrium configuration to the depositional system, (2) an incomplete understanding of the function of sea level in terms of alluvial response, and (3) insufficient knowledge and appreciation of large-scale autogenic behavior, i.e. the stratigraphic response arising from steady forcing, and its stratigraphic products. On the basis of these arguments, the conventional framework overemphasizes the function of (unsteady) allogenic forcing on sedimentation and sediment stacking patterns.

A major achievement of the present study is that the very first step of exploring autostratigraphy, the stratigraphy of large-scale autogenic processes, has been made, on the basis of 'autoretreat' principles, which have recently been extended to include the autogenic responses of river deltas to sea-level fall and of a renewed view of alluvial grade. The strategy of autostratigraphy is opposite to that of the conventional framework (allostratigraphic view of strata, in fact) and can be summarized as follows. In order to identify allogenic or unsteady events in the stratigraphic record, as much of the observed stratigraphic architecture as possible should be interpreted first in terms of autogenic processes. Only then can allogenic events be recognized. In essence, we view the stratigraphic record as the superposition of basin response to steady (autogenic) and time-varying (allogenic) forcing.

The importance of the autostratigraphic approach is tied intimately to the intrinsic response time of the basin. If the timescale of allogenic forcing is small relative to the basin's intrinsic response time, then the conventional sequence-stratigraphic model holds. Autostratigraphic concepts become important when the timescale of allogenic forcing overlaps with the basin's response time. It is important to recognize that the intrinsic response time varies with basin size and climate and, as such, can range over many orders of magnitude. Hence, for a given allogenic signal, e.g. a glacioeustatic sea level cycle, some basins will see that signal as 'fast' while others will see it as 'slow'.

For genetic stratigraphy to be meaningful in the coming decades, autostratigraphy should be explored and developed more thoroughly. In the present report, several discrete topics related to autostratigraphy are presented.