Surface pollen investigation and Late-Quaternary Bitahai pollen record in the mountainous Yunnan province, SW China

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Surface pollen investigations in modern soils or moss polsters are being focused during the last decade. Comparison of surface pollen with adjacent meteorological datasets provides direct pollen-climate relations, which allows quantitative palaeoclimate reconstruction for terrestrial regions by applying the relations to fossil (late Quaternary) pollen profiles (i.e. the BMA/MAT method) (Nakagawa et al., 2002). In Japan, more than 300 surface pollen spectra have been organaised with a successful challenge to detect the lateglacial palaeotemperature variations (Nakagawa et al. 2003).

When East Asia is taken into consideration as a next-step research target, the Yunnan plateau is one of the promising areas for the surface pollen studies. Mesic temperate forests survive in northwestern Yunnan province, whereas vegetation has almost been altered for the rest of China due to its long history with human activities. A large altitudinal variation (ca. 2000-5000m a.s.l.) of the western Yunnan covers a broad temperature range. Moreover, the Yunnan plateau is subject to the intense East Asian/Indian monsoons and has a close climatological relationship with the Japan archipelago.

Here we present the surface pollen dataset from the Jundien district, NW Yunnan and show its first application to a fossil pollen record from Bitahai, ranging from the last deglaciation to the present (Okuda et al. submitted). Bitahai (27.44"N, 99,58"E, 3,540m a.s.l.) is a ca.160 ha lake in the southern Jundien, geomorphologically composed of the southeastern end of the Tibetan (Xizang-Qinhai) plateau, sparsely inhabited with dense, natural montane forest surrounding the lake. The Core BT-1, being 11 m long consisting of peat/gyttja, is age-secured by 9 AMS14C dates showing the last 20,000 years. Results of pollen analysis are consistent with the modern surface pollen distribution, which indicates vertical vegetation migration as a result of palaeotemperature variations during the last deglaciation. The lateglacial phase (13-10 ka) shows abundant shrubs/herbs such as Sorbus, Rhododendron and Bistorta, most resembling the subalpine zone above the present timber line (4200m a.s.l.). The Early Holocene (10-7.5 ka) is dominated by Abies as a leading component of the upper montane coniferous forest (3700-4000m a.s.l.). The mid/late Holocene (~7.5ka) is dominated by Picea forming the middle montane coniferous forest (3250-3700m a.s.l.). When 0.65C/100m is adopted as the present annual-mean temperature lapse rate for the montane Yunnan district (i.e. 2000-4000m a.s.l.), temperature anomalies from the present are calculated as +2 ~ -1C, -1 ~ -3C and ~ -4C for the mid/late Holocene, the Early Holocene and the Lateglacial, respectively. These results agree with the existing palaeotemperature estimates for central to southern China. In this presentation we do not deal with the so-called Younger Dryas event due to insufficient data resolution.

By contrast, the last full glacial (20-13 ka in this context) shows high frequencies of Artemisia which do not have suitable analogues in our current surface pollen datasets (i.e. altitudinal transects). The present annual precipitation around Bitahai Lake is no more than 650 mm/y. When the precipitation reduced below 400-500 mm/y under glacial environments, the vegetation changed into semi-arid steppe that is not sensitive to temperature conditions at that time. It may be that reconstruction for the last glacial cooling on the Yunnan plateau should be expected for another pollen record from Erhai (25.50"N, 100.10"E, 1,960m a.s.l.), which is a larger lake located approximately 200 km south of Bitahai.

References

[1] Nakagawa, T., Yasuda, Y. et al. (2002). Quat. Sci. Rev. 21, 2099-2113.
[2] Nakagawa, T., Yasuda, Y., et al. (2003). Science 299, 688-691.
[3] Okuda, M., Nakagawa, T., Okuno M. and Yasuda, Y. (submitted). Quat. Int.