Environmental changes during the Miocene climatic optimum revealed by lake sediments in SW China

J. LEBRETON-ANBERRÉE[1] AND Z-K ZHOU[12]*

[1]Key Lab of Tropical Forest Ecology, XTBG, CAS, Yunnan 666303 China (julie@xtbg.org.cn)

[2]Key Lab of Biogeography and Biodiversity, Kunming Institue of Botany, CAS, Kunming 650204, China (*correspondence: zhouzk@xtbg.ac.cn)

The Miocene Climatic Optimum (MCO) is a warming event that could serve as an analogue for the present global warming. However, its impact on the Asian monsoon remains largely unknown. In this report, the objectives are: 1) to evaluate the changes in the environment and in the intensity of the Asian monsoon, 2) to infer the drivers of these changes.

Authigenic carbonate $\delta^{13}C$ and $\delta^{18}O$, $\delta^{13}C$ of organic matter ($\delta^{13}Corg$), C/N and Total Organic Carbon were sampled at high resolution (1 sample per 3–4 ka) in Wenshan lacustrine sediments (Yunnan, SW China) dated by paleomagnetism to be 16.7 to 15 Ma old.

The $\delta^{13}Corg$ reveals the presence of the Carbon Maxima which had only been previously found in the marine record [1]. It confirmes that, during the MCO, the perturbation of the carbon cycle was global and paced by 400 ka eccentricity maxima. The $\delta^{18}O$, interpreted to reflect the precipitation amount, varies according to 100 ka cycles, implying a strong influence of the short eccentricity cycle. Overprinting these cycles, the results indicate two successive environmental and climatic stages. During the lower stage (16.7 to 15.7 Ma), the water cycle underwent strong fluctuations. The precipitations were lower, causing lake stratification and low nutrients recycling leading to low algal production. Conversely, during the upper stage (15.7 to 15 Ma), the environmental conditions were more stable, precipitations were higher facilitating lake water mixing and nutrient recycling, therefore enhancing algal productivity. The transition between the two stages coincides with a peak in mean annual insolation.

For the first time in the terrestrial record, we found 1) Carbon Maxima, proving that the carbon cycle was strongly affected, 2) that orbital cycles were already the main driver of Asian monsoon intensity, as it was the case during the Holocene [2]. Surprisingly, global temperatures seemed to have little impact, as suggested by the low correspondence between $\delta^{18}O$ measured at our site and $\delta^{18}O$ of benthic foraminifera.

[1] Holbourn et al. (2007) *Earth Planet. Sci. Lett.* **261** 534–50.
[2] Duan et al. (2014) *Sci. Rep.* **4** 1–7.