

The Maya Terminal Classic Drought replicated in two stalagmites from Columnas Cave, NW Yucatán

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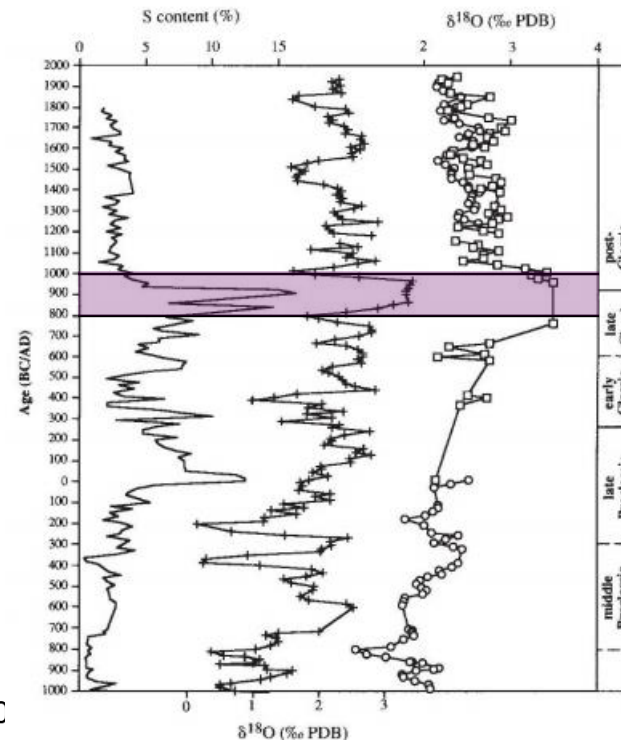
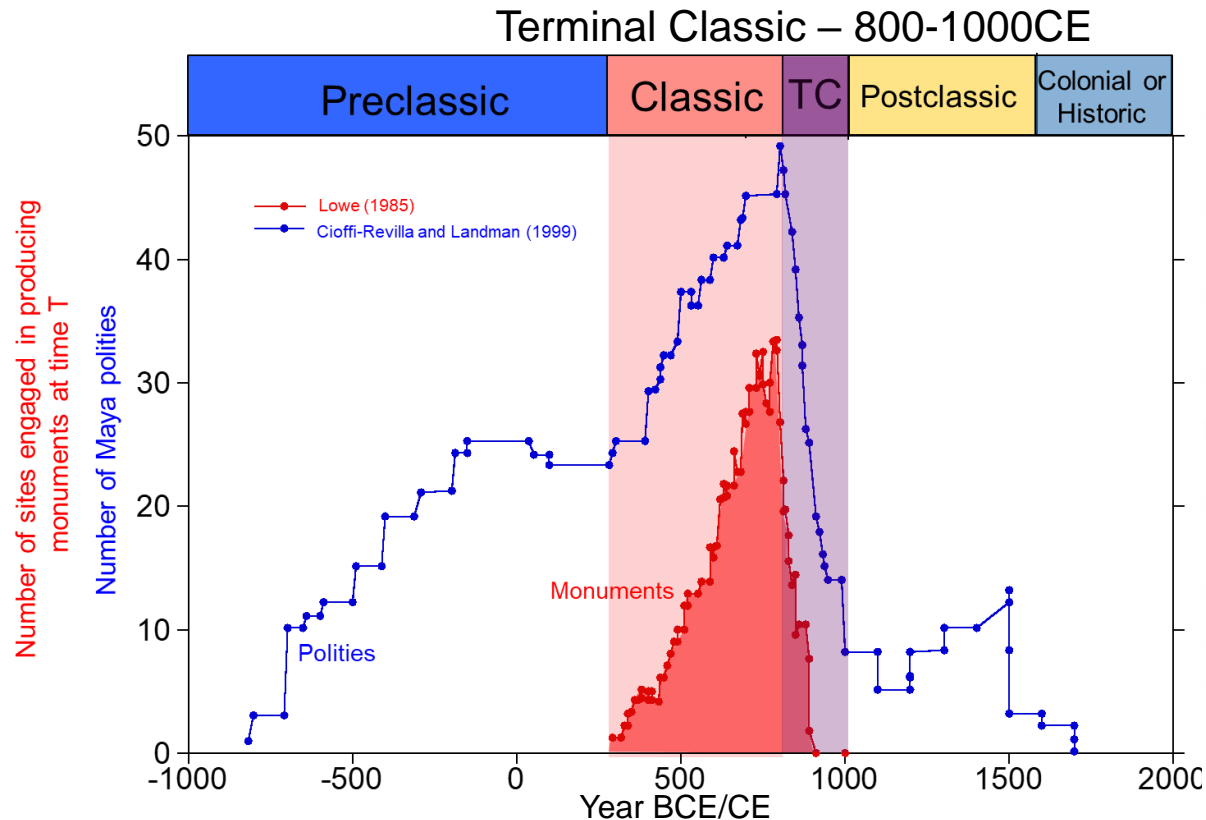
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The Classic Maya Collapse

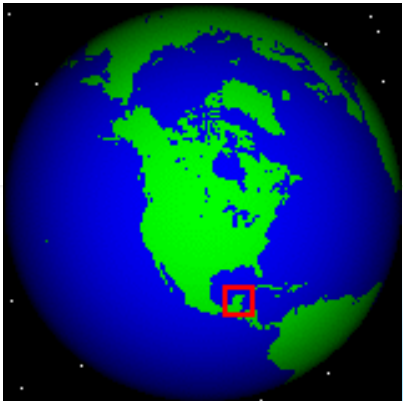
The Terminal Classic period (800-1000CE) saw the disintegration of Classic Maya civilisation. A complex multi-century period of decline and restructuring that would come to be known as the Classic Maya Collapse.



