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

Daniel James1
Stacy Carolin1
Sebastian Breitenbach2
Hai Cheng3
Adam Hartland4
Ian Orland5
Mark Brenner6
Jason Curtis6
Christina Gallup7
Soenke Szidat8
Andrew Mason9
John Nicolson1
James Rolfe1
Simon Crowhurst1
David Hodell1

1Department of Earth Sciences, University of Cambridge, Cambridge, UK
2Department of Geography and Environmental Sciences, Northumbria University, Newcastle, UK
3Institute for Global Environmental Change, Xi’an Jiaotong University, Xi’an, China
4Institute of Geosciences, School of Science, University of Waikato, Hamilton, New Zealand
5Department of Geoscience, University of Wisconsin—Madison, Madison WI, USA
6Department of Earth and Environmental Sciences, University of Florida, Gainesville FL, USA
7Department of Earth and Environmental Sciences, University of Minnesota Duluth, Duluth MN, USA
8Department of Chemistry and Biochemistry, Universität Bern, Bern, Switzerland
9Department of Earth Sciences, University of Oxford, Oxford, UK
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.

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

Records spanning the Maya Terminal Classic
- Lake Sediment
- Speleothem

ECMWF ERA5 annual precipitation contours (1979-2018)

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A new record: HOBO-5

Cueva Columnas
Rancho Hobonil
Universidad Autónoma de Yucatán (UADY)
Yucatán
Sampled on 27/2/2005

Entrance at 40m elevation. Mean cave temperature 25.5°C at 94% humidity. Mean rainfall δ¹⁸O: 1.75‰ (2σ = 2.93) (All Aug-Dec 2006)
HOBO-5 is an additional stalagmite record suggesting drier conditions during or following the Terminal Classic Period.
- A decrease in $^{14}$C 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 $\delta^{18}$O in this region.

- Our results corroborate this. HOBO-5 displays significant positive shifts in $\delta^{18}$O and $\delta^{13}$C spanning 900-950CE, contemporaneous with the Chaac events.
HOBO-5 records less $\delta^{18}$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 $\delta^{18}$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.
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 $\delta^{13}$C wiggle matching.

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

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