

X-ray fluorescence core scanning, magnetic signatures, and organic geochemistry analyses of turbidites of Ryukyu Trench floor

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The southwestern Ryukyu Trench represents the ultimate sink of sediments shed from Taiwan into the Philippine Sea, which is mainly transported to the trench by turbidity currents via submarine canyons. This study presented very thin-bedded turbidites intercalated with hemipelagites in core KR1518PL04/PC04, obtained at 6,147m water depth on the Ryukyu Trench floor. We also analyze the Ryukyu Trench cores of YK1501PC14 and YK16116K handy cores east of KR1518PC04. These trench cores are mainly composed of homogeneous gray mud layers intercalated with coarser layers of silty sand. The coarse-grained layers are olive-black in color and mostly < 2 cm thick. Based on deep-sea turbidite classification criteria and deep-water sediment facies, the silty sand beds are interpreted as turbidites and the mud layers as hemipelagites. We performed X-ray fluorescence core scans (ITRAX profiles), magnetic measurements, and organic geochemistry analyses to discriminate turbidites from hemipelagites. Generally, Ca/Fe and Zr/Rb ratios in the ITRAX profiles mark distal turbidites (about 1 to 3 cm thick), and Zr/Rb peaks mainly reflect grain size changes. Detailed grain size analyses of a relatively thick turbidite showed a good correlation between elemental ratios (Ca/Fe and Zr/Rb) and the upward-coarsening and upward-fining units that delimit the bottom and top of turbidites, respectively. Detailed analyses of a representative turbidite show a good correlation between Ca/Fe and Zr/Rb peaks with upward-coarsening and upward-fining trends that delimit the turbidite. In PC04, three of these turbidites also presented MS peaks and magnetic signatures of pyrrhotite, which we interpret as evidence of long-range sediment transport from Taiwan to the Ryukyu Trench floor by long-runout turbidity currents. We performed organic geochemistry analyses ($\delta^{13}\text{C}$, TOC, and TN) to compare turbidites and hemipelagites in core PC04, as identified based on the Ca/Fe and Zr/Rb proxies. The results concluded that hemipelagites are characterized by low Ca intensities, high TOC and TN contents, and heavy $\delta^{13}\text{C}$ values, whereas turbidites show high Ca intensities and peak Ca/Fe values. The multi-proxy approach employing high-resolution XRF core scans to differentiate turbidites from hemipelagites contributes to establishing a comprehensive view of modern Ryukyu Trench sedimentation.

Keywords: distal turbidite, Pyrrhotite, ITRAX, Ryukyu Trench, Taiwan