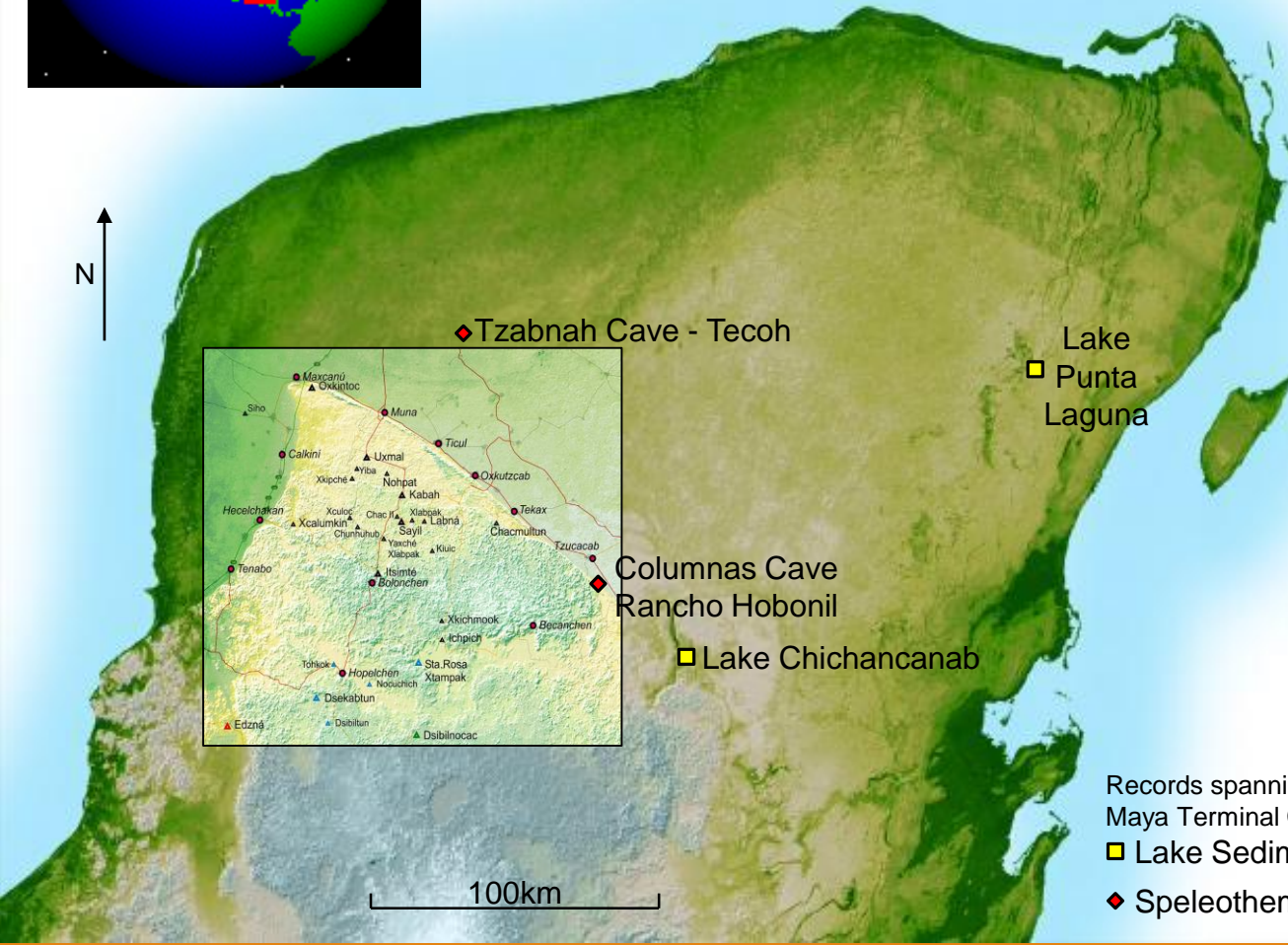
Chaac – The Maya Rain God
(Photo: Mark Brenner)



Hodell *et al.* (1995) first provided evidence for a possible link between increased drought frequency and the Collapse.

