Hemming/Goldstein

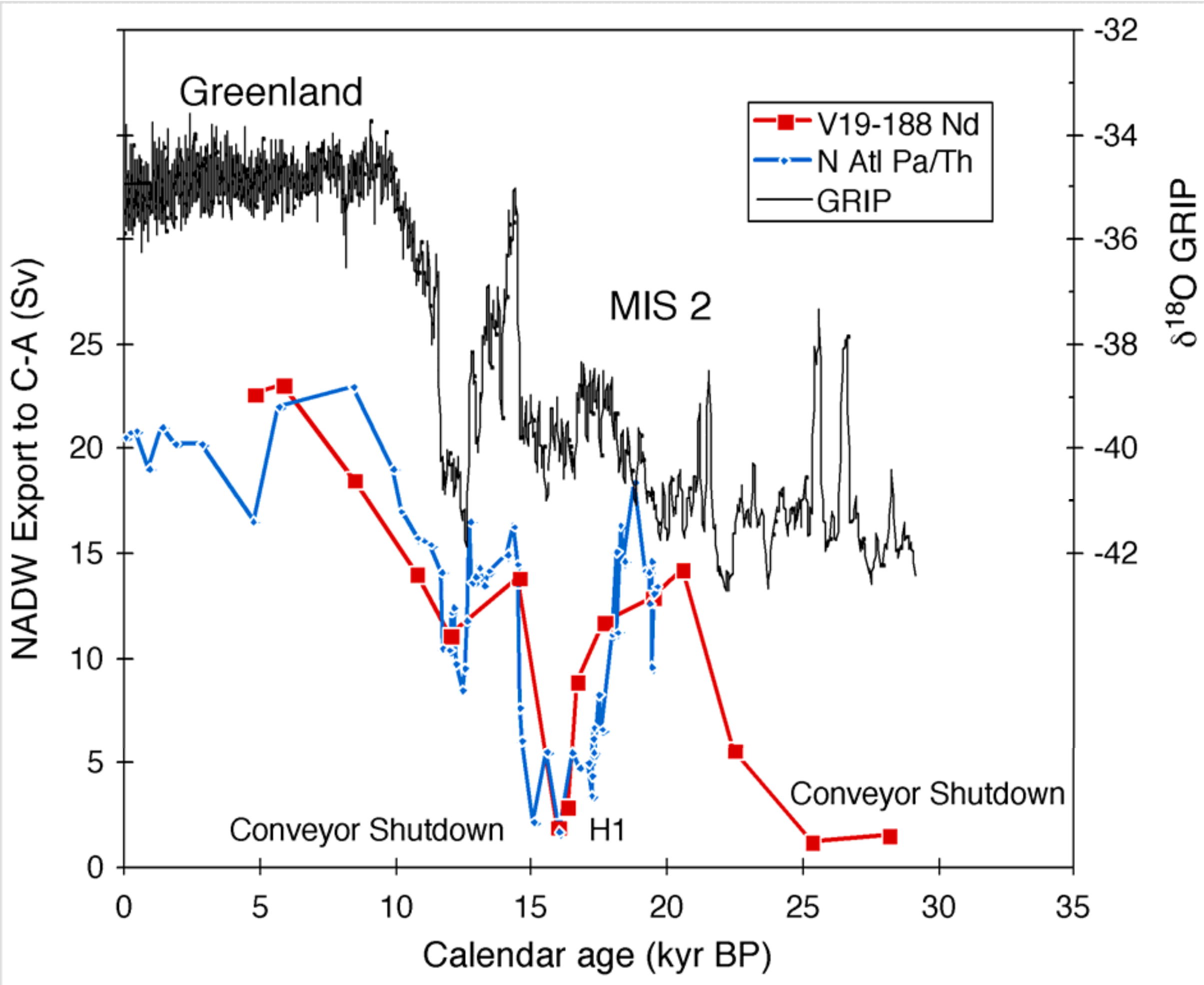
- Heinrich events (provenance of ice rafted detritus)
- Deep water circulation changes (authigenic Nd)
- Changes in surface currents (terrigenous provenance)

Junior Scientists Supported due to this funding

- Grad students: Randye Rutberg, Alex Piotrowski, Allison Franzese
- Post-docs: Katharina Pahnke, Jenna Cole
- And many summer interns

Significant evidence of climate responses during deglaciation- Nd

V19-188 and Pa/Th



V19-188, Carlsberg Ridge, Indian Ocean as a proxy for the Circum-Antarctic. Deep water mass is modified Circumpolar Deep Water;

Compared with Pa/Th from the Bermuda Rise

Similar NADW Export estimates for εNd and Pa/Th:

Both indicate Conveyor shutdown after Heinrich Event 1,

and significant weakening during "Younger Dryas" but no shutdown.

V19-188 indicates shutdown during MIS 2 before 23 kyr

(N Atl Pa/Th data from McManus et al. 2004;
Nd isotope data from Goldstein and others, in prep.)

Abrupt changes in Antarctic Intermediate Water circulation over the past 25,000 years

KATHARINA PAHNKE[1]*, STEVEN L. GOLDSTEIN[1,2] AND SIDNEY R. HEMMING[1,2]

Authigenic Nd from Tobago Basin (MD99-2198

Authigenic Nd from Brazil margin (KNR159-5-36GGC

Intermediate water benthic Cd/Ca from Atlantic cores from published papers

Intermediate water benthic d18O from Atlantic cores from published papers

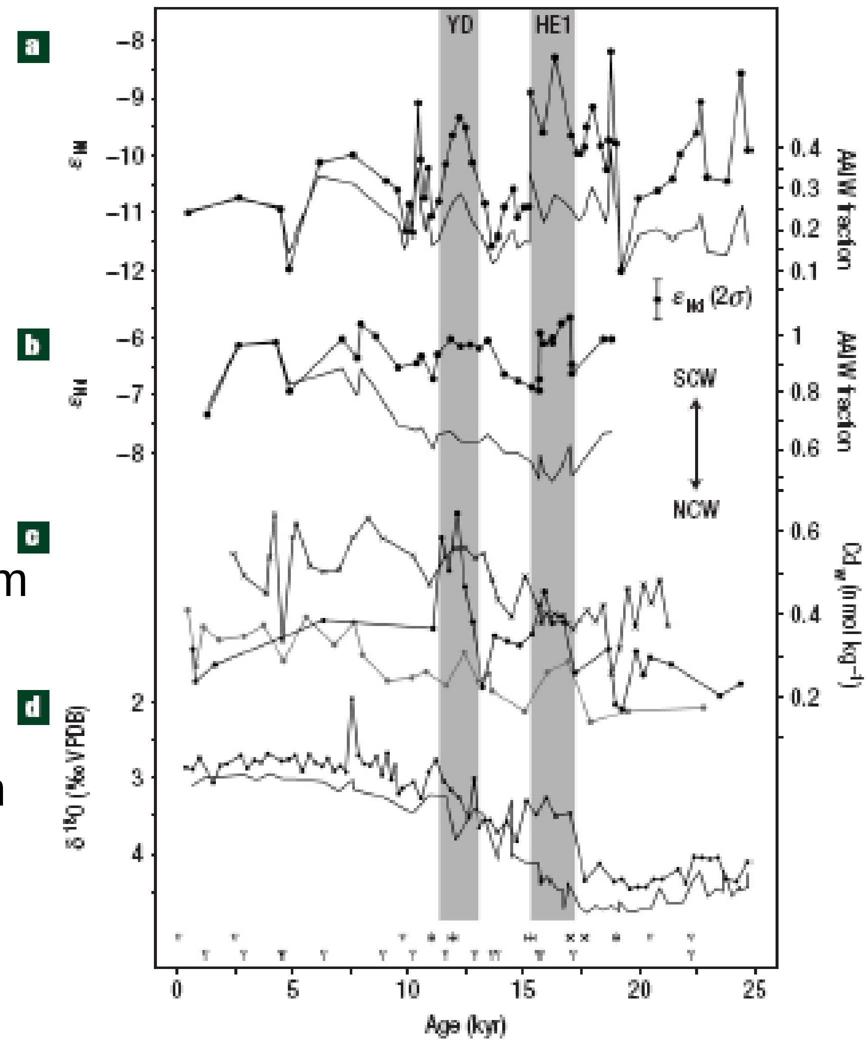


Figure 2 Atlantic intermediate-water records.

nature geoscience | VOL 1 | DECEMBER 2008 | www.nature.com/naturegeoscience

Hemming/Goldstein

- Heinrich events (provenance of ice rafted detritus)
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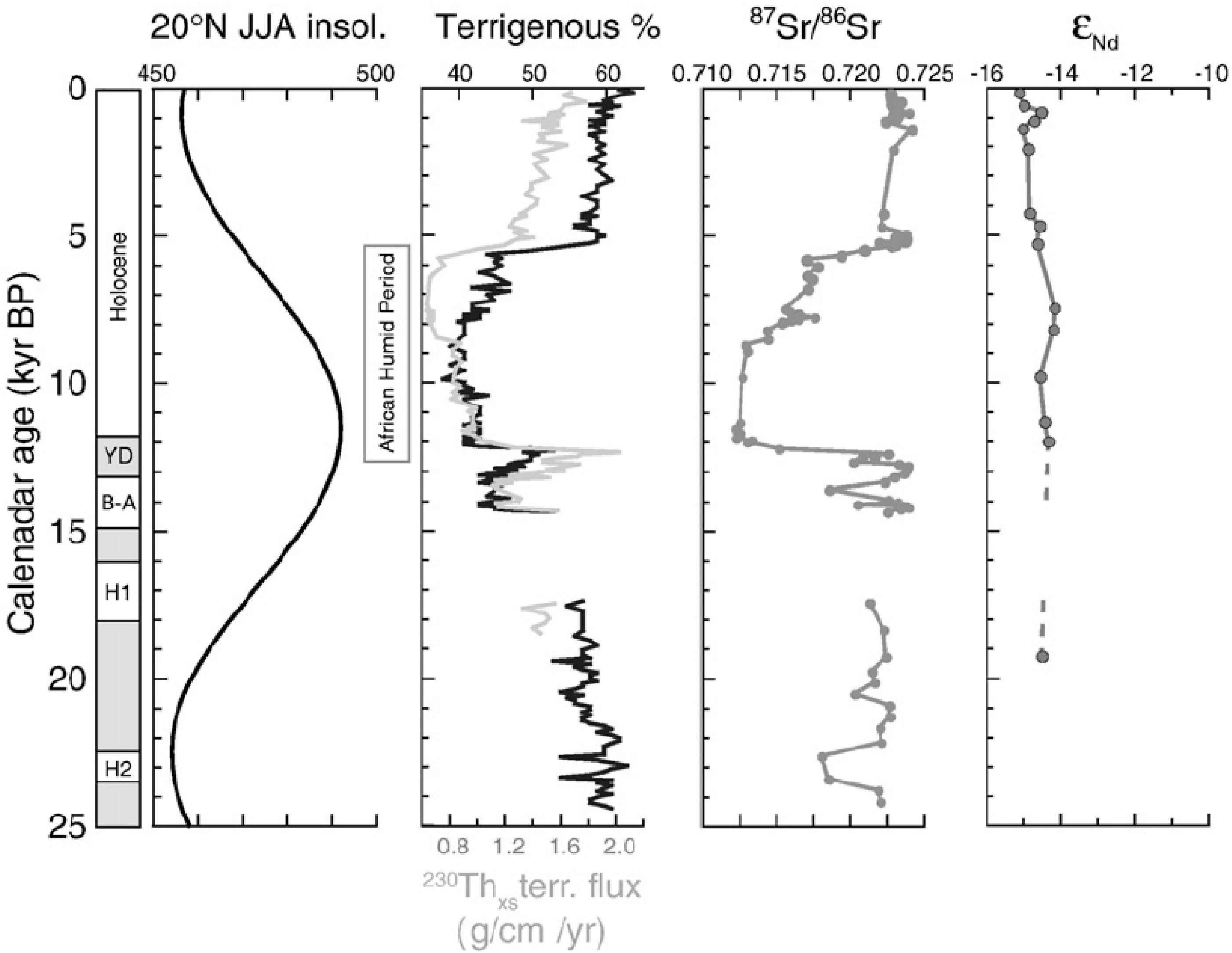
- Changes in surface currents (terrigenous provenance)
- Changes in aridity
  - Dust records

