

Sedimentary Characteristics of Turbidites Discovered off Eastern Taiwan by Using Multivariate Statistics and Non-Destructive Core Scanning Techniques

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Rapid depositional layers (RDL), or turbidites, in long-term marine sedimentary records have been widely used to infer extreme events, such as earthquakes, submarine landslides, tsunamis, typhoons, and floods. Characterizing such turbidites with their triggering mechanisms becomes the critical step to infer long-term event risk and recurrence statistics. In this study, more than 700 turbidites have been identified based on the optical images in the 12.77 meters long core MD18-3538, which was retrieved from the distal part of the Taitung Submarine Canyon off eastern Taiwan. Conventional methods, such as visual observation and time-consuming analyses of grain size, mineralogy, and geochemistry, may not be sufficient due to their relatively low sampling resolution. A data-driven approach to objectively classify the characteristics of turbidites thus was developed by combining multivariate statistics with non-destructive core scanning techniques, including principal component analysis (PCA) and cluster analysis (CA), as well as data from multi-sensor core logger (MSCL), X-ray fluorescence (XRF) scanning, spectrophotometer reflectance, radiography, and X-ray computed tomography (CT). The results show that turbidites in core MD18-3538 can be characterized by higher density, P-wave velocity, and XRF counts of Ca and Sr. Moreover, the turbidite layers can be further divided into high magnetic susceptibility turbidites and low magnetic susceptibility turbidites. This study provides a fast, non-destructive, and high-resolution method that, combined with statistical methods, can reliably identify turbidites in long-term records. It provides new prospects for turbidite classification off eastern Taiwan and other places with similar geological setting. The triggering mechanisms of turbidites can therefore be further discussed.

Keywords: Rapid Depositional Layers, Turbidites, Taitung Submarine Canyon, XRF Scanner, CT-images