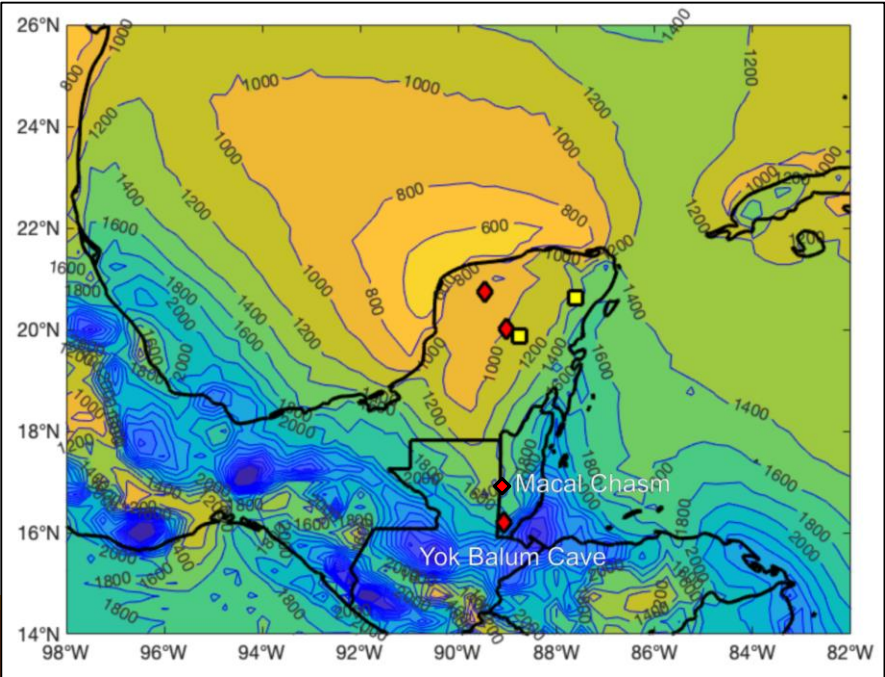


The Yucatán Peninsula



- ▲ Maya Polity
- Modern Settlement

ECMWF ERA5 annual precipitation contours (1979-2018)



- Records spanning the Maya Terminal Classic
- Lake Sediment
- ♦ Speleothem

A new record: HOB0-5

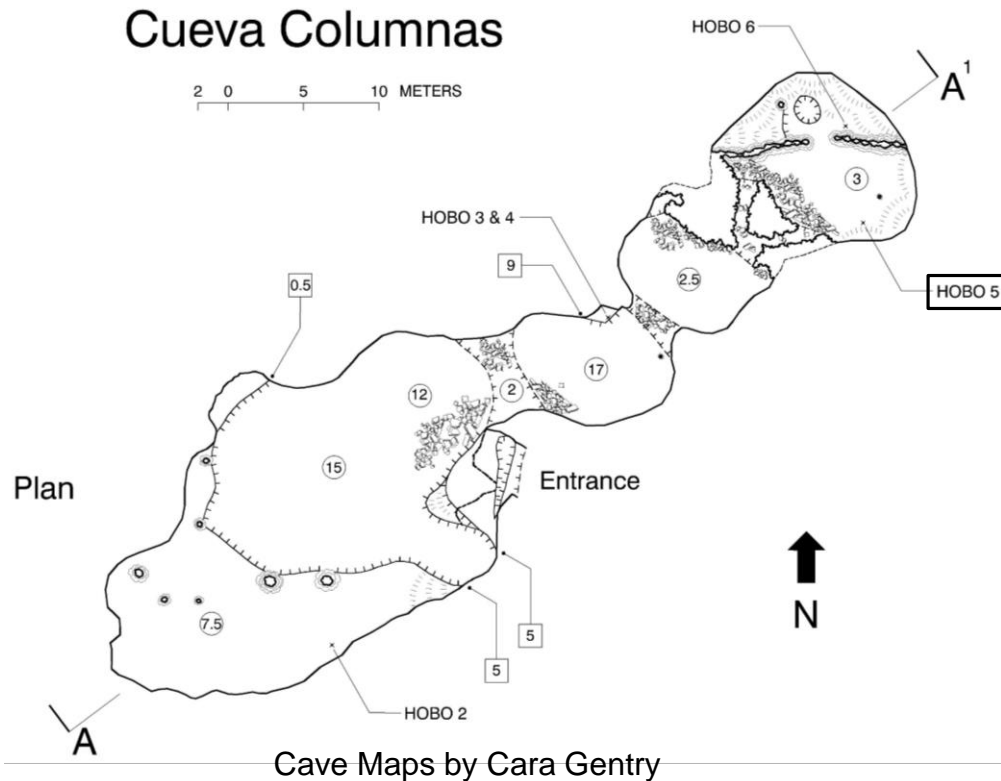
Cueva Columnas

Rancho Hobonil

Universidad Autónoma de Yucatán (UADY)