Contrasting compositions of Saharan dust in the eastern Atlantic Ocean during the last deglaciation and African Humid Period

Jennifer M. Cole [a,*], Steven L. Goldstein [a,b], Peter B. deMenocal [a,b], Sidney R. Hemming [a,b], Francis E. Grousset [a,c]

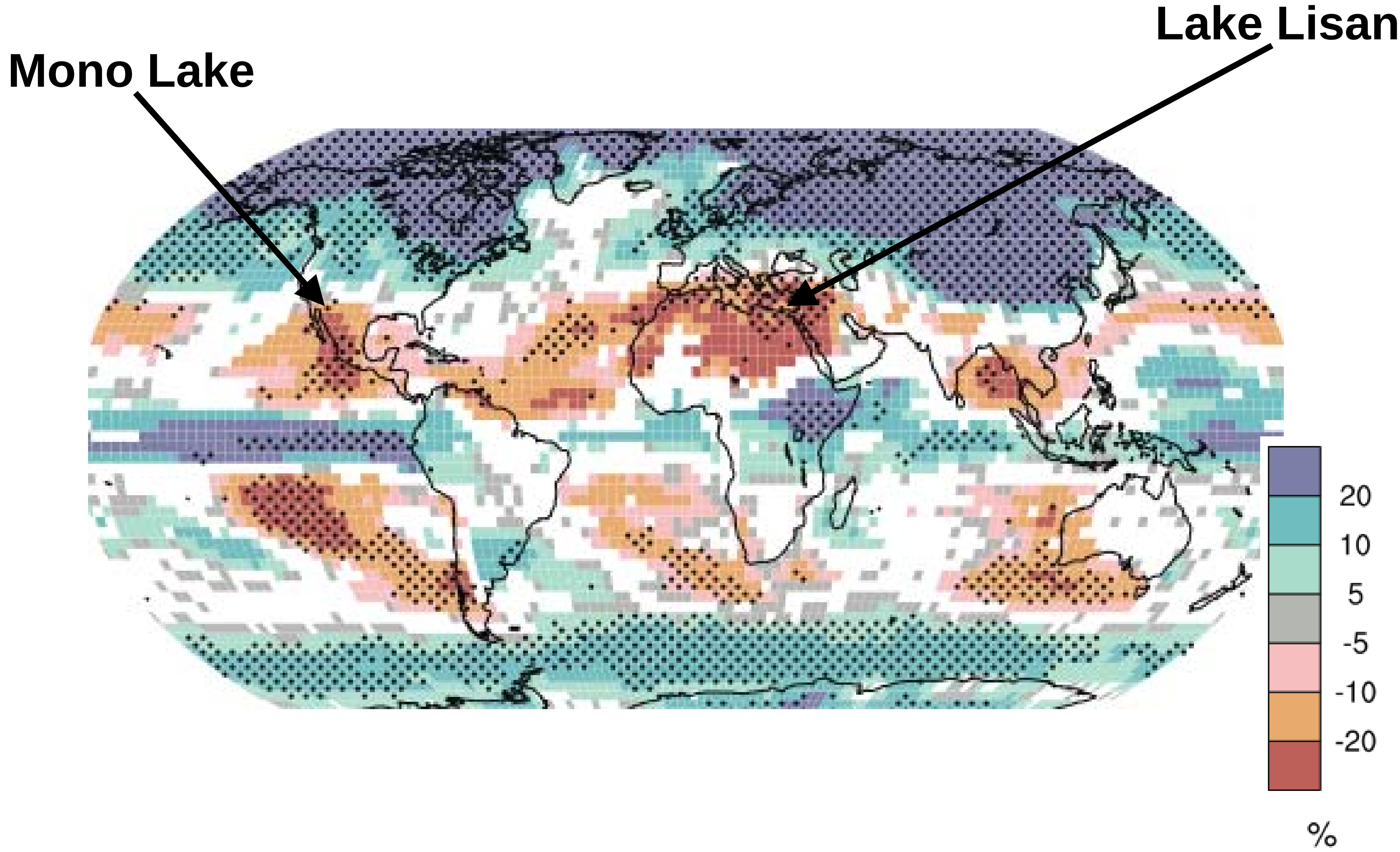


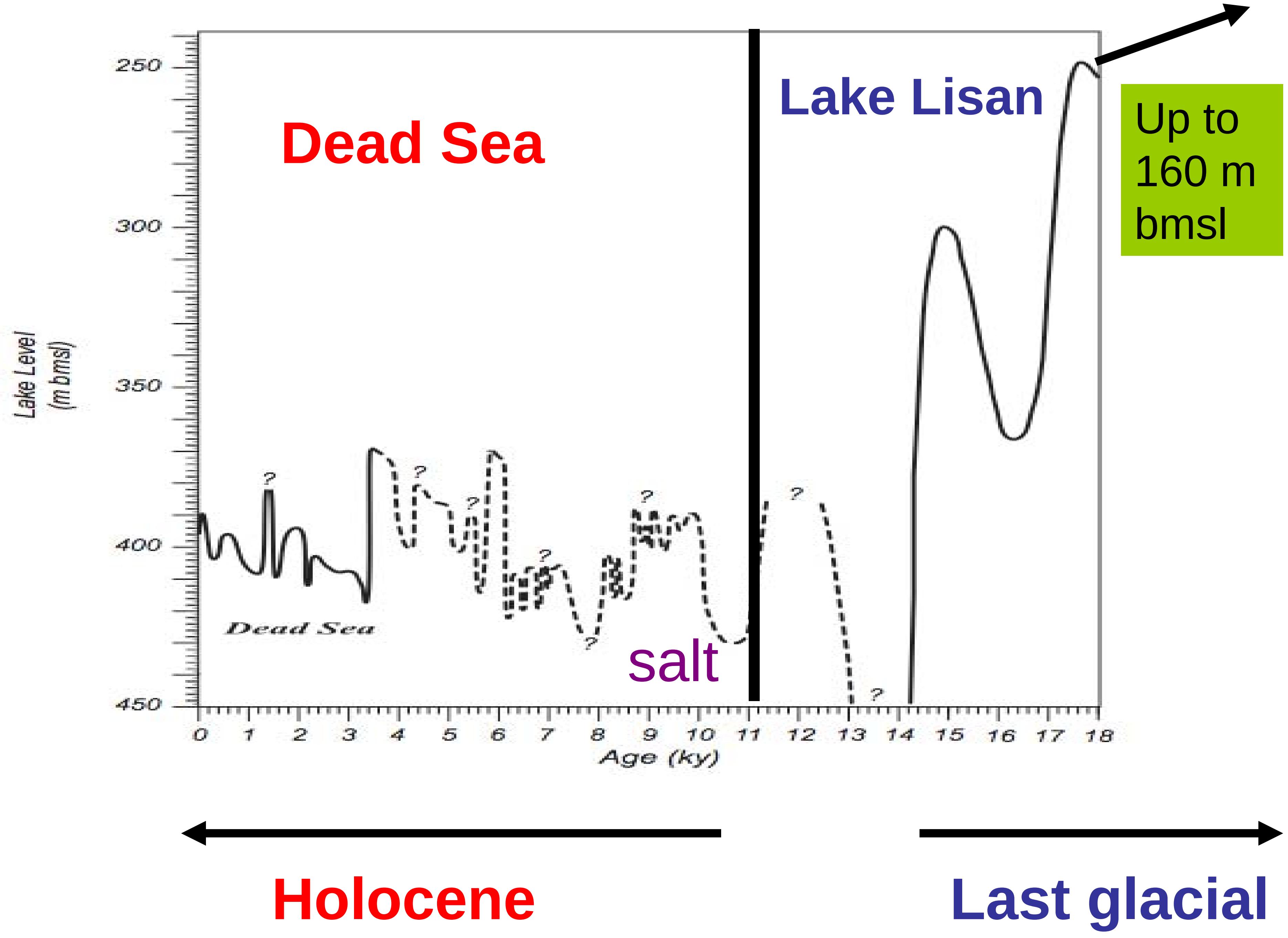
J.M. Cole et al. / Earth and Planetary Science Letters 278 (2009) 257–266

