

Precipitation variability in subtropical Taiwan during the last 18000 year

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Abstract

Paleohydrological changes linking to East Asian Monsoon (EAM) activity were inferred based on $C_{\text{organic}}/N_{\text{total}}$ ratio (OC/TN) of total organic matter extracted from a 15-m sediment core from Tung-Yuan Pond in subtropical Taiwan. Sediments with high values of OC/TN associated with increased OC content suggest large runoff resulted from extensive rainfall paced following strong summer insolation during intervals of the deglacial, the early and mid-Holocene. While those measurements with low values correlate to abrupt cooling events: the Heinrich event 1, the Younger Dryas, and North Atlantic drift ice during the Holocene. Paleomagnetic parameters were also used as additional climate proxies. High values of S-ratio indicate relative wet circumstances, generally, in association with high OC/TN ratios. Simulated hematite mass increased in those cold and dry intervals. Consequently, it is suggested that paleorainfall variability in terms of those climate proxies can be used to trace the EAM activity. Moreover, the early Holocene (11.5-8.5 ka) witnessed high frequency hydrological variability. After 6 ka (the late mid-Holocene Hypsithermal) the area appears receive less precipitation reflecting the weakening summer insolation.

Introduction

Global warming and water shortage are serious crises for current humankind's livelihoods. To find out best resolutions for these challenges, reconstruction of past global climate changes, which can provide information about boundary conditions on simulation of future climate changes, has been attempted and verified. In the South-East Asian monsoon area, for example, the climate change is influenced by an alternation of dominance between the dry-cold winter and warm-humid summer monsoons (An, 2000). The intensification of summer monsoon is possibly resulted from strengthened insolation during the early Holocene (Herzschuh, 2006). In the region, effective moisture in terms of water vapor precipitation increased since the

Last Glacial Maximum (LGM) and reached the peak during the early mid-Holocene (Herzschuh, 2006). However, works on stalagmites suggested that the increasing trend was interrupted by global cooling events during the Holocene (Dykoski et al., 2005; Wang et al., 2005).

A sediment core TYP-B recovered from Tung-Yuan Pond (Figure 1) in subtropical southern Taiwan preserved mud layers and interbedded peats, and thus was chosen to reconstruct hydrological change in the study area. The age-depth model of core TYP-B shows a continuous sedimentation in the deepest basin of the lake Tung-Yuan Pond, and a successive record in age since the last 18,000 cal yrs. To test whether the study area has experienced fluctuation of rainfall for the time span, a conservative OC/TN ratio of total organic matter is applied. For comparison among multiple proxies, content of magnetic minerals was determined as well.

References

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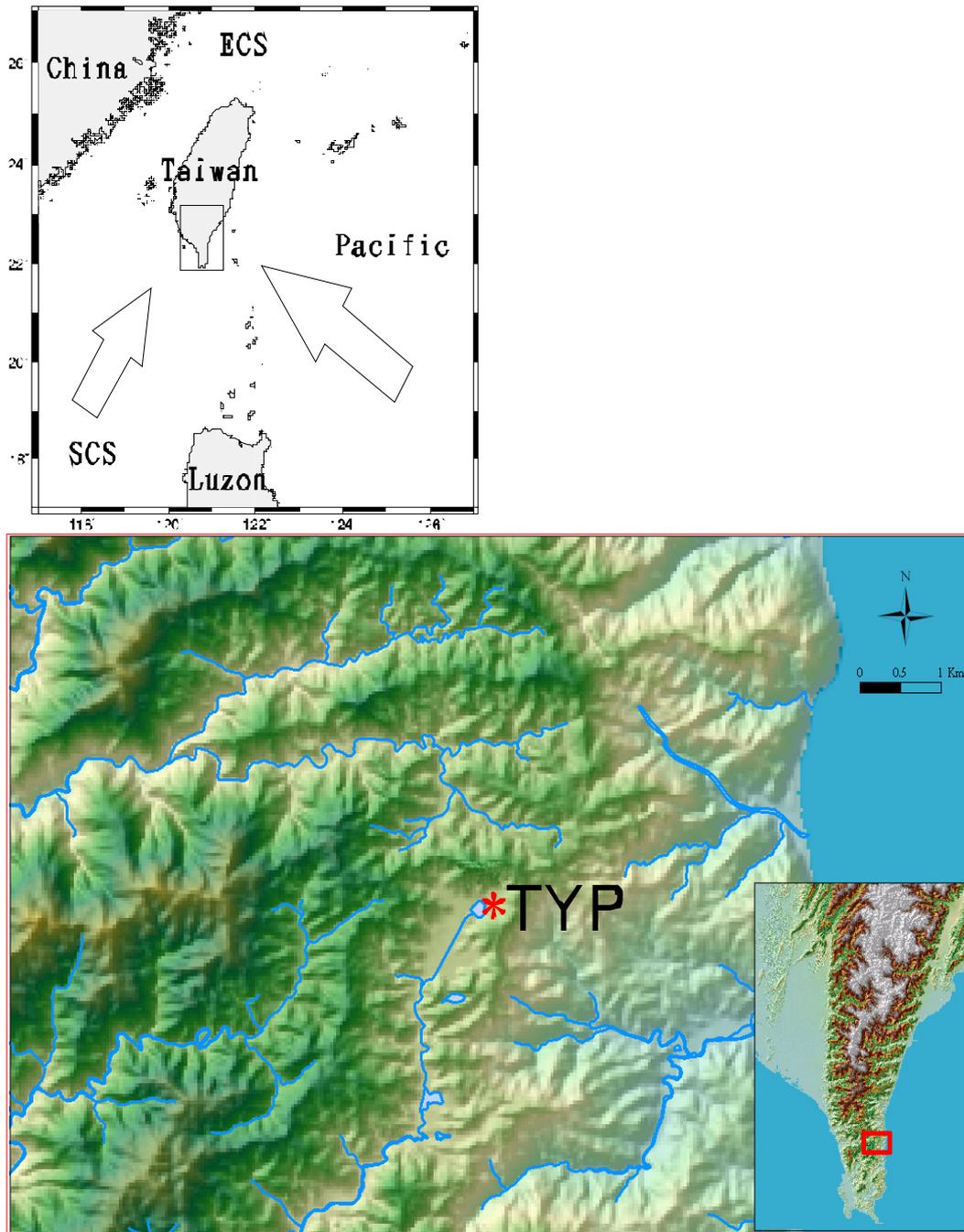


Figure 1. Location map showing Taiwan Island, Luzon Island and China, and the East China Sea (ECS), Pacific and South China Sea (SCS) surrounding the Taiwan (upper), and the study lake Tung-Yuan Pond (TYP) (lower). Arrows in the upper map indicate the flow paths of typhoons visiting to Taiwan, while southern Taiwan is enlarged as an inlet in the lower map. Typhoon data from the Central Weather Bureau, Taiwan are available at <http://photino.cwb.gov.tw/tyweb/mainpage.htm>.