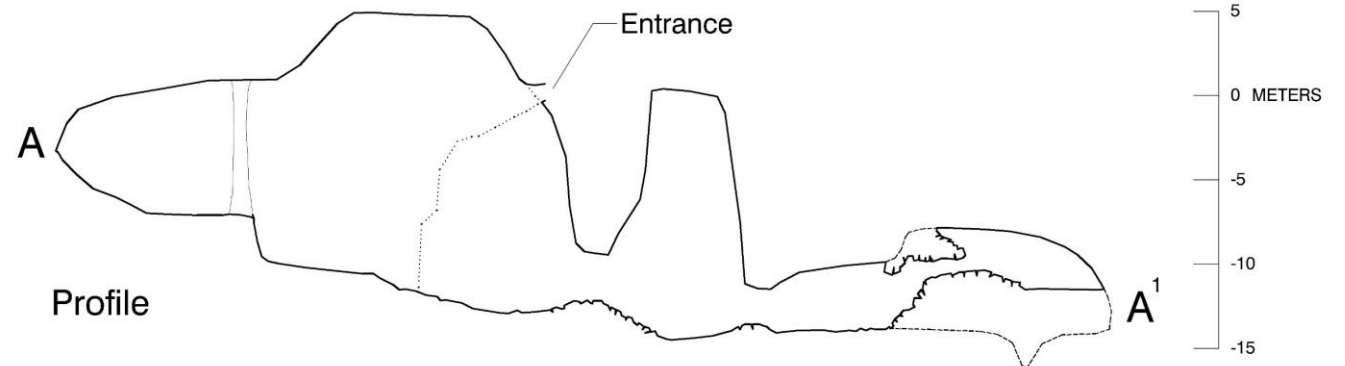
Yucatán

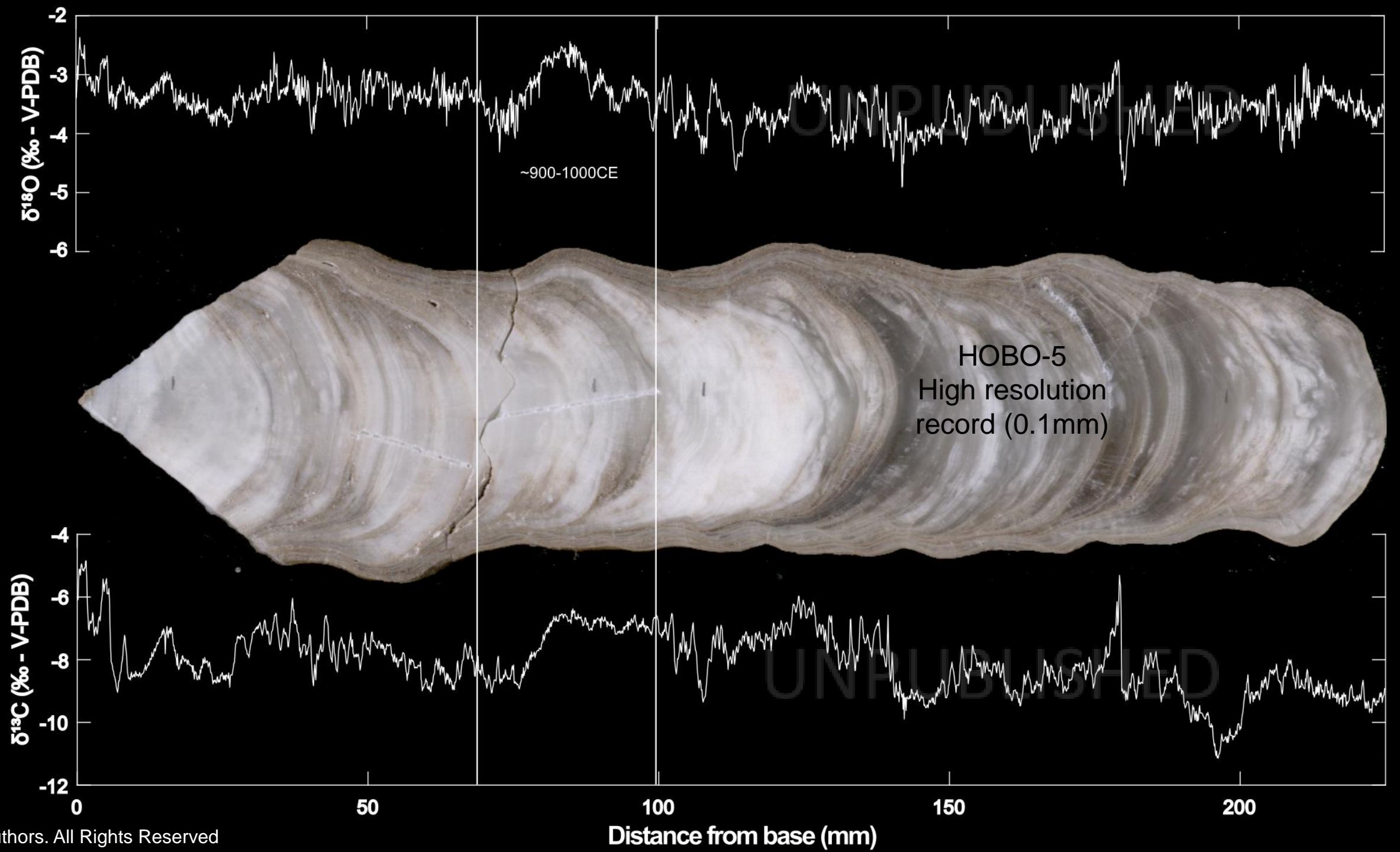
Sampled on 27/2/2005

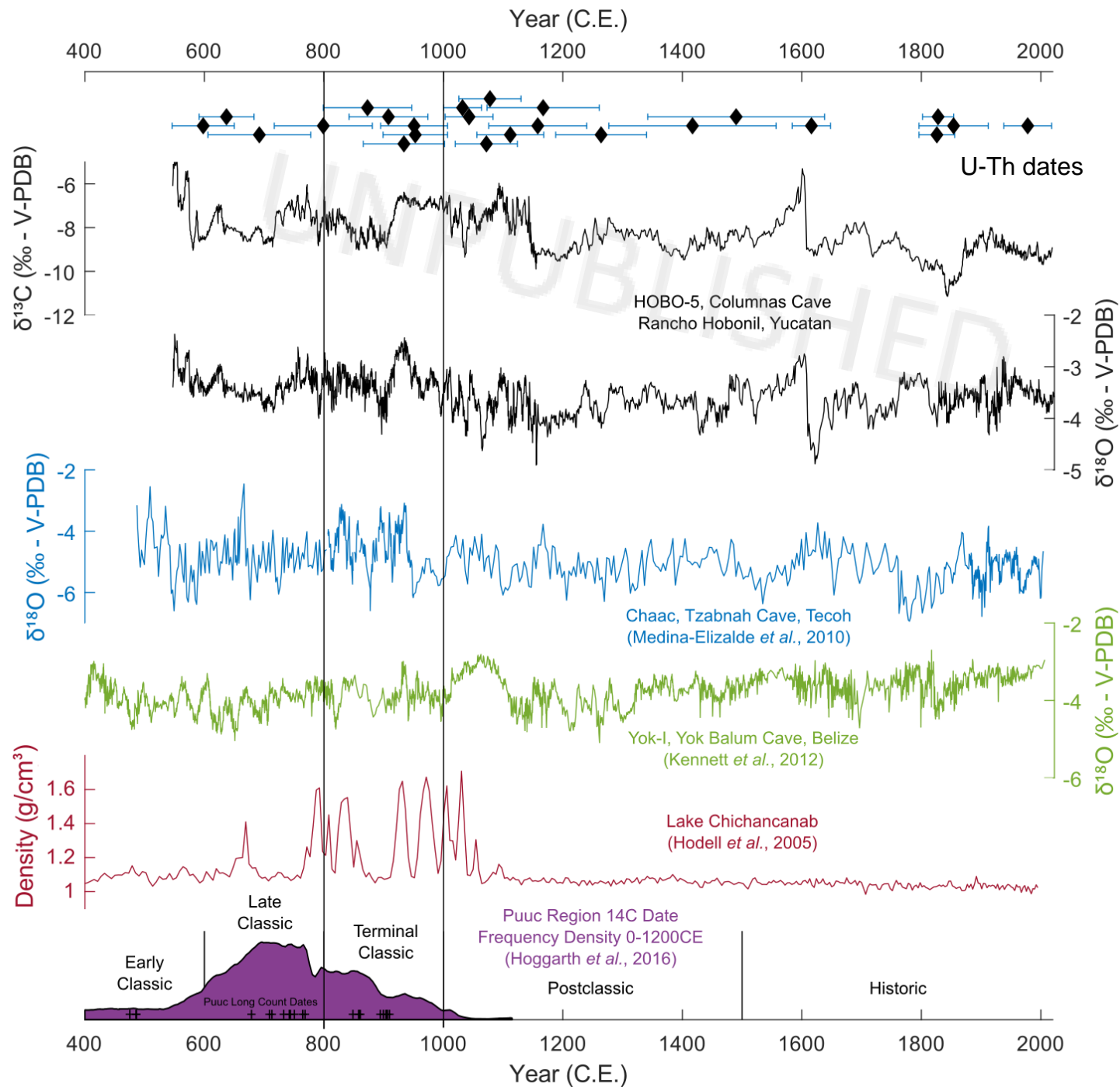


Photos: D. Hodell,
M. Brenner