Hemming/Goldstein

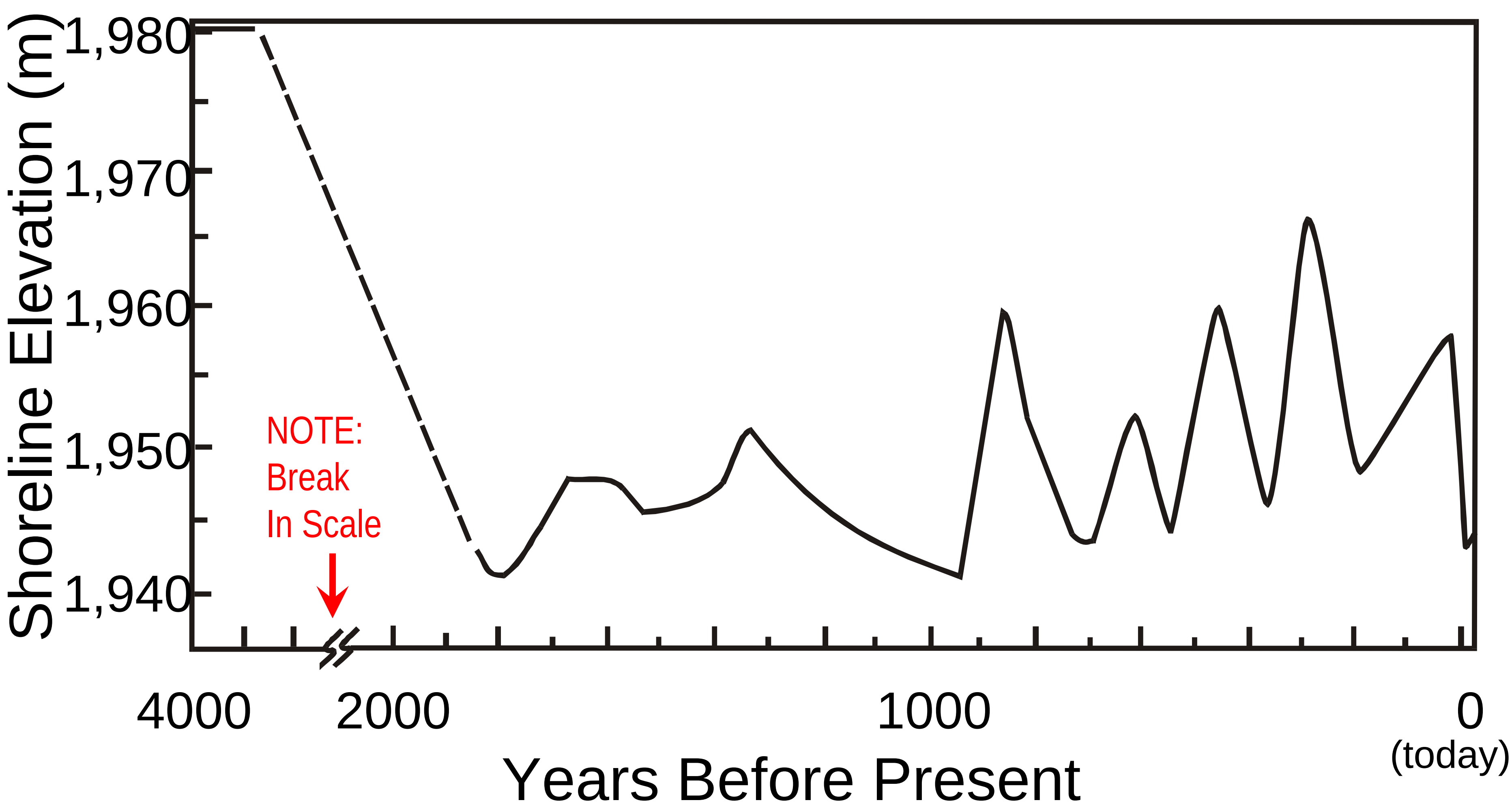
- Heinrich events (provenance of ice rafted detritus)
- Deep water circulation changes (authigenic Nd)
- Changes in surface currents (terrigenous provenance)
- Changes in aridity
  - Dust records
  - Lake Lisan (Goldstein), Mono Lake (Hemming)

IPCC projected changes in winter precipitation for the interval 2090-2099, compared to today's average




Dead Sea
Lake Lisan
Up to 160 m bmsl
salt
Lake Level (m bmsl)
250
300
350
400
450
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Age (ky)
Holocene
Last glacial

Mono Lake Level Over the Last 4000 Years



from Scott Stine

Chronology:

