

HEINRICH STADIAL EVENT 4 RECORDED IN BRAZILIAN STALAGMITE



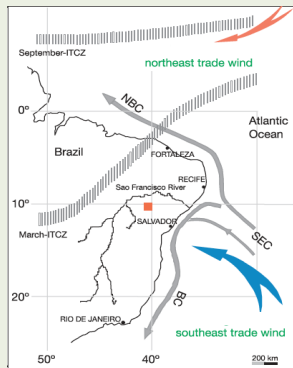
KATHLEEN WENDT¹, XIANFENG WANG², R. LAWRENCE EDWARDS¹, HAI CHENG¹, AND AUGUSTO AULER³



¹ Department of Earth Sciences, University of Minnesota ²Earth Observatory of Singapore, Institute of Nanyang Technological University ³Instituto do Carste

MOTIVATION

- The precise timing and duration of Heinrich Stadial (HS) Events remains a topic of active debate.
- Precipitation levels over NE Brazil increased during HS events due to a southerly displacement of the Intertropical Convergence Zone.^a
- In order to constrain the timeline of HS events, we aim to study a sequence of NE Brazilian speleothems known to grow during these events.^a



Stalagmite TBV-40 grew during HS-4 from 39.66-38.89 ka B.P and a portion of HS-6 from 66.4-65.4 ka B.P.

- A detailed study of the timing and duration of HS-4, as recorded in TBV-40, includes:
- High resolution ²³⁴U/²³⁰Th dating
 - Confocal microscopy band counting

Figure A: Orange square indicates the location of Toca da Boa Vista cave (40°51'39"W 10°09'36"S).

XRD

Powder X-ray microdiffractometry revealed a transition from aragonite to calcite at ~39.5 ka B.P.

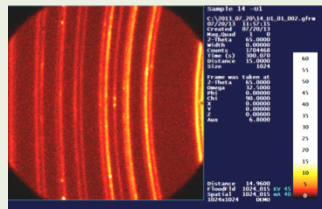


Figure B (upper): micro-XRD Bruker AXS detects aragonite.

Figure C (lower): TBV-40 calcitic and aragonitic growth periods during HS-4 plotted in time with the Hulu Cave record.^d

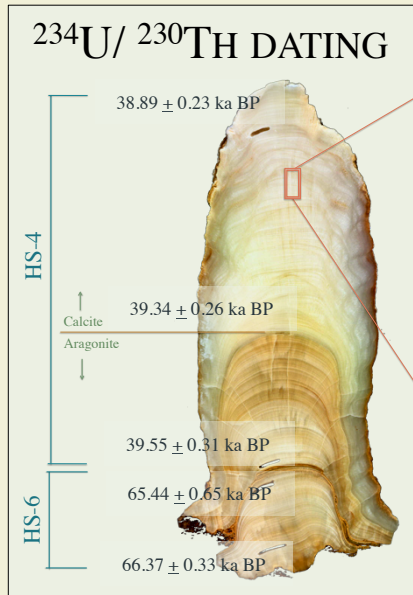
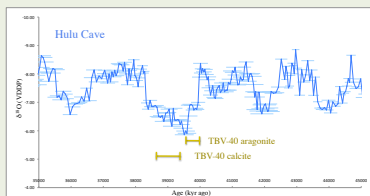


Figure D: TBV-40 cross section. ²³⁰Th dates previously obtained by Xianfeng Wang.^a

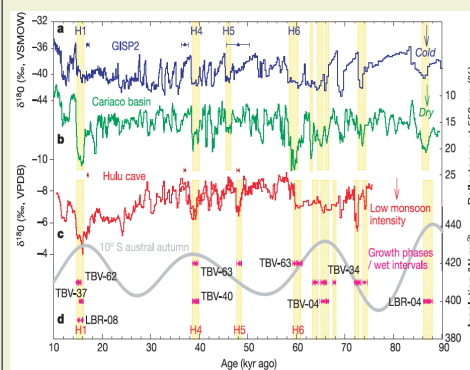
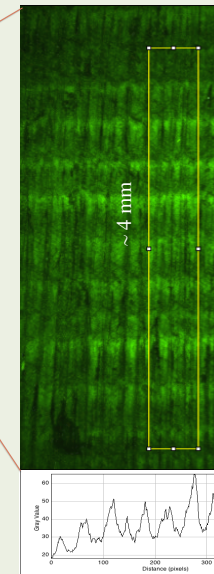


Figure E: Comparison of speleothem growth patterns from NE Brazil with several Northern Hemisphere palaeoclimate archives.

a. $\delta^{18}\text{O}$ values of Greenland ice^b b. Cariaco basin sediments from ODP Hole 1002C^c c. $\delta^{18}\text{O}$ values of Hulu cave stalagmites^d d. NE Brazil speleothem growth patterns indicated by pink bars.^a

CONFOCAL MICROSCOPY



Confocal laser fluorescence microscopy revealed banding in TBV-40.

Light to dark band couplets may represent an seasonal flux of organic-rich drip water.

Fluorescing bands were hand counted using Vinther et al. statistical counting methods.^e

Bands are most distinct in calcite regions, with a total of 307 ± 6 bands.

HS-4 aragonite section totaled 106 ± 10 bands.

Figure F: Confocal image captured by Nikon AZ100 microscope at 488nm excitation wavelength.

Figure G (left): Luminosity profile, obtained from yellow rectangle in figure E,

DISCUSSION

- We infer that calcite growth represents a shift in cave conditions from lower to higher humidity.
- If confocal bands are annual, the approximate duration of the calcite growth phase is 307 ± 6 years. The HS-4 aragonite section is estimated at 106 ± 10 years.
- Future work, including additional ²³⁰Th dates and stable isotope analysis will further constrain the duration of HS-4 event while providing insight into the paleoclimate of NE Brazil.

ACKNOWLEDGMENTS

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