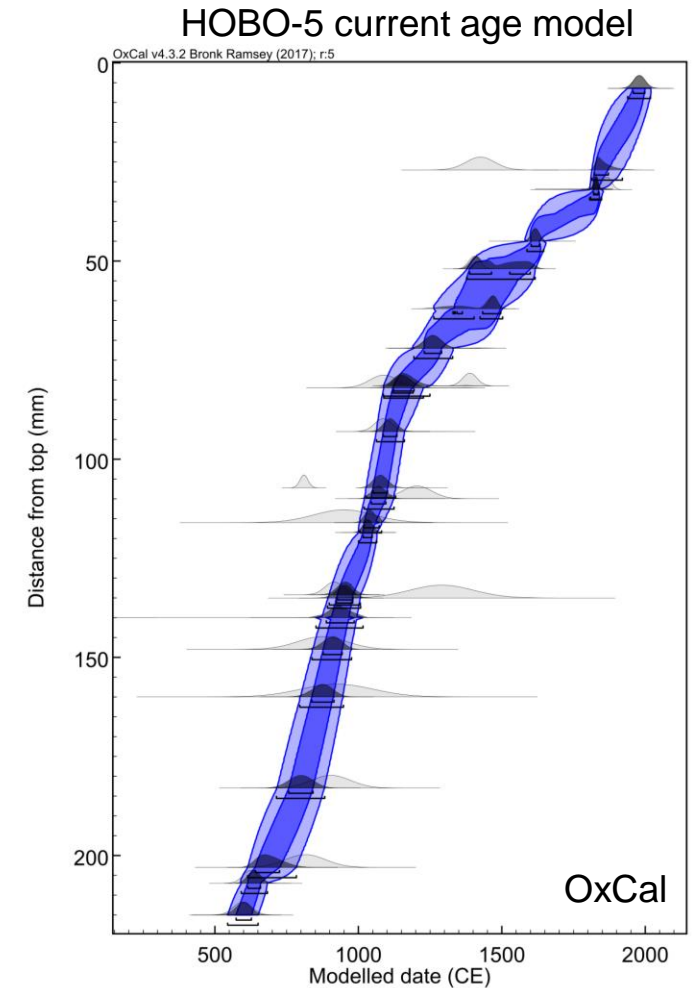
Entrance at 40m elevation.
Mean cave temperature
25.5°C at 94% humidity.
Mean rainfall $\delta^{18}\text{O}$: 1.75‰
($2\sigma = 2.93$)