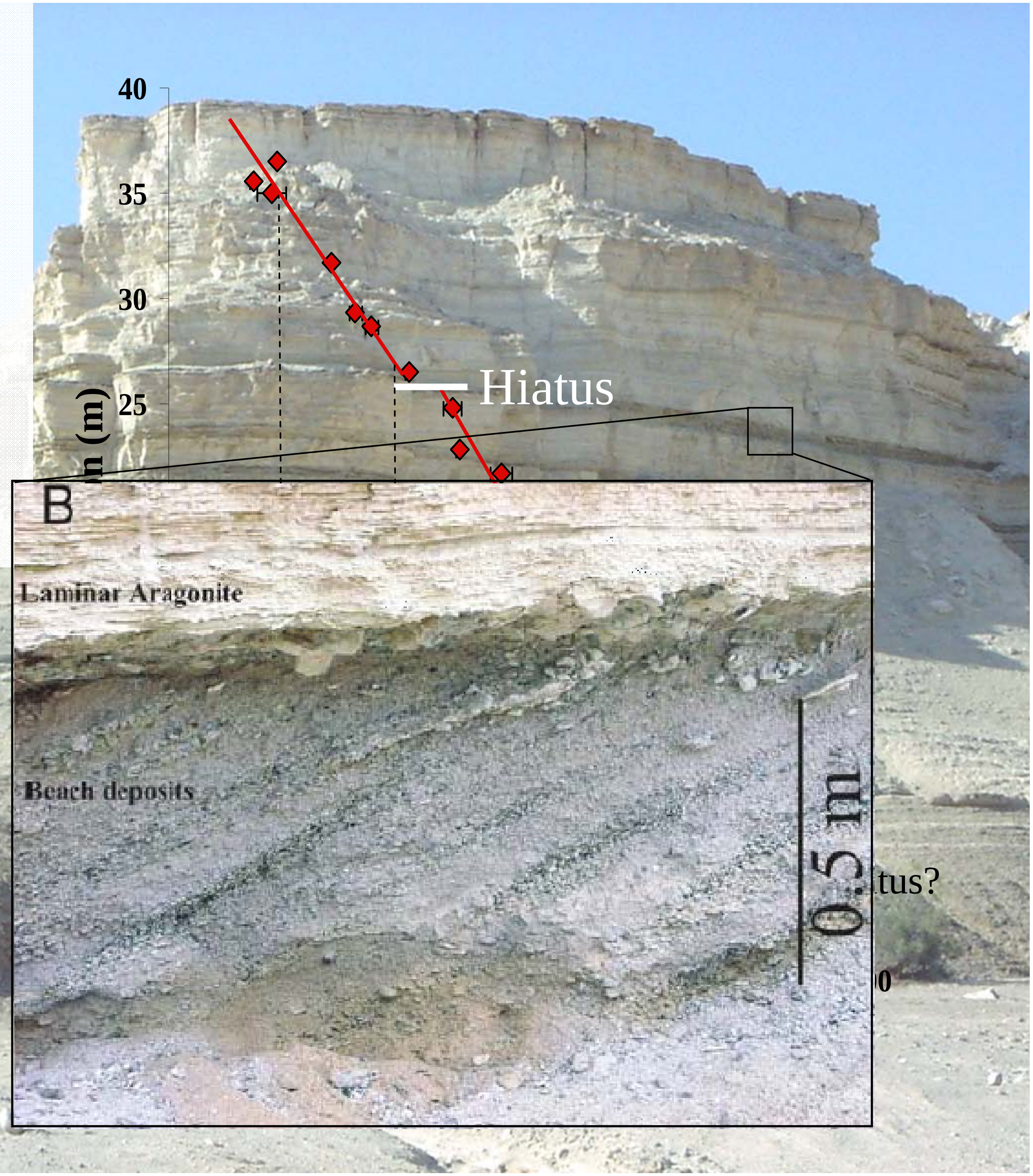
^{14}C dating

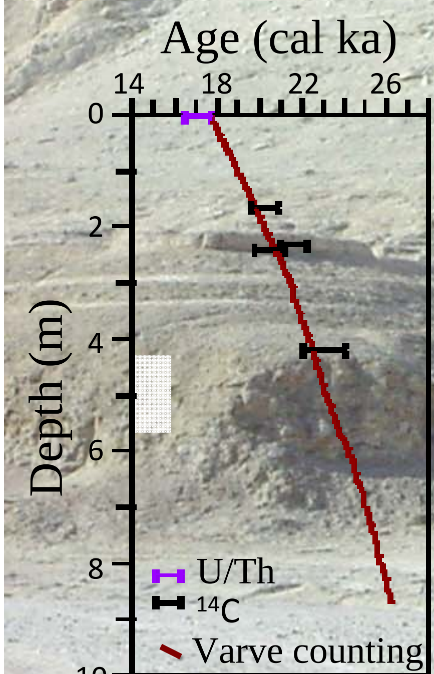
U/Th dating

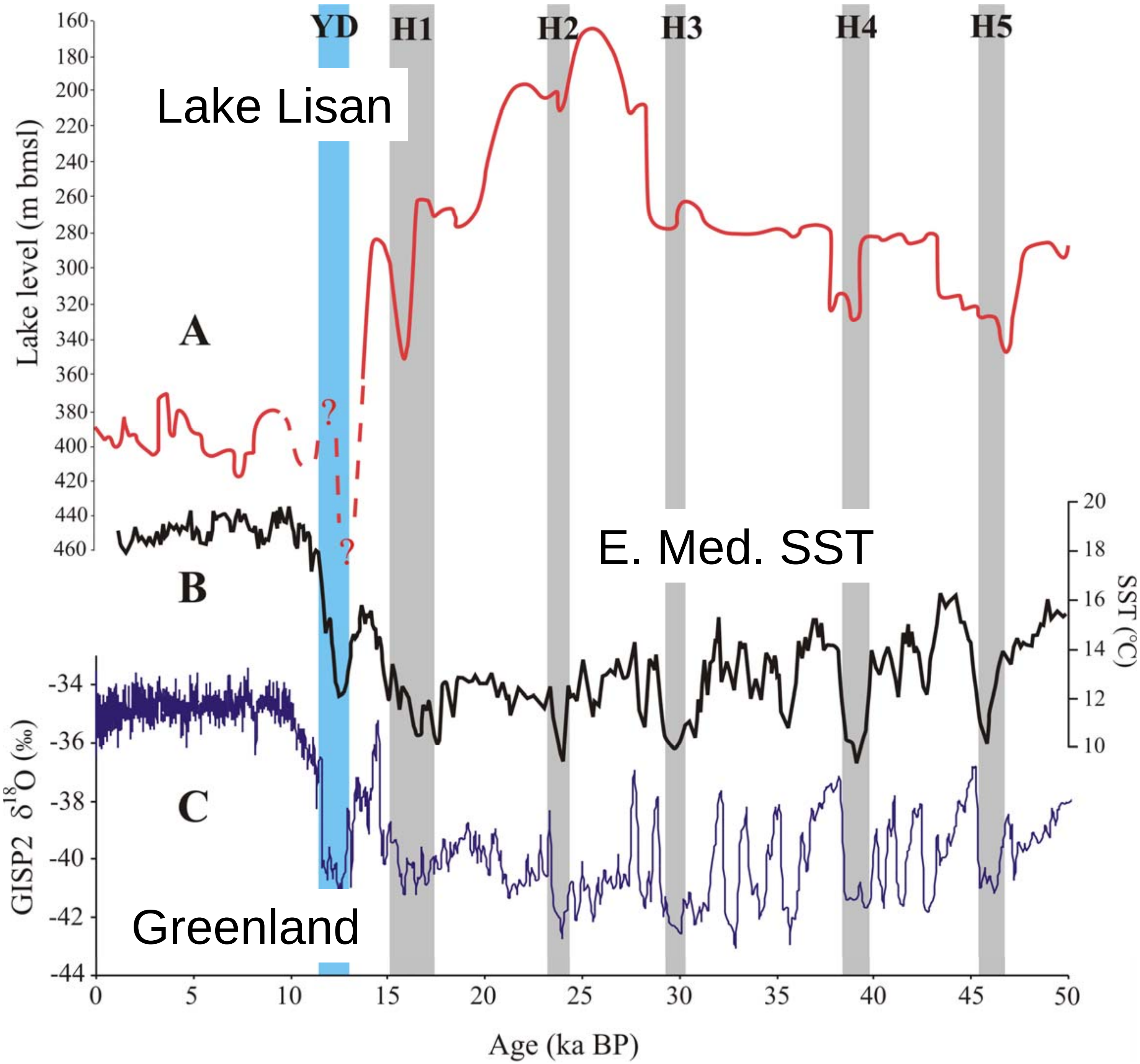
Varve counting

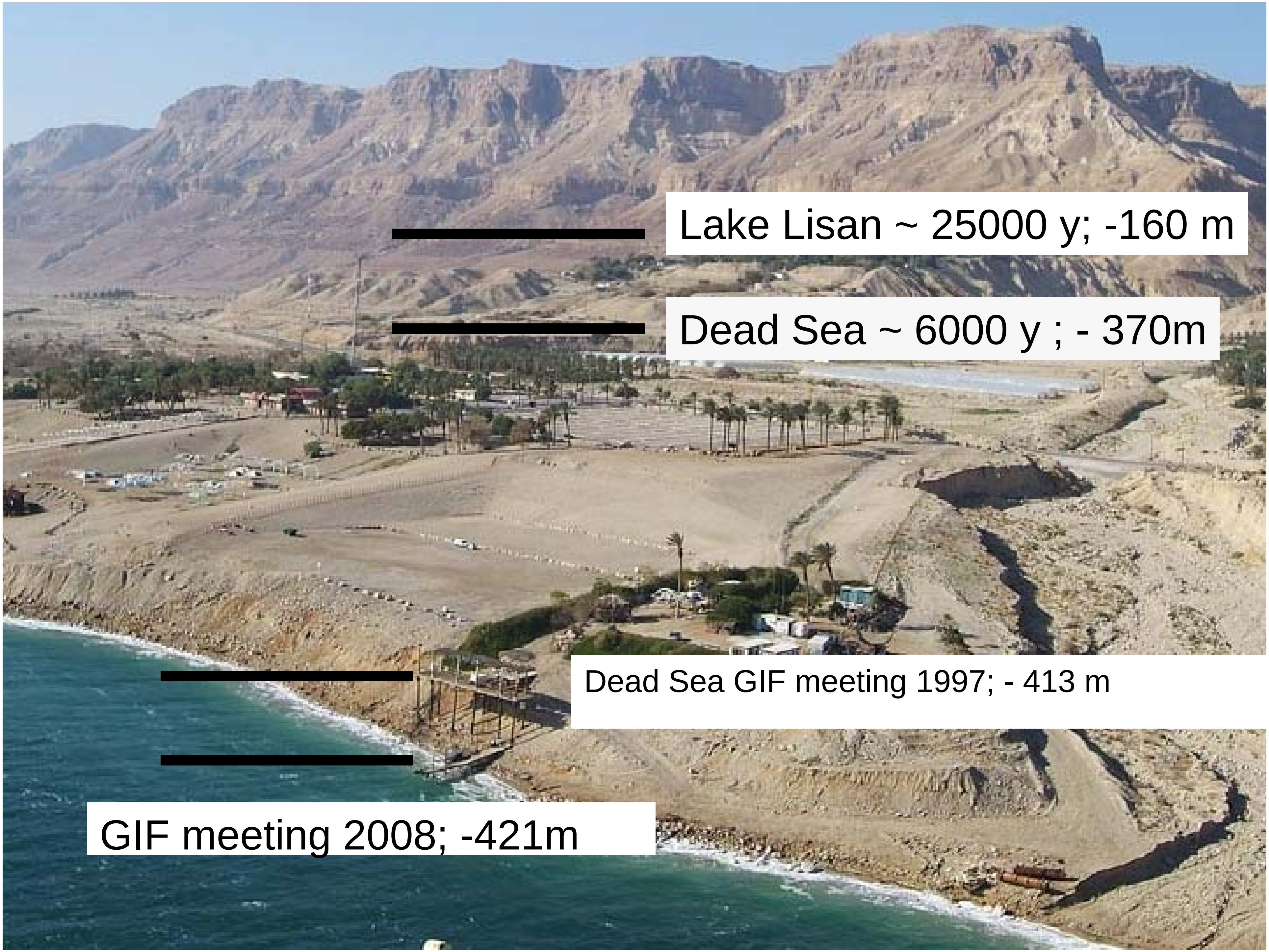
Haase Schramm et al., 2004

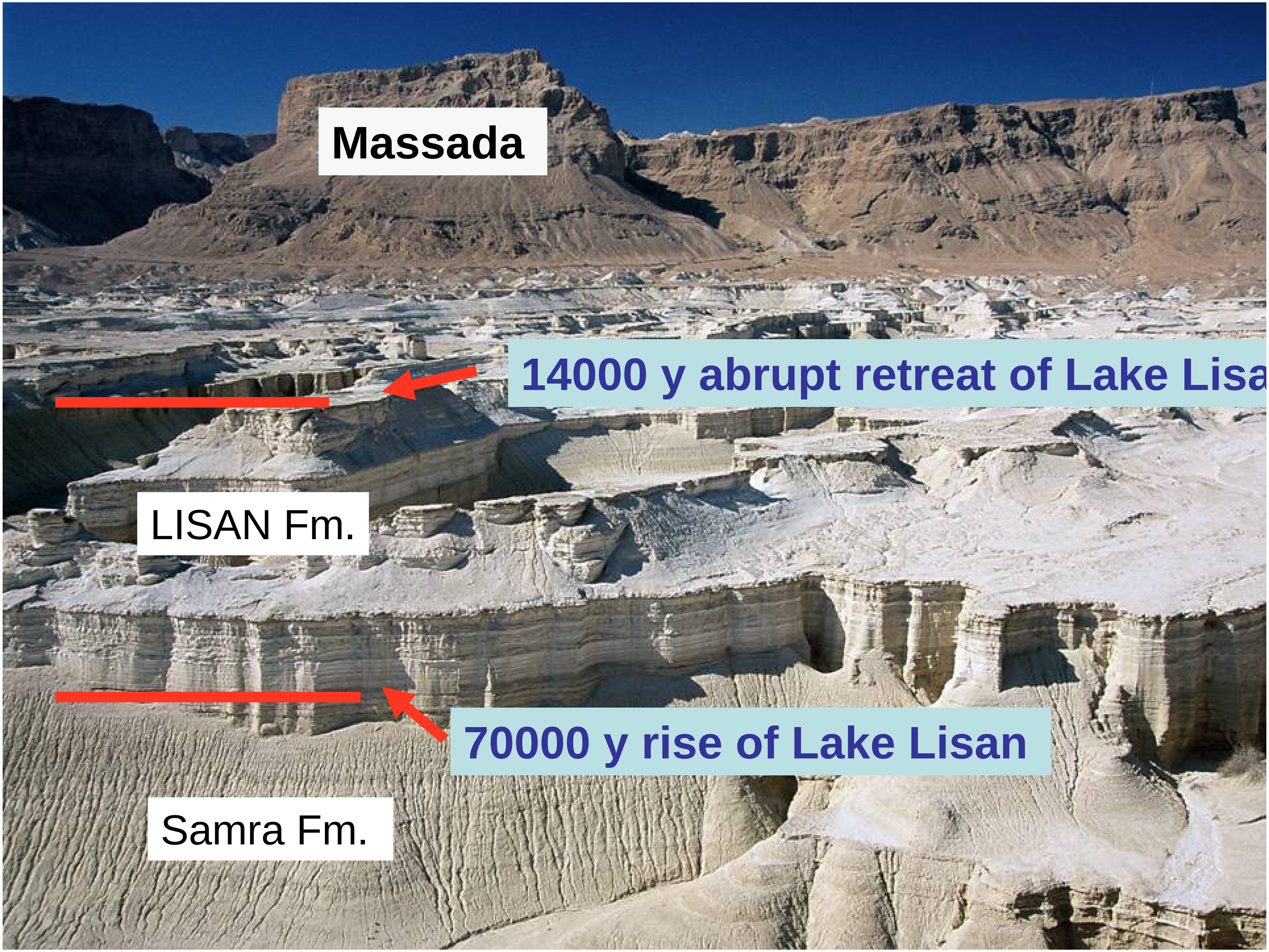
Prasad et al., 2004





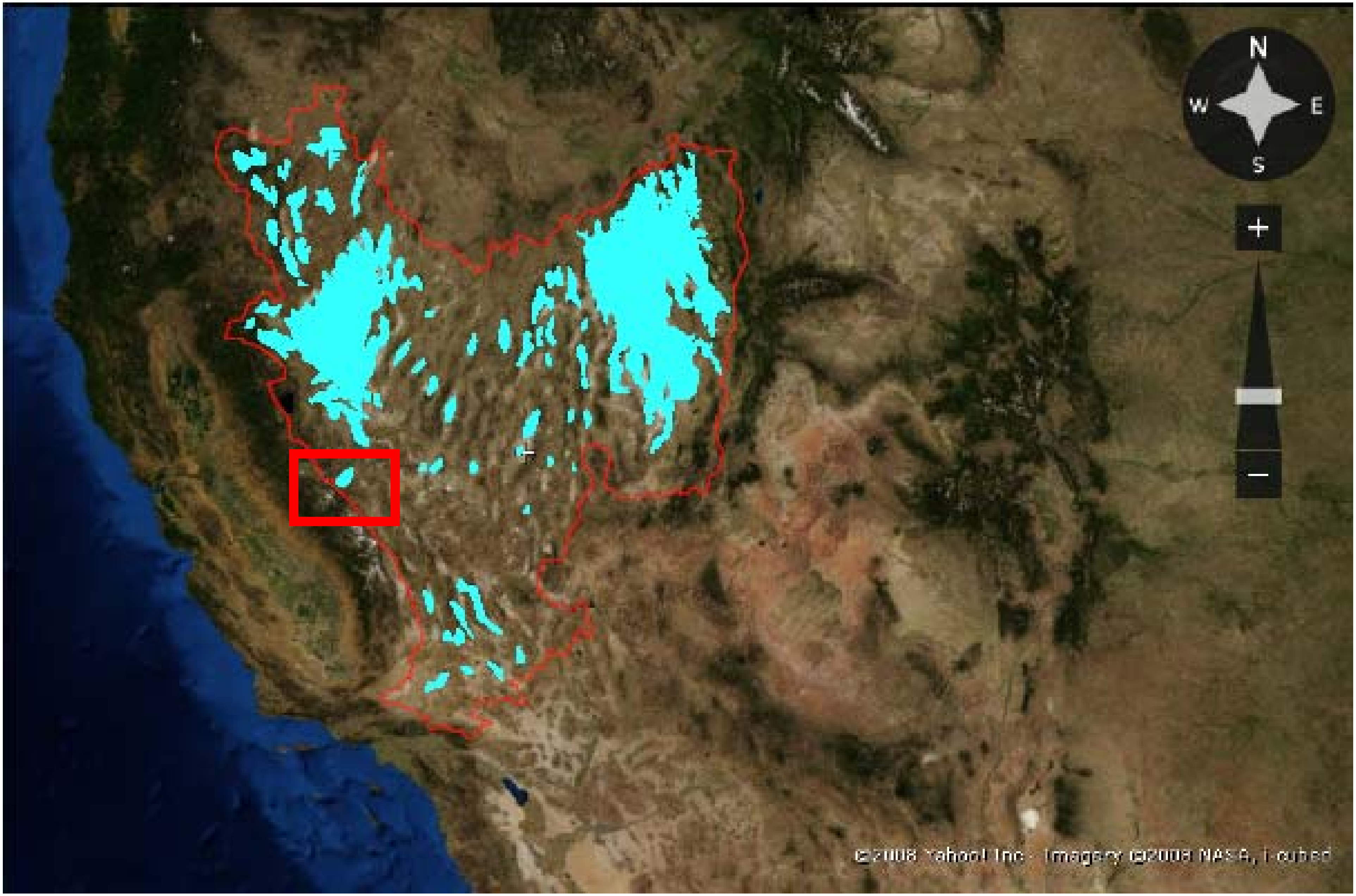

YD
H1
H2
H3
H4
H5
Lake Lisan
Lake level (m bmsl)
A
B
C
E. Med. SST
SST (°C)
GISP2 δ18O (‰)
Greenland
Age (ka BP)

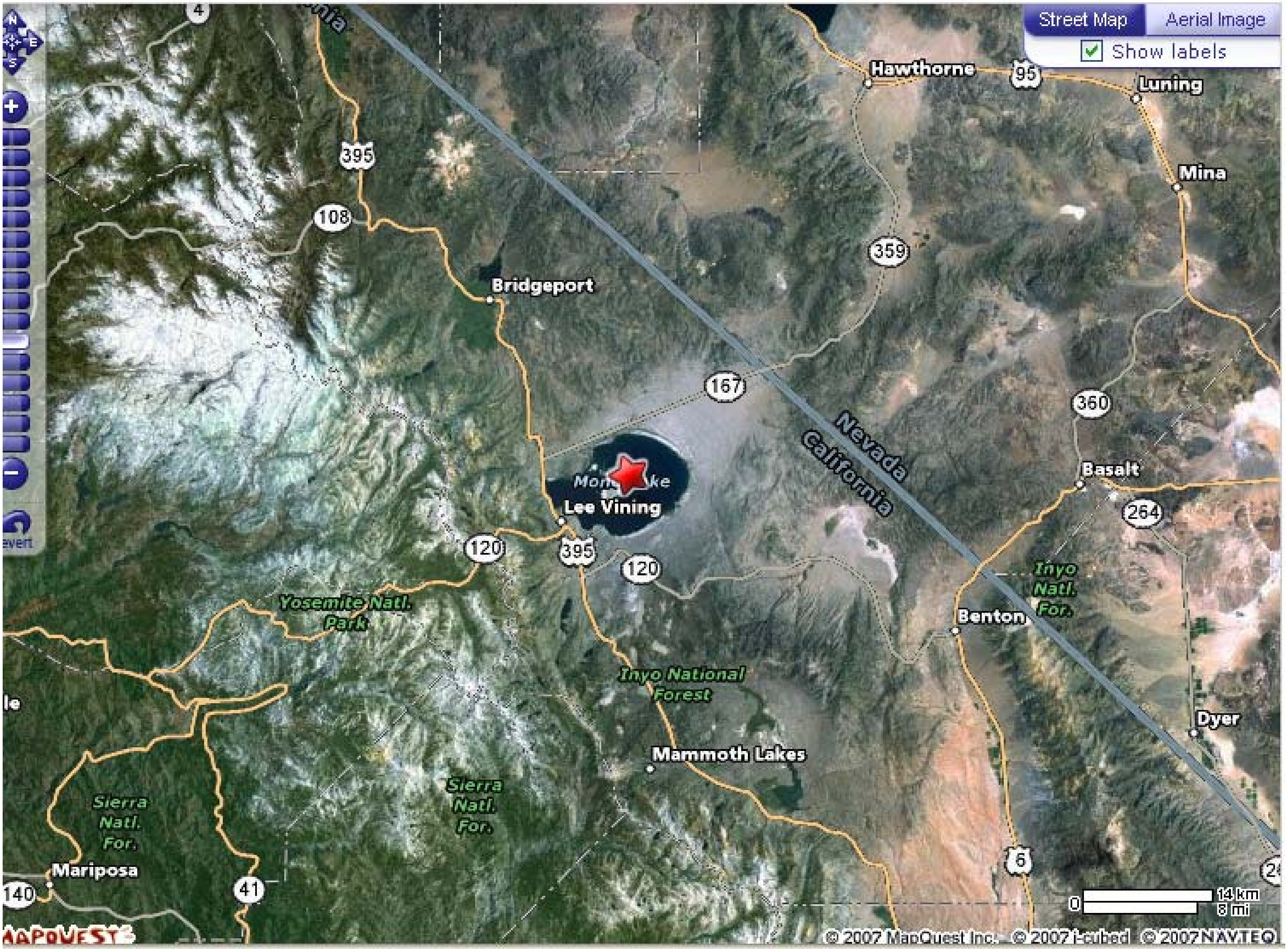

Lake Lisan ~ 25000 y; -160 m
Dead Sea ~ 6000 y ; - 370m
Dead Sea GIF meeting 1997; - 413 m
GIF meeting 2008; -421m


Massada
14000 y abrupt retreat of Lake Lisa
LISAN Fm.
70000 y rise of Lake Lisan
Samra Fm.


