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Geochemical insights into the provenance of large scale North Atlantic turbidites

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The North Atlantic margin has been subject to several very large (>100 km3) submarine landslides. Motion of some of these slides has been shown to generate damaging tsunamis, which travelled long distances across the ocean, such as that generated by the Storegga slide at 8.15 ka BP. If such a tsunami occurred again, it would pose a major hazard to northern European coastlines. Therefore identifying the source and age of past slide deposits is important to quantifying the risk to UK and the rest of coastal Europe. In this study we analyse the distal deposits of slides (turbidites) to assess their provenance. We present initial results from a new shallow piston core dataset from the Storegga slide, Trænadjupet slide, Lofoten Drift and basin, and the outer edge of the Voring plateau.

Turbidite mudcaps were analysed using both the non-destructive, semi-quantitative Itrax micro-XRF core scanner at BOSCORF for major elements. In addition ICP-MS was used to determine the rare earth element (REE) abundances, allowing the relationship of distal turbidite deposits to be established. REEs are a good source discriminator due to the stability and immobility of lanthanide group elements, and the preservation of elemental ratios during transport. Due to hydraulic fractionation only the finest mud fraction was analysed to avoid the bias associated with heavy mineral concentrations . Clusters of distinct elemental ratios indicate different provenances for the distal turbidites, notably the Eu/Eu* anomaly and (Gd/Yb)N. The clusters demonstrate each deposit has a unique geochemical signature and provide insights into the history of past large-volume slides in the region and the influence of contour current-reworking of deep-water deposits.

The Norwegian margin has a long record of large-scale landslides, which are commonly linked to glacial-interglacial transitions. This margin is also an important location of deep-water formation, with strong currents capable of transporting turbidite muds over significant distances.. Using the geochemical approach outlined above, the contribution of failures from different sectors of the margin can be assessed in each of these basins.

Future work will involve tracking turbidite mud caps in deep water basins to understand the extent of land-slide run-out. This has important implications for ocean circulation models, paleoclimatic reconstructions and future hazard assessments.