

Earthquake triggered submarine landslide deposits in the southern Okinawa Trough: Their grain size distribution and possible provenance

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Abstract

Since the 1929 Grand Banks earthquake, it has been well documented that earthquakes have the potential for triggering turbidity currents. Hence, we are able to use the turbidites, an alternative way to study paleo-earthquakes, as records of paleo-seismicity. The target area of this study (Okinawa Trough) is an active, incipient, intra-continental backarc basin formed behind the Ryukyu arc-trench system in the western Pacific. Owing to its special geological and hydrological settings, it acts like an efficient receptacle for sediments from Taiwan and the East China Sea shelf. The high sediment flux let us have an opportunity to obtain a high-resolution record of the seismo-turbidites. Such a record might make it possible to identify the spatial and temporal variation of grain size between different earthquake events.

Grain size analysis and X-radiograph results have been used to identify the turbidite layers and their sedimentological features in the box cores. From these data, we find that the box cores which containing turbidite layers can be divided into three categories. According to their thickness and grain size analysis results, the box cores which belong to the first category are thinner than other two categories and located surrounding outside of the turbidite deposition zone. In the second category, the thickness and grain size of the turbidite layers are larger than the first category. These cores are sited in the northern part of the turbidite deposition zone. For the last category, which located at the southern part of the turbidite deposition zone, have the thickest turbidite layers and largest grain size than other categories. The grain size profiles also indicate that there is a fining-upward trend in thick turbidite layers.

For the sake of understanding the transport of turbidites generated by the Hualien Earthquake ($M_L 6.8$) on March 31, 2002, we analyzed the sediment layers which represent the year of 2002 in our core samples. The spatial distribution of grain size reveals that the earthquake triggered turbidity current may delivered sediments from the north continental slope of the SOT (between the Mien-Hua Canyon and Keelung

Sea Valley) and stopped at the deepest part of the SOT. For the turbidites triggered by the 1966 M_L 7.8 (24.24°N, 122.67°E), the 1959 M_L 7.5 (25°N 122.5°E) and the 1947 M_L 7.2 (24.8°N, 123°E) earthquakes show the same pattern with Hualien Earthquake. However there seems no clear transport direction for the 1986 M_L 6.8 (23.99°N, 121.83°E) earthquake.

For understanding the transport of sediments in non-earthquake influence years, we picked some samples from the non-turbidite sections for grain size trend analysis. The result suggested that the Kuroshio is the dominant factor that influences the transportation of sediments in the southern Okinawa Trough, and the Lan-Yang River and eastern Taiwan might be the major source of these sediments.