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Hyperpycnal Flow Turbidites as an Indicator for Sequence Boundary in Slope Turbidite Systems of Spitsbergen Central Basin

There are several mechanisms to generate sustained flow turbidites in a basin. In Eocene Central Basin of Spitsbergen, direct river input by hyperpycnal flows was responsible for generating sustained turbidity flows, since (1) shelf-edge delta distributaries feed directly into upper-slope channels; (2) great volumes of fresh river water lowered the salinity in the small basin; (3) tectonically active source area provided high erosion rates; (4) rivers that entered the basin were small and highly sediment-laden; (5) narrow shelf enabled hyperpycnal flows to reach the shelf edge; (6) systematic progradation of slope turbidite systems during the lowstands indicates continuous sediment input; (7) turbidity currents feeding the slope were very weekly erosive and non-ignitive.

Surge-type turbidites also occur, but in stratigraphically lower parts of the seaward-stepping clinoform complexes, whereas sustained flow turbidites are frequent close to the maximum regression. In localities where feeder systems are preserved on the shelf edge, the transition from surge-type flows to sustained flows correlates into an interval where shelf deltas reached the shelf edge and stepped down onto the upper slope, indicating a relative sea-level fall. The sequence boundary occurs at the top of each of the seaward-stepping clinoform complexes. Rivers can go hyperpycnal independent of the sea-level position, but such flows die quickly if they do not debauch onto a slope. Thus, hyperpycnal flows have a much greater potential to reach the deep-water slope or basin floor during sea-level lowstands, when the rivers/distributary channels make it to the shelf edge and the flows are delivered directly onto a slope.