(All Aug-Dec 2006)

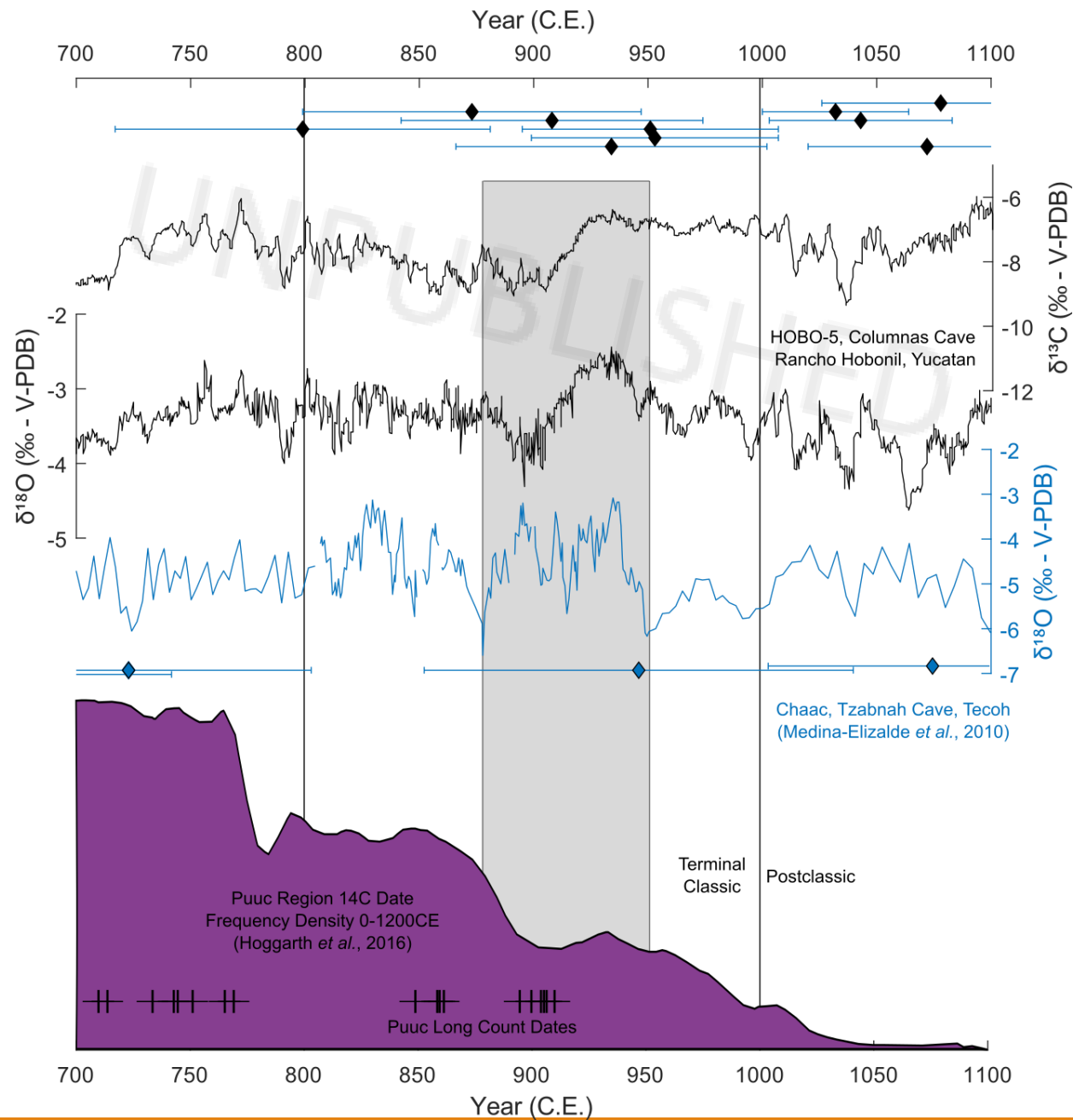






HOB0-5 is an additional stalagmite record suggesting drier conditions during or following the Terminal Classic Period.



