

Terrestrial sediment response to changes in accommodation

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Sequence stratigraphy works best in the marine environment. A current research challenge is to extend this approach to terrestrial sequence stratigraphy is the recognition that, as for marine settings, cyclic variations in accommodation control stratigraphic subdivision, correlation and interpretation. In marine stratigraphy, changes in accommodation are closely linked to changes in relative sea level. In non-marine stratigraphy the changes in accommodation may be the result of climatic, tectonic or eustatic variation and may not be directly linked to sea level.

Cyclic changes in accommodation result in characteristic depositional patterns in alluvial, lacustrine and organic facies. The critical level controlling sequence generation is the migrating river channel base in alluvial strata. Under low accommodation conditions, channels reoccupy their earlier positions without significant aggradation, resulting in braided and or amalgamated fluvial facies generation. Under higher accommodation conditions, channels are able to aggrade prior to reoccupation and are more likely to preserve channel and floodplain facies under meandering stream conditions. Lacustrine facies are more common during times of highest accommodation.

Terrestrial organic deposits formed from peat are controlled by the position of the groundwater table. To integrate organic deposits into a sequence stratigraphic framework, we have been investigating a range of contrasting depositional settings ranging from rifted margins and cold climate Gondwanan coals from the Sydney Basin of Australia, to subtropical foreland basin coals from the Western Canada Sedimentary Basin. Several well defined examples from these studies have enabled recognition of upward trends in increasing accommodation as identified from a range of sedimentological, stratigraphic and coal compositional data.

Initial conditions of low accommodation are marked by regional surfaces of either erosion or non-deposition. These surfaces are accompanied by soil profiles and root horizons or Glossifungites ichnofacies. Increasing accommodation leads to a better match subsidence and peat growth and is reflected in brighter coals with increased H/C ratios, lower ash contents and high volatile matter and vitrinite content. Further increases in accommodation lead to flooding of the peat and a consequent decrease in acidity. This enables an increase in microbial activity which is reflected in suppression of vitrinite reflectance, increase in fluorescence and a corresponding increase in sulphur content. In two cases, flooding progresses to transgression of the peat and the deposition of fossiliferous marine roof rocks. Stratigraphic correlation's indicate that these examples of upward increase in accommodation can be placed in either the lowstand wedge or transgressive systems tracts.