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# Linkage between natural diasters and Kiwulan cultural hiatus over the last 1000 years in the Lanyang drainage system, northeastern Taiwan

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Active tectonic activities and frequent typhoon visits make Taiwan unique in having very high rates of uplift, precipitation, denudation and sedimentation. Particularly, intense rainfall associated with typhoons often causes flooding, large-scale landslides and debris flows in river systems, such natural disasters affecting human activities at the present time and in the past. The Typhoon Morakot in 2009 may serve as a modern analog of such events in the geological past.

Site Kiwulan is a newly discovered archaeological site of the Iron Age in Lanyang Plain. A cultural hiatus, found around 1200-1500 cal. yr AD, suggests that the settlement was once abandoned. It remains a mystery what caused this event.

This study assembles radiocarbon dates of upland river terraces, organic proxies in flood plain lake sediments and content of wood shreds in nearby marine sediments. These records are synthesized to infer the frequency and magnitude of ancient floods over the past 1250 years in the Lanyang Drainage System in northeastern Taiwan.

Alluvial fan terraces distributed along the banks of upper Lanyang River are considered to be remains of ancient debris flow events, and their radiocarbon dates fall in two time ranges: 850-1100 and 1400-1600 cal. yr AD. Organic proxies such as TOC and C/N ratio representing terrestrial plant input were measured from bulk sediments of Lake Dahu and Lake Meihua in the Lanyang Plain. Peak values of TOC, C/N ratio and organic indicator from Itrax-XRF core scanner are conspicuous during 900-950, and 1400-1500 cal. yr AD, implying frequent flood events. Abundance peaks of wood shreds and C/N ratio in marine box core ORI-801-7A occurred during 950-1050 and 1450-1550 cal. yr AD, coinciding with those terrestrial input events recorded in lake sediments.

In summary, different lines of evidence collected from the Lanyang Drainage System suggest that flood events were more frequent during two particular periods: 900-950 cal. yr AD and 1400-1500 cal. yr AD. The later period corresponds to the cultural hiatus at Site Kiwulan, suggesting that the lost civilization may be related to severe and frequent flooding of the Lanyang Plain during that period.