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Recognising tectonic and climatic signals in the Paleogene stratigraphy offshore Norway

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Landscapes and their sediment routing systems can be exposed to various tectonic and climatic perturbations that affect sediment production, transport and delivery to nearby sedimentary basins. Here we investigate a Paleogene depositional system offshore western Norway that was subjected to long-term (~10 Myr) tectonic perturbation and significant hinterland erosion. Superimposed on this long-term uplift, the system was also subjected to a short-lived climatic perturbation during the Paleocene-Eocene Thermal Maximum (PETM), which lasted ~200 kyr. Regional 3D seismic reflection data is integrated with high resolution well data to map the stratigraphic response to these different scales of perturbations on the depositional system. The initiation of the tectonic perturbation is marked by an angular unconformity in seismic data. A rapid increase in sediment flux followed, causing initial progradation of a shelf-slope wedge. Sediment supply estimates indicate that the tectonic uplift caused an order of magnitude increase in sediment flux to the basin, which peaked in the latest Paleocene. This period coincided with the PETM, which is documented by biostratigraphic data as a discrete event within the overall regressive system. Although the PETM often is characterised by increased continental runoff, no increase in sediment supply is evident from seismic data. This work shows that the system response to tectonic and climatic perturbations may vary along strike, depending on the size of the routing systems and the antecedent topography prior to hinterland uplift. A low supply system may produce a tectonically-linked shelf-slope wedge that is of similar thickness as a climatically-linked wedge in a high supply system. This study documents how the same routing system responded to perturbations operating at different spatial and temporal scales and may help recognise similar process-response relationships in other areas.

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