

Partitioning and Preservation of Sediments over Multiple Time-Scales

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Recent developments in concepts dealing with the sequence stratigraphy of fluvial, shallow- and deep-marine sediments along with a source-to-sink approach to the stratigraphic record have fertilized the growth of new ideas on sediment partitioning and preservation.

Partitioning and preservation of sediments is a function of multiple forcing conditions operating at several different time-scales; to analyse the long-term stratigraphic product requires that also shorter term variations in supply, transport and erosion is considered. On short time scales (100 - 10³ years), high-magnitude, high frequency events dominate. Tectonic impact and eustatic fluctuations are negligible. Climate is a first-order control and events such as storms, floods, monsoons and earthquakes play a major role in delineating the spatial and temporal distribution of erosional and depositional landscapes and seascapes. The repetition of these events, together with every-day background sedimentation drives the short term development of source-to-sink systems and constitutes the basic building blocks (lamina and beds) of the stratigraphic record at any scale. On intermediate time-scales (10³ -10⁵ years) fluctuations in autogenic and allogenic processes become more important. Milankovitch-frequency eustatic variations are of primary importance in controlling near-coastal and shelf stratigraphy and sediment delivery to deep water. In the continental realm climate-controlled (Milankovitch-frequency) variations in sediment supply together with time-sedimentation thresholds created by the integration of autogenic and allogenic mechanisms control timing of channel aggradation, incision and avulsion. On long time scales (>10⁵ years) uplift and subsidence becomes increasingly important relative to other forcing factors in defining the long term definition of source vs. sink and the ultimate stratigraphic preservation whereas changes in sediment supply and sea-level (Milankovitch-frequency and longer) modulates the partitioning of sediments.

What is eventually preserved is the result of the interplay between subsidence rates and rates of intrinsic changes, in combination with its external forces such as climatically driven variations in sediment supply and sea-level. However, beds and laminae will always constitute the basic elements of the stratigraphic record - longer-term changes in boundary conditions only changes the way these are stacked.