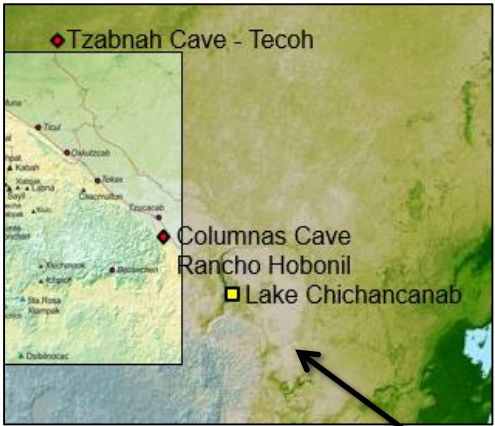


- A decrease in ¹⁴C record density implies population decline in the Puuc region ~850-950CE (Hoggarth *et al.*, 2016)
- The Chaac record suggests these population declines align with more frequent drier periods. Medina-Elizalde *et al.* (2010) show a correlation between modern rainfall amount (1966-94) and stalagmite δ¹⁸O in this region.
- Our results corroborate this. HOB0-5 displays significant positive shifts in δ¹⁸O and δ¹³C spanning 900-950CE, contemporaneous with the Chaac events.

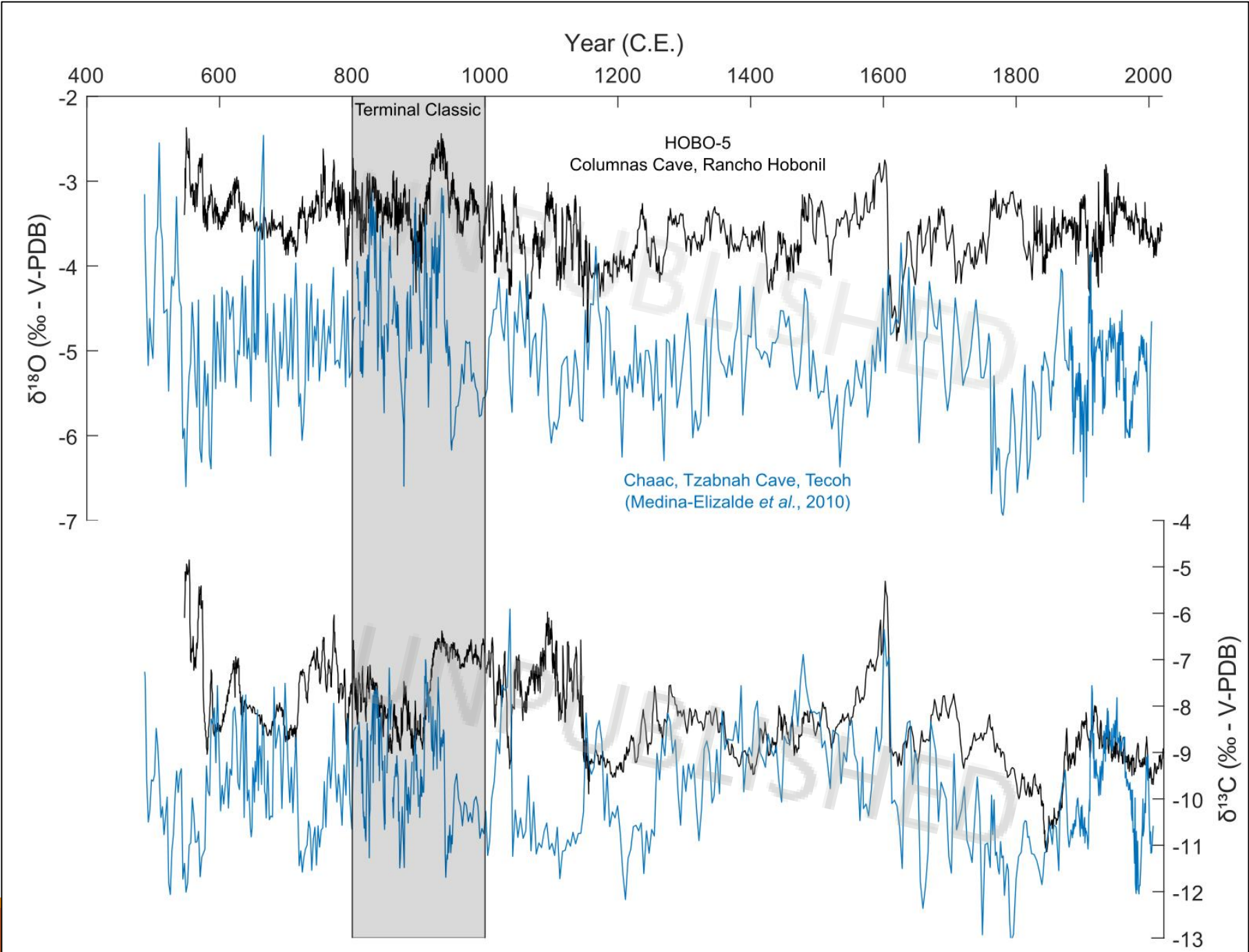
HOBO-5 records less $\delta^{18}\text{O}$ variability than the nearby Chaac record, and values are consistently higher.