~~14000~~~12000 y abrupt retreat of Lake Russell
70000 y rise of Lake Russell

Maximum extent of Great Basin Lakes during the Last Glacial Maximum





Street Map
Aerial Image
Show labels
4
Hawthorne
95
Luning
Mina
395
108
Bridgeport
359
167
360
Nevada
California
Basalt
264
Lee Vining
120
395
120
Yosemite Natl. Park
Inyo Natl. For.
Benton
Inyo National Forest
Dyer
Mammoth Lakes
Sierra Natl. For.
Sierra Natl. For.
Mariposa
140
41
6
0
14 km
8 mi
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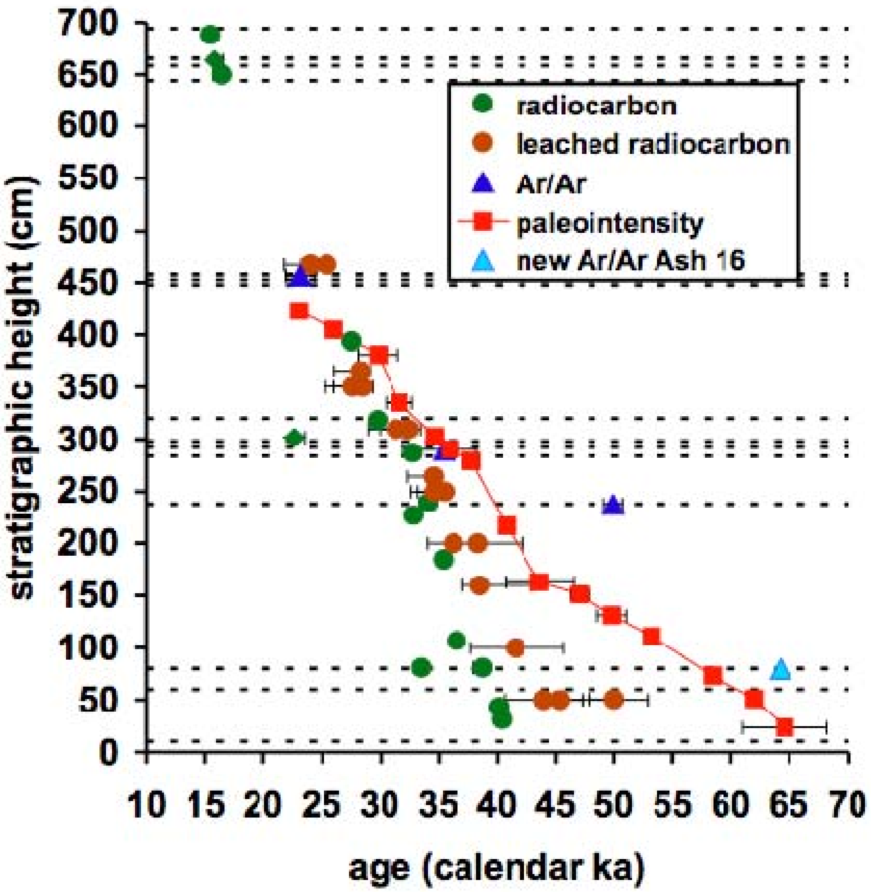
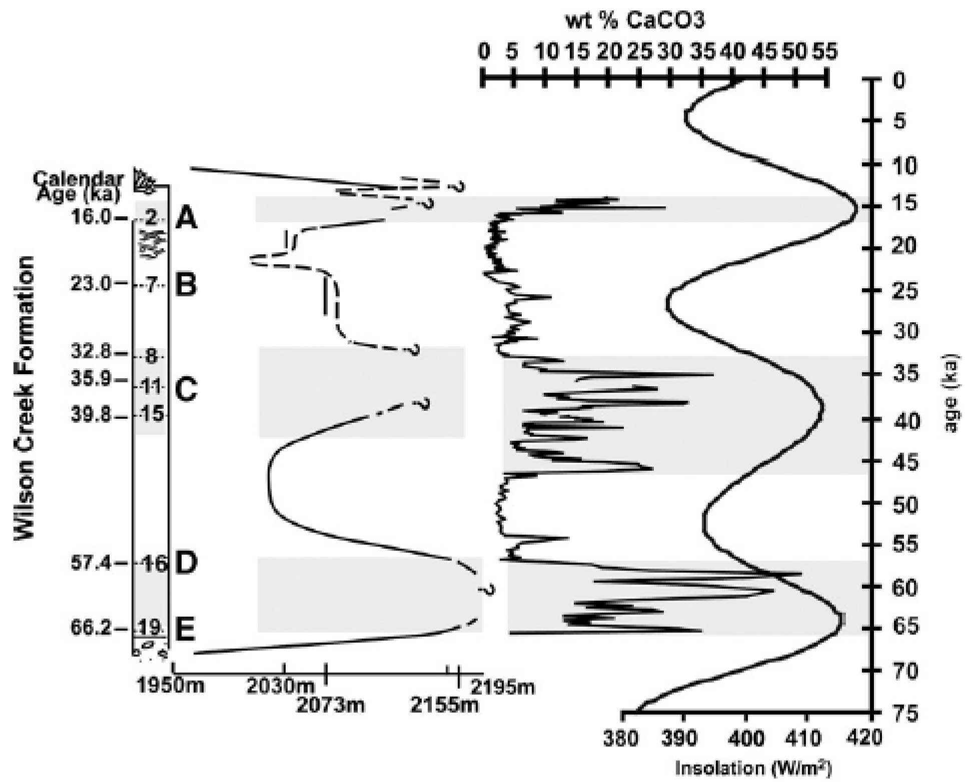
ELSEVIER
Available online at www.sciencedirect.com
ScienceDirect
Earth and Planetary Science Letters 252 (2006) 94–106
EPSL
www.elsevier.com/locate/epsl

