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Impact of atmospheric relative humidity on vegetation changes during the Late Holocene reconstructed using the 17O-excess of phytoliths from sediments of Lake Ngofouo (Republic of Congo, Central Africa)

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Vegetation changes during the late Holocene in central Africa, especially in the Republic of Congo, are characterized by transitions between forests and savannas. However, the variables (climatic, anthropogenic) behind these transitions are still poorly identified, leading to an ongoing debate around the drivers of the central African forest block opening. Moreover, in tropical regions, the vapour pressure deficit (VPD) that controls photosynthesis and transpiration, constitutes a primary driver of ecosystems primary production and dynamics. In this context, we use a new proxy of atmospheric relative humidity (RH), which coupled with temperature allow to estimate VPD, the ^{17}O-excess (d'^{17}O – 0.528 x d'^{18}O) of phytoliths. A series of calibrations have shown that the ^{17}O-excess of plant leaf water that, according to the Craig and Gordon model is controlled by RH during transpiration, is transferred to phytoliths. A quantitative relationship linking the ^{17}O-excess of phytoliths and RH of the growing season applies to controlled and natural climatic conditions regardless of vegetation type and atmospheric temperature. We propose to combine this new proxy of past RH, with phytoliths morphology, a long-standing paleo-vegetation proxy, to compare past RH and vegetation changes at the same temporal and spatial scales. Phytoliths were extracted from the sediments of Lake Ngofouo, located in a forest-savanna mosaic zone and which record the last 2000 years. Phytoliths types were identified and the ^{17}O-excess of bulk phytoliths samples were analysed. Our preliminary results show a decoupling between RH and vegetation changes. A transition from forest to savanna was identified between 1534-1505 BP, following an increase in fire activity ca. 1540 BP, which marks the beginning of the recurrence of fires in the landscape. During this period no change in RH was observed (high estimated RH ~80-90%). A forest-savanna mosaic thus emerged in the landscape at 1460 BP, characterized by high percentage of grass phytoliths, despite a still high RH (~80%). RH decreased after from 79 to 62% between 997-829 BP and then increased from 62 to 83% between 829-490 BP. During the same period, tree cover increased from 829 to 662 BP and then decreased from 662 to 490 BP which occurred at the same time as an increase in population density and fire activity. It seems that the RH increase probably triggered an increase in grass biomass and thus in available fuel sufficient for more frequent and/or larger fires, which might be responsible for the later decrease in tree cover. The transition from forest to savanna at lake Ngofouo was not associated with a

change in RH and was probably the result of the fire regime change that happened before. Interestingly, the later increase in RH impacted the vegetation differently; first by an increase in tree cover, and then by an increase in fire activity that resulted in a lower tree cover. This highlights the potential and complicated feedback that might exist between climate, fire and vegetation.

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