Multivariate statistical and multi-proxy constraints on earthquake-triggered sediment remobilization processes in the central Japan Trench

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Understanding the impact of earthquakes on subaqueous environments is key for submarine paleoseismological investigations seeking to provide long-term records of past earthquakes that allow assessing seismic and tsunami hazards on relevant time scales. In the central Japan Trench, three event deposits (i.e., turbidites) linked to past major earthquakes over the last 1,500 years have been identified and stratigraphically correlated across several isolated basins along the trench. However, their spatio-temporal petrographic and geochemical fingerprints have not yet been established, limiting our knowledge about sediment source and the underlying remobilization processes induced by these past earthquakes. In this study, we show that the existing event-stratigraphic correlation can be significantly enhanced by employing a multivariate statistical correlation of X-ray fluorescence core scanning, magnetic susceptibility, and wet bulk density data from cores taken along the central Japan Trench. Such statistical correlation is confirmed by heavy mineral analysis of the turbidite sands and further combined with new erosion model based on previously reported bulk organic carbon ^{14}C dates. We find that surficial sediment remobilization, a process where strong seismic shaking remobilizes just the upper few centimeters of slope sediment, is the predominant remobilization process during strong earthquakes at the Japan Trench. This finding sheds light on source-to-sink processes in hadal trenches during earthquakes and helps to assess the completeness of the turbidite paleoseismic record. We further suggest that shallow-buried tephra on the slope might significantly influence the volume and the geochemical and petrographic fingerprints of remobilized sediment.