Revised chronology for late Pleistocene Mono Lake sediments based on paleointensity correlation to the global reference curve

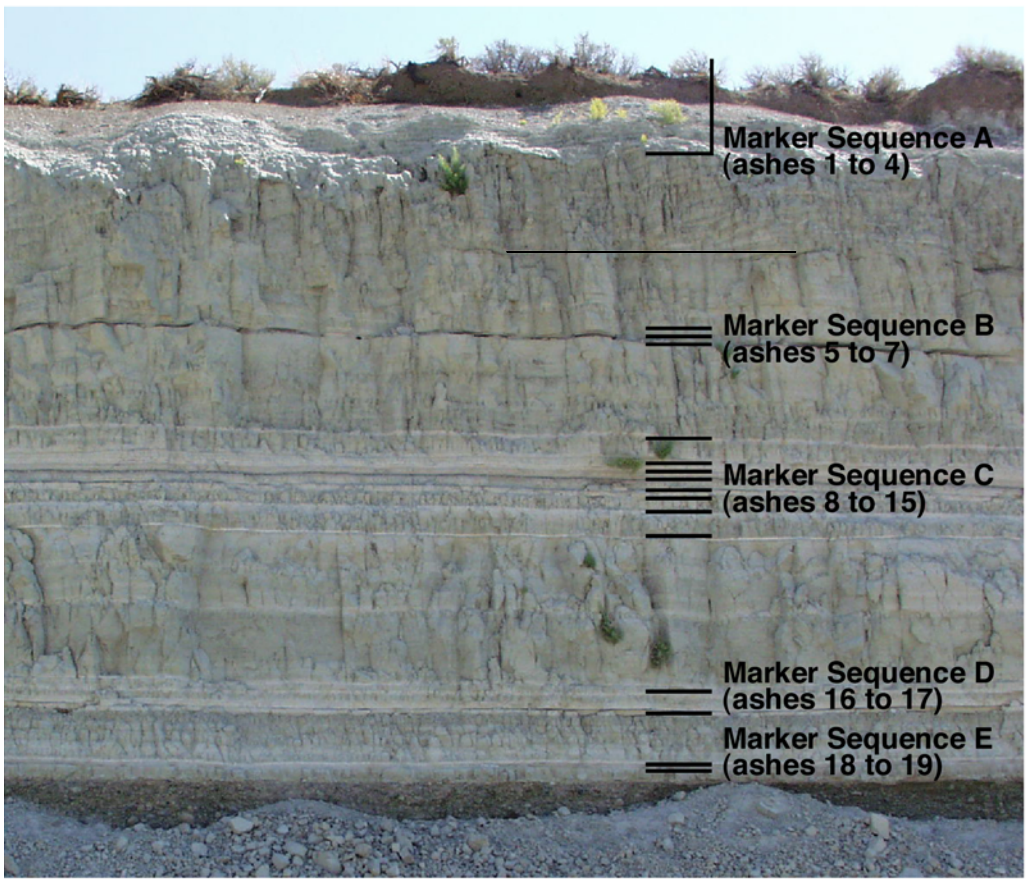
Susan H. Zimmerman [a,*], Sidney R. Hemming [a,b], Dennis V. Kent [b,c], Stephanie Y. Searle [a]



