



Millennial-scale fluctuations in Saharan dust supply across the decline of the African Humid Period

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The Sahara is the world's largest dust source with significant impacts on trans-Atlantic terrestrial and large-scale marine ecosystems. Contested views about a gradual or abrupt onset of Saharan aridity at the end of the African Humid Period dominate the current scientific debate about the Holocene Saharan desiccation. In this study, we present a 19.63 m sediment core sequence from Lake Sidi Ali (Middle Atlas, Morocco) at the North African desert margin. We reconstruct the interaction between Saharan dust supply and Western Mediterranean hydro-climatic variability during the last 12,000 yr based on analyses of lithogenic grain-sizes, XRF geochemistry and stable isotopes of ostracod shells (Zielhofer et al. 2017a, 2017b). A robust chronological model based on AMS ¹⁴C dated pollen concentrates (Fletcher et al. 2017) supports our multi-proxy study. At orbital-scale there is an overall increase in southern dust supply from the Early Holocene to the Late Holocene, but our Northern Saharan dust record indicates that a gradual Saharan desiccation was interrupted by multiple abrupt dust increases before the 'southern dust mode' was finally established at 4.7 cal ka BP. The Sidi Ali record features millennial peaks in Saharan dust increase at about 11.1, 10.2, 9.4, 8.2, 7.3, 6.6, 6.0, and 5.0 cal ka BP. Early Holocene Saharan dust peaks coincide with Western Mediterranean winter rain minima and North Atlantic cooling events. In contrast, Late Holocene dust peaks correspond mostly with prevailing positive phases of the North Atlantic Oscillation. By comparing with other North African records, we suggest that increases in Northern Saharan dust supply do not solely indicate sub-regional to regional aridity in Mediterranean Northwest Africa but might reflect aridity at a trans-Saharan scale. In particular, our findings support major bimillennial phases of trans-Saharan aridity at 10.2, 8.2, 6.0 and 4.2 cal ka BP. These phases coincide with North Atlantic cooling and a weak African monsoon.

References

- Fletcher, W.J., Zielhofer, C., Mischke, S., Bryant, C., Xu, X., Fink, D., 2017. AMS radiocarbon dating of pollen concentrates in a karstic lake system. *Quaternary Geochronology* 39, 112–123.
- Zielhofer, C., Fletcher, W.J., Mischke, S., De Batist, M., Campbell, J.F.E., Joannin, S., Tjallingii, R., El Hamouti, N., Junginger, A., Steele, A., Bussmann, J., Schneider, B., Lauer, T., Spitzer, K., Strumpler, M., Brachert, T., Mikdad, A., 2017a. Atlantic forcing of Western Mediterranean winter rain minima during the last 12,000 years. *Quaternary Science Reviews* 157, 29-51.
- Zielhofer, C., von Suchodoletz, H., Fletcher, W.J., Schneider, B., Dietze, E., Schlegel, M., Schepanski, K., Weninger, B., Mischke, S., Mikdad, A., 2017b. Millennial-scale fluctuations in Saharan dust supply across the decline of the African Humid Period. *Quaternary Science Reviews* 171, 119-135.