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High-resolution mixed paleoseismic and paleoclimatic record revealed by turbidites in eastern Taiwan over the past 2000 years

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Taiwan is undergoing extremely high hazards due to its specific geodynamic and climatic contexts, involving very high seismicity and ~4 typhoons per year. Both types of events can generate underwater gravity currents, triggered either by submarine coseismic slope failures or by large onshore floods. The resulting deposits are turbidites. We present results from a 18.35-m long core collected from the Ryukyu forearc, eastern Taiwan. The coring site is located in the Nanao basin, 100km east of Taiwan, at a water depth of 3671m. It is fed with sediment mainly by the Hoping Canyon and its tributaries, which are directly connected to fluvial sources on land. An additional source is the submarine slope of the Ryukyu forearc. We carried out a multi-proxies study based on gamma density, magnetic susceptibility, X-ray fluoroscopy, XRF, laser granulometry, binocular observations, and 14C dating carried out on plant debris within turbidites. The aim of the study is to characterize the type of deposits, the origin, and try to establish their triggering factor. Two distinct families of turbidites appear. Type 1 presents a simple sequence with normal grading, whereas Type 2 shows multiple pulses outlined by granulometric variations. The two types show an enrichment in quartz (increase in Si/Al) and heavy minerals (increase in Ti/K) reflecting a sorting of the densest / heavy minerals. The mineralogy of most deposits is compatible with the erosion of metamorphic watersheds in Taiwan. However, Type 2 deposits additionally contain pulses characterized by a concentration of foraminifera, which testifies to sliding of the hemipelagic cover of the submarine slope. 14C dating reveals: A) extremely high sedimentation rates, ~10m/ka, B) an average turbidite recurrence-time of 30 years. Type 1 could be associated with large typhoons/floods with an average recurrence of ~40 years, while Type 2 turbidites show a recurrence of ~120 years, consistent with nearby paleoseismic records.

Keywords: Turbidite, Paleo-Earthquake, Paleo-Typhoon, Extreme event, Submarine