# Sequence stratigraphy — Historical perspective of concepts, problems and challenges in exploration

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## Laporan (Report)

Dr. Robert J. Weimer gave the above talk at the Geology Department, University of Malaya on the 13th April 1994 at 5.00 pm. Dr. Weimer is Professor Emeritus — Colorado School of Mines, Consultant at Golden, Colorado and AAPG Foundation's Roy M. Huffington Distinguished Lecturer.

## Abstrak (Abstract)

Sequence stratigraphy was originally defined by Sloss as the study of genetically related strata that are bounded by unconformities. A sequence was regarded as a lithostratigraphic unit. The definition has since been expanded to include strata "bounded by unconformities or their correlative conformities" (Mitchum *et al.*), and a sequence is now a chronostratigraphic unit.

Using this broadened definition, a new hierarchy of chronostratigraphic terms has been introduced to subdivide depositional sequences (i.e., the Exxon model). Contrary to this proposed usage, I believe that the new terms are still lithostratigraphic in content. I regard them as unnecessary because they largely duplicate current terminology that has been in part formalized by the stratigraphic code of the North American and International Commissions of stratigraphic nomenclature. These codes have the flexibility both for use by all workers using stratigraphic terms and for change as needed. Moreover, the nomenclature allows for separation of objective observational data from interpretations, a goal essential to all scientific studies but not achieved by the Exxon model.

When viewed within the historic framework of stratigraphic analyses, sequence stratigraphy in a strict sense is a specialized study of lithostratigraphy that emphasizes unconformities or key surfaces, condensed sections and related facies associations. In a broad sense, sequence stratigraphy is the same as stratigraphy but with more emphasis on explaining sedimentary cycles caused by relative sea level changes, syndepositional tectonics, or autocyclic depositional processes. However, without recognition of unconformities, a sequence stratigraphic study would not differ from a traditional stratigraphic analysts in describing and interpreting sedimentary cycles on all scales.

In some basins, e.g., Mesozoic and Cenozoic continental margin basins, subsurface stratal patterns derived from multifold seismic profiles are also used in establishing sequences. However, such expensive seismic data are not always available to stratigraphers for analysis and interpretation. Furthermore, cratonic basins and some foreland basins seldom exhibit stratal patterns on seismic sections to identify sequences. For these reasons, stratigraphic terminology derived from seismic data should not be established to guide other types of stratigraphic analysis.

In petroleum exploration within shelf areas of foreland and continental margin basins and cratonic basins, two types of unconformities are particularly important. Both relate to sea level changes. The first type, a subaerially exposed lowstand surface of erosion (LSE, or sequence boundary), is caused by relative sea level lowering. The boundary is recognized by incised paleovalleys, paleosls and missing facies. The second type is a transgressive surface of erosion (TSE, sometimes called a ravinement surface), and occurs where shoreface erosion moves over coastal plain deposits during a relative sea level rise.

Examples of subtle stratigraphic traps for petroleum in siliciclastic rocks associated with unconformities are discussed for foreland and cratonic basins of the Western Interior, USA and Mid-Continent region. Also reviewed are the problems of applying the new sequence stratigraphic terminology in relation to established terminology.

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