Within the Terminal Classic Period, both records replicate a decadal scale shift to more positive $\delta^{18}\text{O}$ values.

This may be due to Columnas' higher elevation above the water table, or an rainout effect along the prevailing wind direction as shown.



Prevailing wind

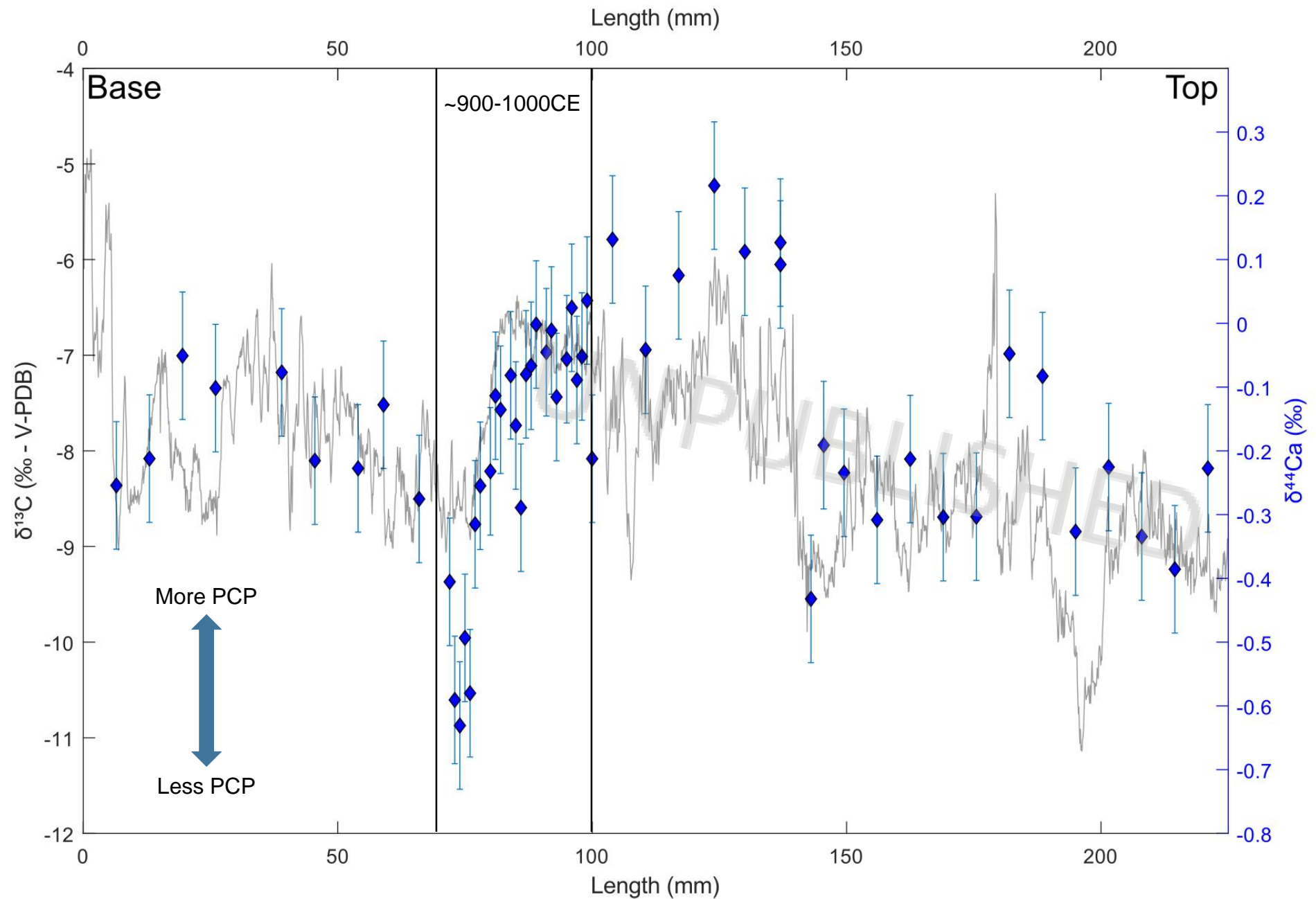


HOBO-5's $\delta^{44}\text{Ca}$ record tracks the observed $\delta^{13}\text{C}$ changes.

Major shifts in both isotope records coincide with the onset of the inferred Terminal Classic droughts.

$\delta^{44}\text{Ca}$ and $\delta^{13}\text{C}$ do not return to pre-TCD values until ~1150CE (140mm).

These records are consistent with changes in PCP.



A high resolution stable isotope record has also been generated for HOBO-6.

An age model for HOBO-6 remains to be produced, results plotted here are correlated by a modern age tie point and $\delta^{13}\text{C}$ wiggle matching.

HOBO-6 does not demonstrate the offset at ~1600CE.

Thank you for listening. I will now gladly accept questions.

