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Stable carbon isotope fractionation in pollen of Atlas cedar: first steps towards a new palaeoecological proxy for Northwest Africa

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Analysis of stable carbon isotopes can provide information on climate and the environmental conditions at different growth stages of the plant, both past and present. Carbon isotope discrimination in plant tissue is already well understood, and can be used as a drought stress indicator for semi-arid regions. Stable carbon isotope ratios measured directly on pollen provides the potential for the development of long-term environmental proxies (spanning thousands of years), as pollen is well preserved in the environment. Atlas Cedar (Cedrus atlantica Endl. Manetti ex Carrière), is an ideal test case to develop a pollen stable carbon isotope proxy. The tree grows across a wide altitudinal and climatic range and is extremely sensitive to moisture availability. The pollen is abundant, and easily identifiable to the species level in pollen analysis because different cedar species are geographically confined to different regions of the world. In 2015 we sampled 76 individual cedar trees across latitudinal, altitudinal and environmental gradients, highly focused on the Middle Atlas region of Morocco, with 25 additional samples from botanical gardens across Europe and the US to extend these gradients. Here, we report new stable carbon isotope data from pollen, leaf and stem wood from these samples with a view to assessing and quantifying species-specific fractionation effects associated with pollen production. The isotopic response of individual trees at local and wider geographical scales to altitude and climatic conditions is presented. This research forms part of an ongoing PhD project working to develop and calibrate a modern carbon isotope proxy in Atlas cedar pollen, which can ultimately be applied to fossil sequences and complement existing multi-proxy records (e.g. pollen analysis in lake sediments, tree-rings).