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The evolution of typhoon dynamics affecting Taiwan as recorded in marine sedimentary archives since the Last Glacial Maximum

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Taiwan is located in the Typhoon Alley, an area that experiences the most frequent occurrence of severe tropical cyclones reaching categories 3 to 5 on the Saffir-Simpson scale. The island experiences 4.5 typhoons annually, threatening infrastructure and lives with landslides, heightened seismic hazards, and severe storm surges inducing floods. Currently, debates persist regarding the connection between current global warming and the evolution of these extreme events. Studying the dynamics of typhoons in paleo-archives may provide insights into the major mechanisms influencing their frequency and intensity. Past investigations into the evolution of typhoon dynamics have predominantly relied on continental sedimentary archives. In Taiwan, these archives are limited due to extensive erosion caused by heavy rainfalls and earthquakes, rarely providing records that extend beyond the Holocene period. On the other hand, marine sedimentary archives are protected from this erosion, and typhoons and earthquakes can be recorded over longer periods of time. One way to distinguish typhoon deposits from the other is to examine the source of the organic matter. The massive erosion caused by typhoons increases the sediment load of rivers and transfers terrestrial organic matter to the ocean. Using a combined approach of geochemical proxies (n-alkanes, n-alkanols, and C/N), we were able to identify continental organic matter-enriched deposits in cores MD18-3523 and MD18-3532, collected east off Taiwan. The MD18-3523 core was retrieved from a levee of the Hoping Canyon, while the MD18-3532 from an intra-slope basin of the Ryukyu accretionary prism, was disconnected from hyperpycnal flows from Taiwan. Furthermore, surface and subsurface ocean temperatures might exert major control over typhoon dynamics by affecting the amount of moisture and temperature supplied to them. We, therefore, compared the occurrence of the typhoon deposits with surface and subsurface seawater temperature changes since the Last Glacial Maximum, in the northwestern Philippine Sea, reconstructed using archaeal lipid-based TEX86 and RI-OH paleothermometers in cores MD18-3523 and MD18-3532. In doing so, we observed a notable and continuous escalation in typhoon intensity over the deglaciation as surface and subsurface seawater warms up. This intensification is characterized by an initial appearance of hypopycnal plumes during the Bølling–Allerød period in core MD18-3532, followed by the occurrence of hyperpycnal flows during the Early Holocene and the last 2 kyr of the Late Holocene in core MD18-3523. These

results suggest a dominant role for sea temperatures in the dynamics of typhoons affecting Taiwan during deglaciation, potentially mirroring future effects of global warming.

Keywords: Typhoon, Sea Surface Temperature, Biomarkers, EAGER, Geochemistry