



A millennium-long depositional record of tsunamis on a western Pacific, typhoon-prone coast in northern Taiwan

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Located in the western circum-Pacific seismic zone, the island of Taiwan has been frequently suffered from coastal hazards of tsunamis and tropical cyclones/typhoons. Based on the world-leading century-old typhoon record of Taiwan, the historical tsunami deposits and their processes have been distinguished from those of typhoons. This study took advantages of the present knowledges as a key to the prehistorical tsunami deposits and processes. Taiwan's north coast was selected for the study of facies investigation because the area was damaged by the historical AD 1867 tsunami which has been verified by a number of historical accounts and geological evidences of marine event deposits. A total of four marine event layers was identified in this study, and characterized by landward fining in grain size and inland distributions of 800 m, which specify the extensive inundations and long tsunami wavelengths. These layers are sharp-based, fining-upward, poor-sorted quartz sands and boulderly rounded gravels, and were attributed to the rapid settling of reworked dune sands, rocky shore debris, and offshore pumices by suspension-rich turbulent flows, instead of the typhoon-wave deposition processes that tend to be low in suspension and high in sorting. The layer elevations are ranged from 3 to 11.5 that exceed the typhoon surge maximum at 2.3 m high of the last three decades with the global warming promotion, and thus punctuate the tall tsunami build-ups and run-ups. Thick mud and soil layers are intercalated with the event layers, represent prolonged periods of slow accumulations, and underscore a recurrence interval of 150-300 years and the low tsunami frequency, while typhoons are frequent with an annual average of 4 landfalls on the island. By integrating the historical and geological evidences, a marine event stratigraphy of the coast was established, showing a historical and three prehistorical tsunamis which were probably sourced from the regional normal faulting in the past millennium.