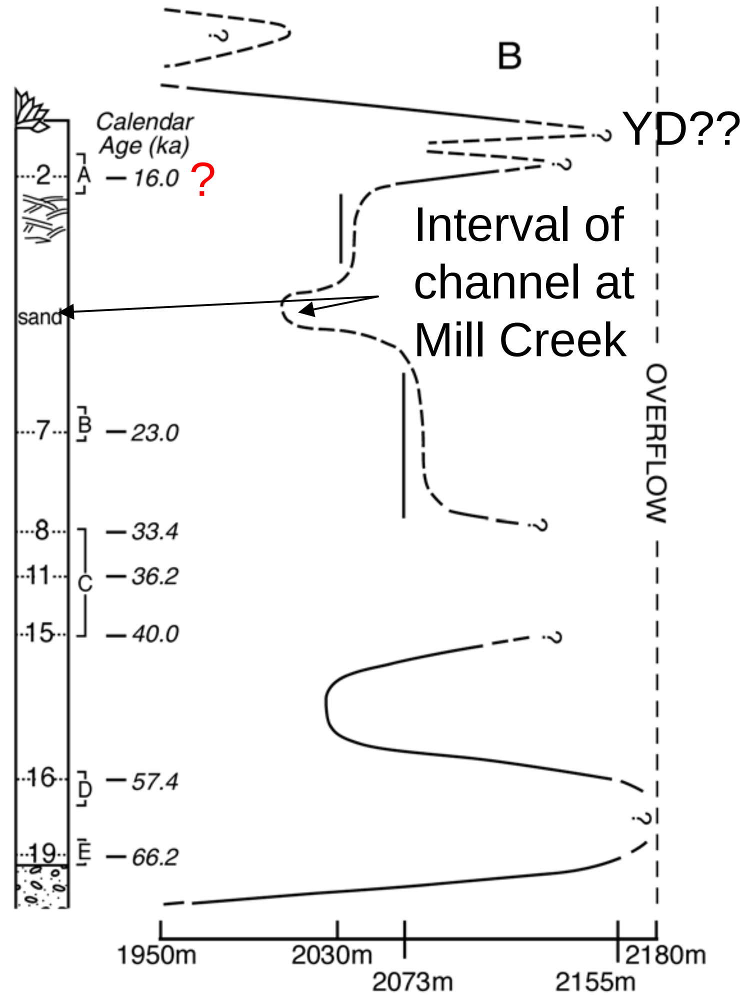


Wilson Creek Formation at type locality

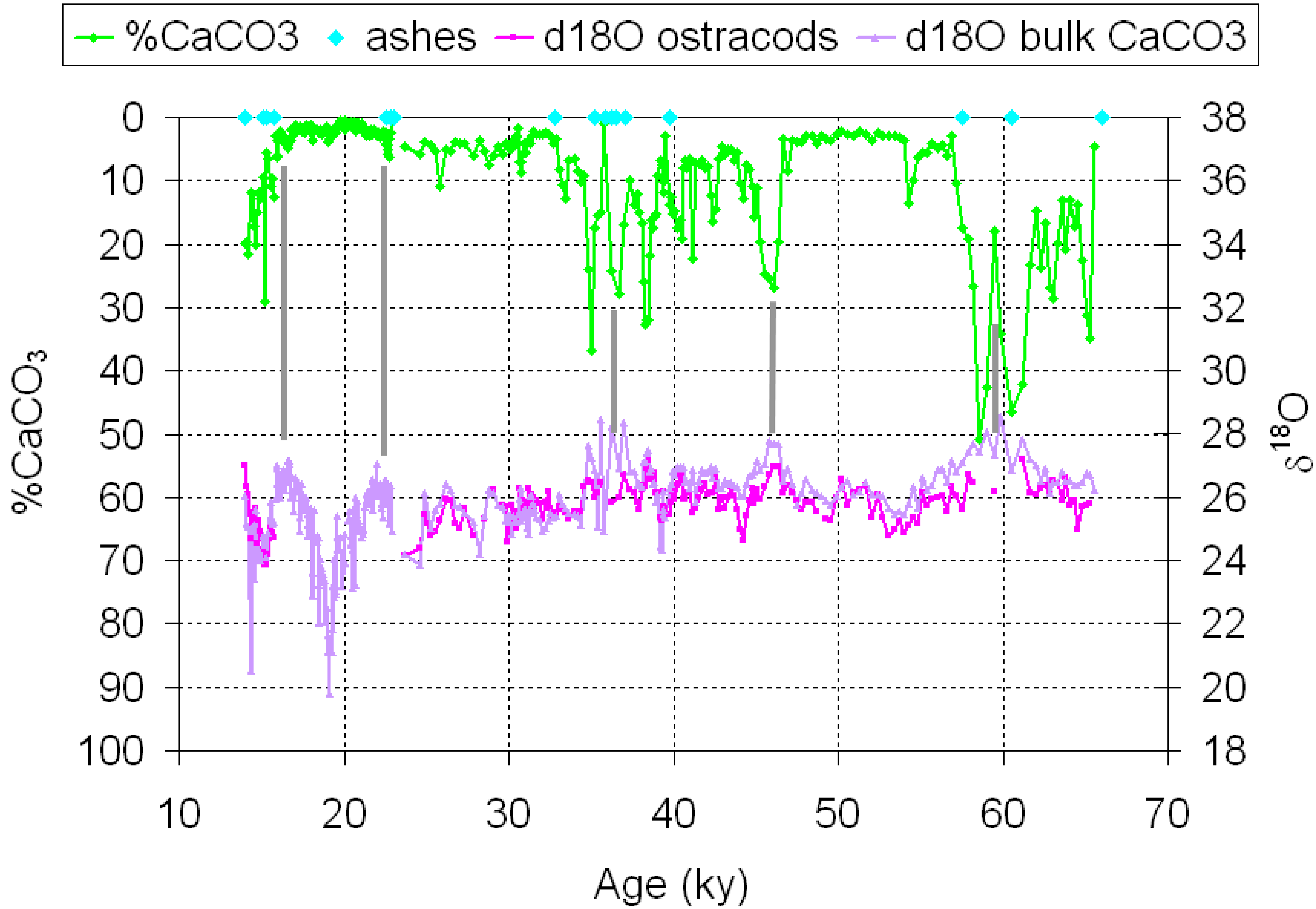
A



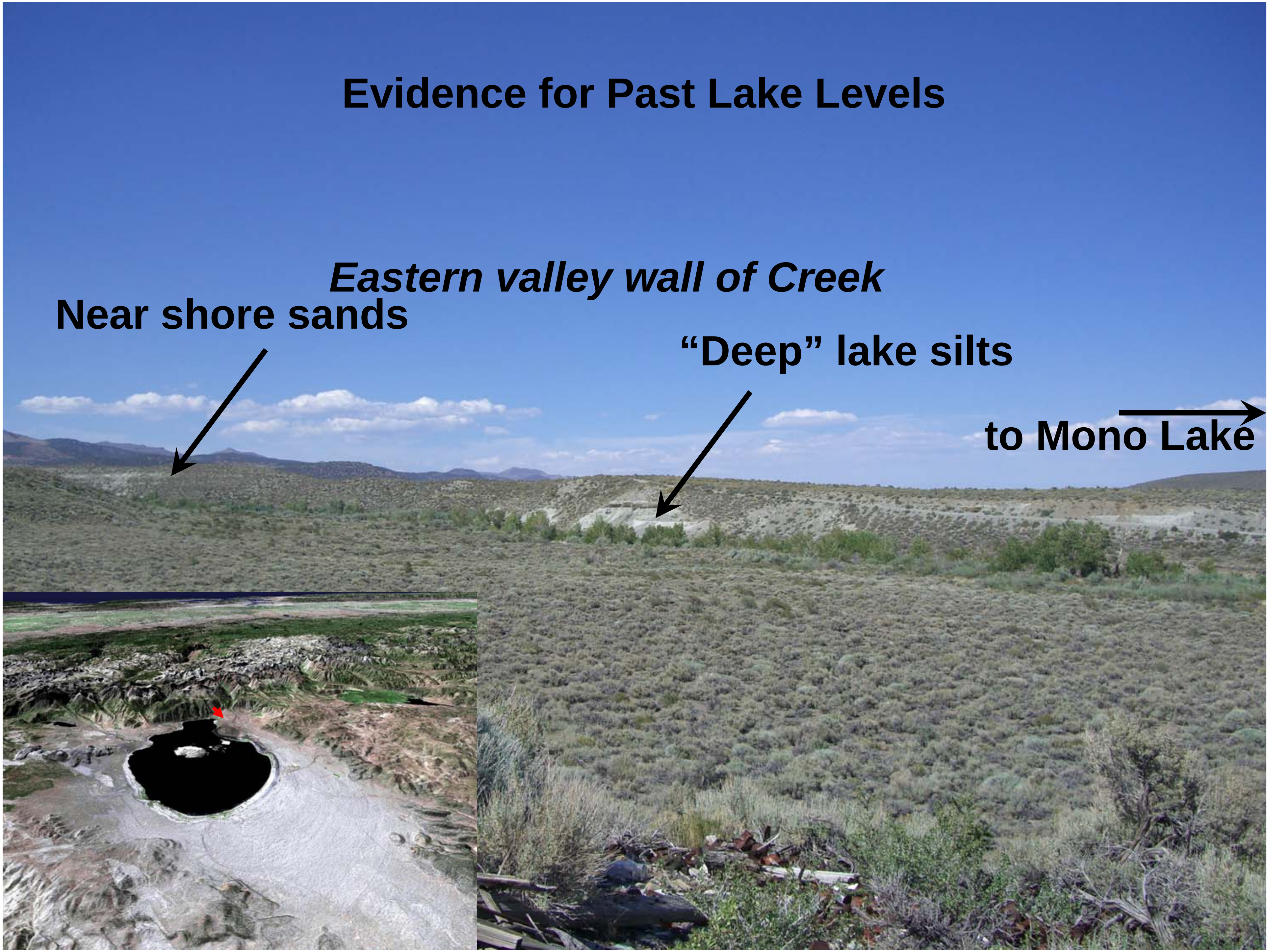
B



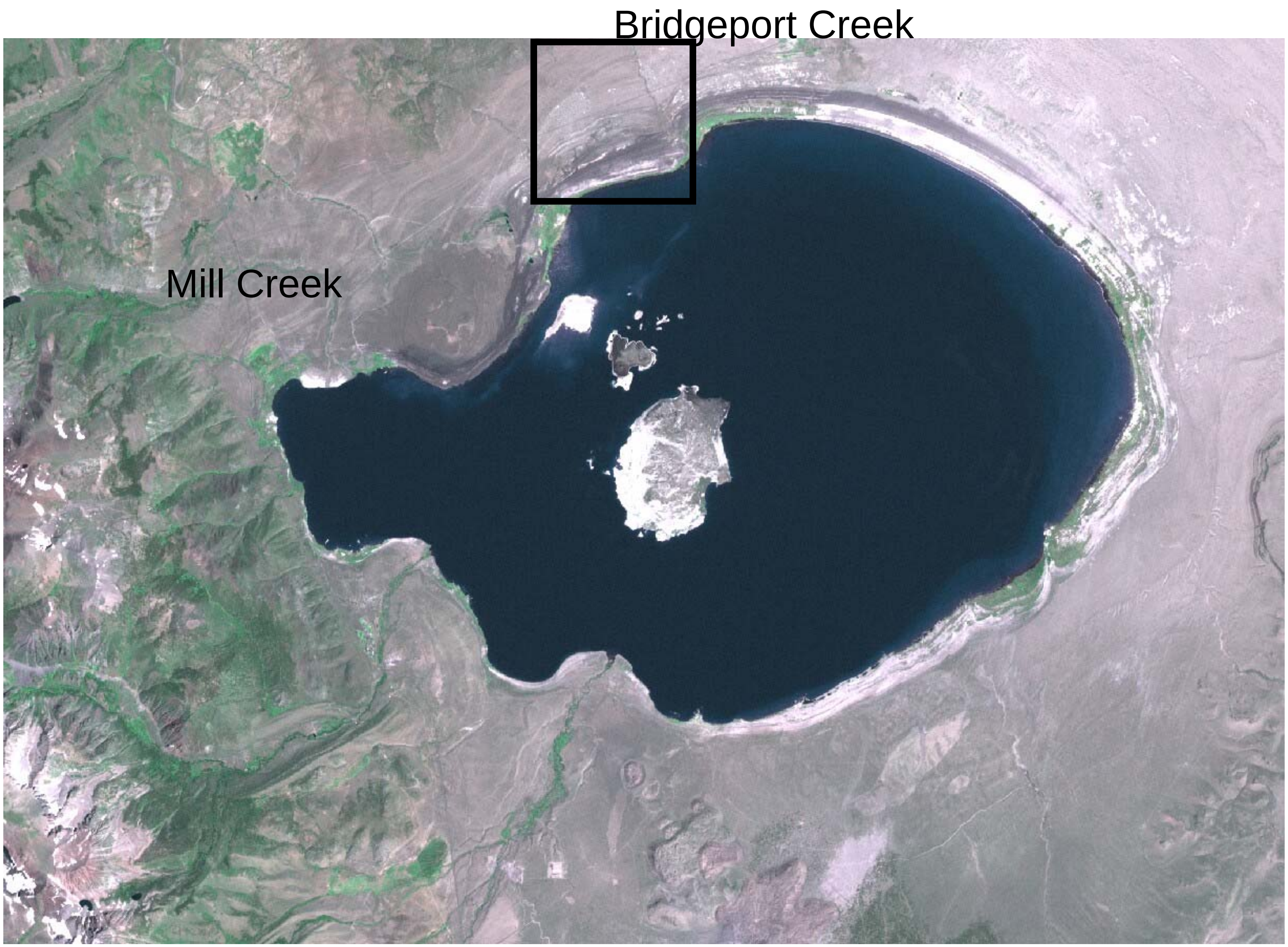
Stratigraphy from Lajoie, 1968
Ages from Zimmerman et al., 2006



