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Annually resolved multi-proxy reconstruction of the end of the Piànico interglacial about 390 ka ago

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Interglacial climate dynamics under natural conditions are still not fully understood. In particular, more information at sub-annual to decadal resolution is required from previous interglacial periods to better understand the spectrum of short-term natural climate oscillations.
Interglacial varved lacustrine sequences are valuable archives that provide long palaeoclimate records at seasonal resolution. The palaeolake sequence of Piànico (Southern Alps) includes a 15,500 year succession of endogenic calcite varves, which formed under peak interglacial conditions ca 400 ka ago. We used a multi-proxy approach based on varve microfacies, detrital layer seasonality, frequency and thickness, stable isotopes on endogenic calcite and geochemical analyses to reconstruct the interglacial climate.
The interval of peak interglacial conditions is characterised by at least four rapid climate oscillations and by a period of rapid climate deterioration at the end of the interglacial; after 15,500 years of predominantly endogenic varve deposition, we observe a sudden shift towards clastic-detrital dominated sedimentation. This shift took place in few years and probably marks the appearance of a glacier in the catchment, transporting siliciclastic material from the inner Alps into the basin. However, ca 430 years before this major shift in the sedimentary environment, first signals of a cooling climate are observed: summer layers became thinner, whereas detrital layers, proxy for extreme precipitation events, were deposited more frequently, pointing to higher frequency of snowmelt and extreme precipitation events during spring and summer. Additionally, a drop in d18O of endogenic calcite occurs, indicating lower spring/summer temperatures. Time lags of up to 150 years between different proxies indicate complex environmental responses to a changing climate.