

Linking tectonostratigraphy and denudation history: insight from a mass balance approach

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The offshore deep-sea stratigraphy provides the archive for reconstructing the paleoenvironment of the surrounding land and continental shelf areas. Mapping of seismic reflections as well as borehole correlation may identify the processes and timing of basin infilling. Regional and local tectonic events will be linked to other controlling factors in defining the structural configuration in order to identify the relative source-to-sink system for each time interval (Fig. 1).

Mass-balance (or source-to-sink) studies have been applied to quantify the erosion in the catchment area by examining the amount of depositional products in the basin area (e.g. Laberg et al., 2012). Sedimentation and denudation rates are important parameters in this approach reflecting the interplay between sedimentation processes, bedrock composition, tectonic dynamics and climate (e.g. Sømme et al., 2009). Moreover, the ratio between drainage areas against sediment load estimates can be compared with ratios for modern systems as a control (i.e. for fluvial and paleo-fluvial systems).

This approach has been implemented for glaciated or non-glaciated margins, passive or active settings, and for short-term or long-term systems (e.g. Helland-Hansen et al., 2016). In the petroleum industry, denudation estimates are used as an input to calculate maximum burial depth and for predicting hydrocarbon maturation. For the high-latitude margins, this method shows that paleo-ice streams were the most prominent agents in eroding the continental shelf forming the cross-shelf troughs and the Trough Mouth Fan at their front (e.g. Vorren et al., 2011). Mass-balance studies will ultimately contribute to more detailed paleoclimatic reconstruction to better understand the Quaternary glacial history.

Here we present the mass-balance approach and its application in various geological settings. We will highlight some results from the Norwegian margin as well as example from field studies. A series of assumptions and challenges when using this method will be further discussed.

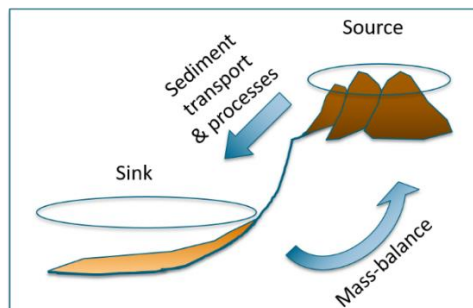


Fig. 1. Schematic drawing illustrating the mass-balance approach. Depositional volume in the sink area is calculated in order to estimate the erosional volume in the source area.

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