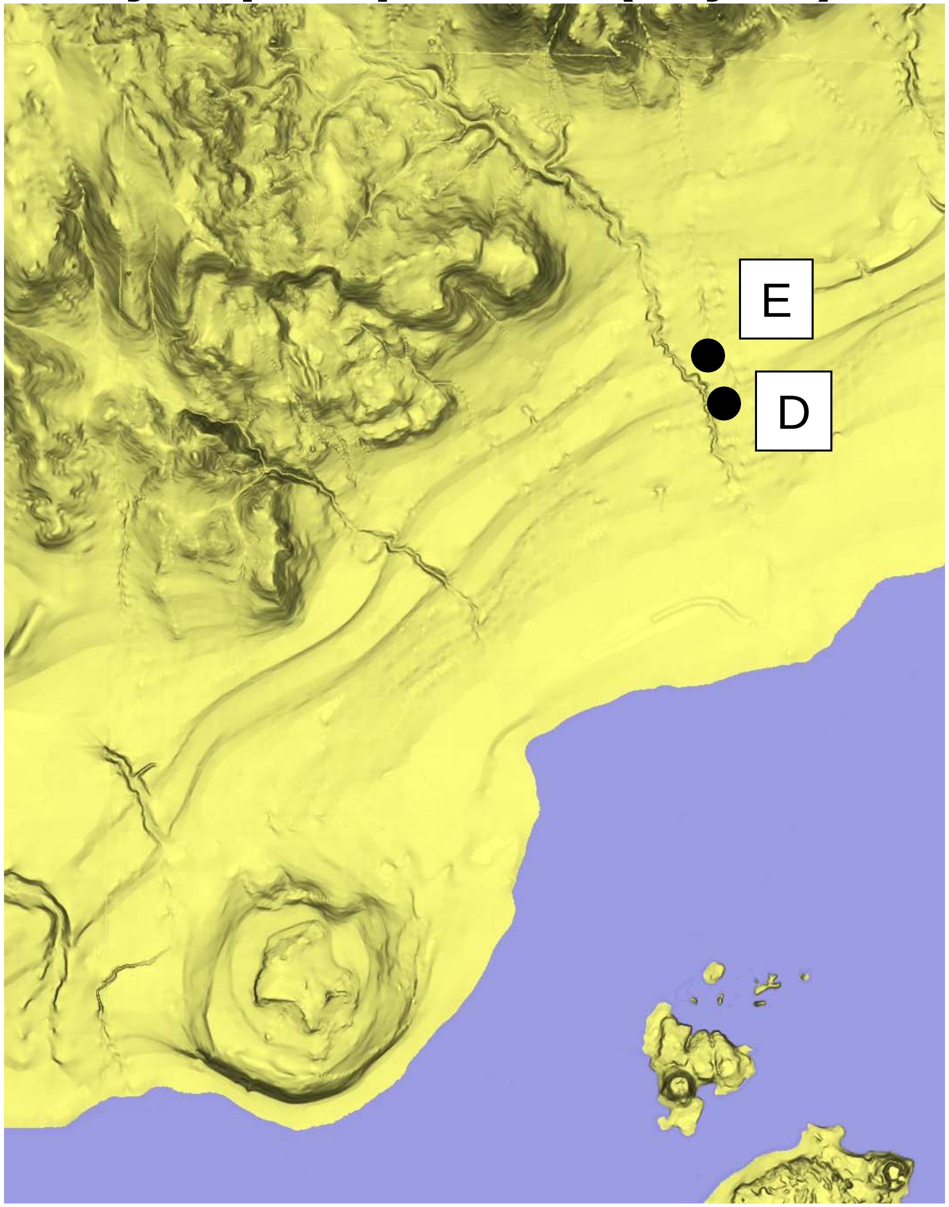
Proxy data from Benson et al. (1998); Chronology from Zimmerman et al. (2006)

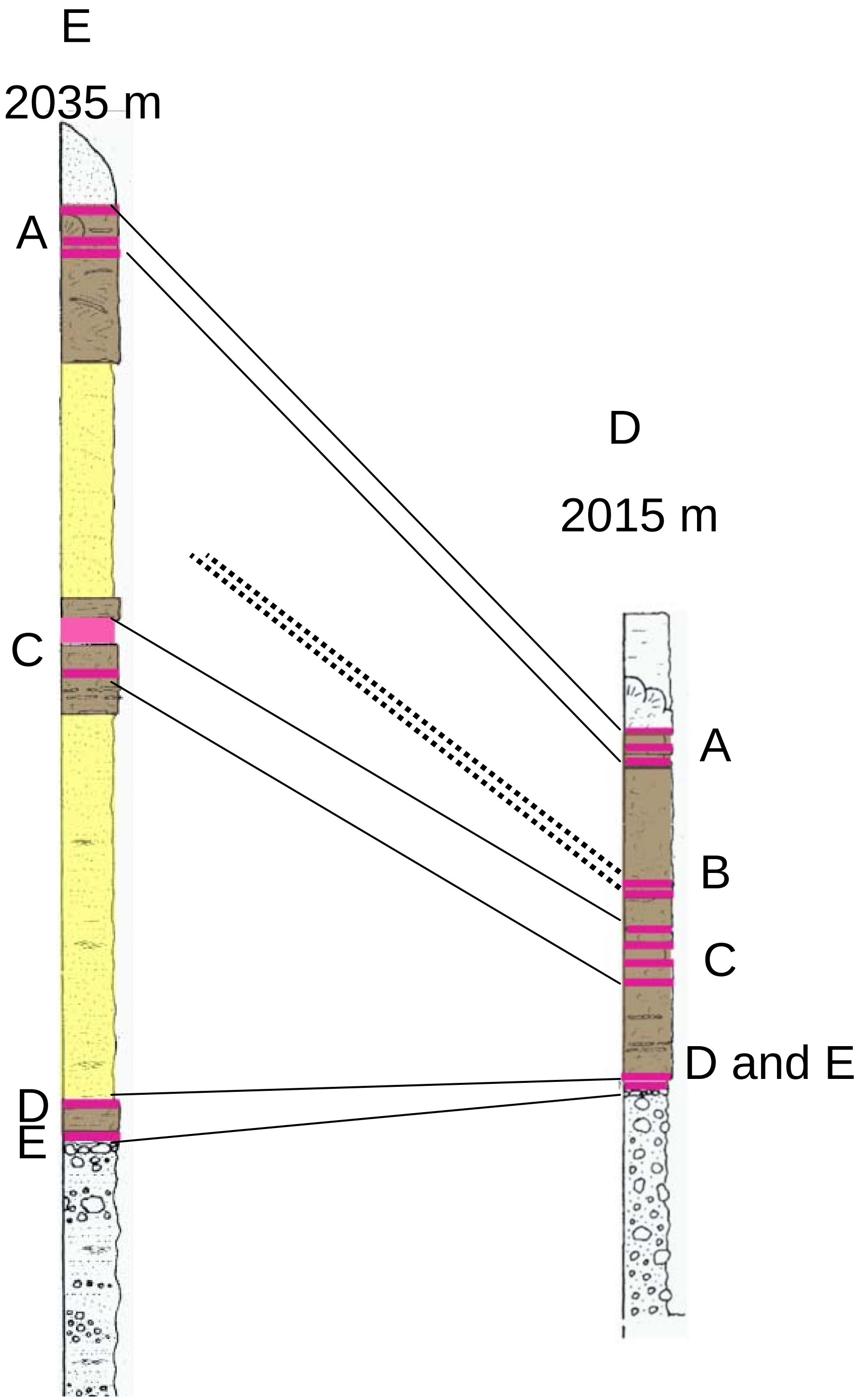

Evidence for Past Lake Levels
Eastern valley wall of Creek
Near shore sands
"Deep" lake silts
to Mono Lake

Geomorphic/Stratigraphic Evidence:

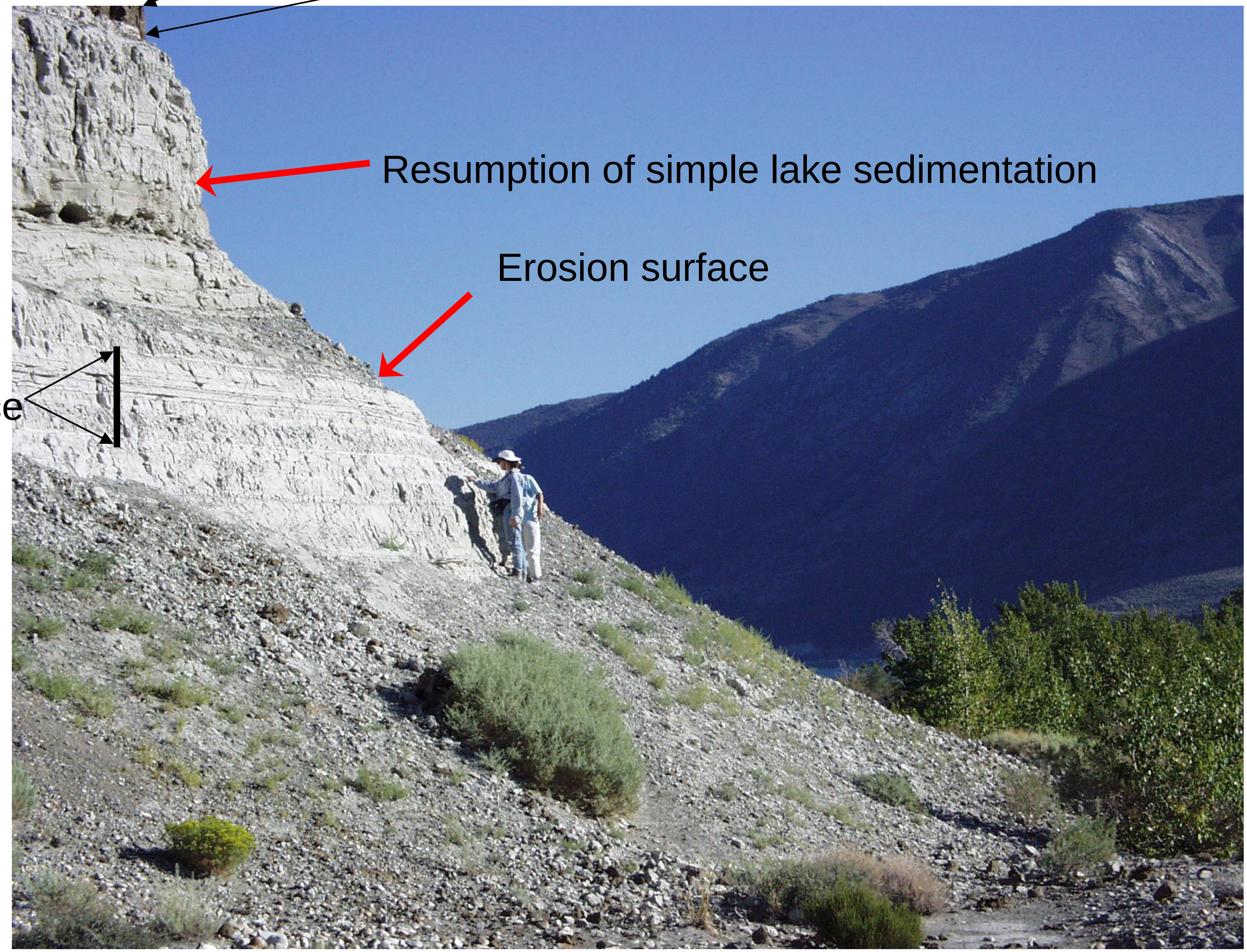


Putting past shorelines into the sedimentary layer perspective (Lajoie)

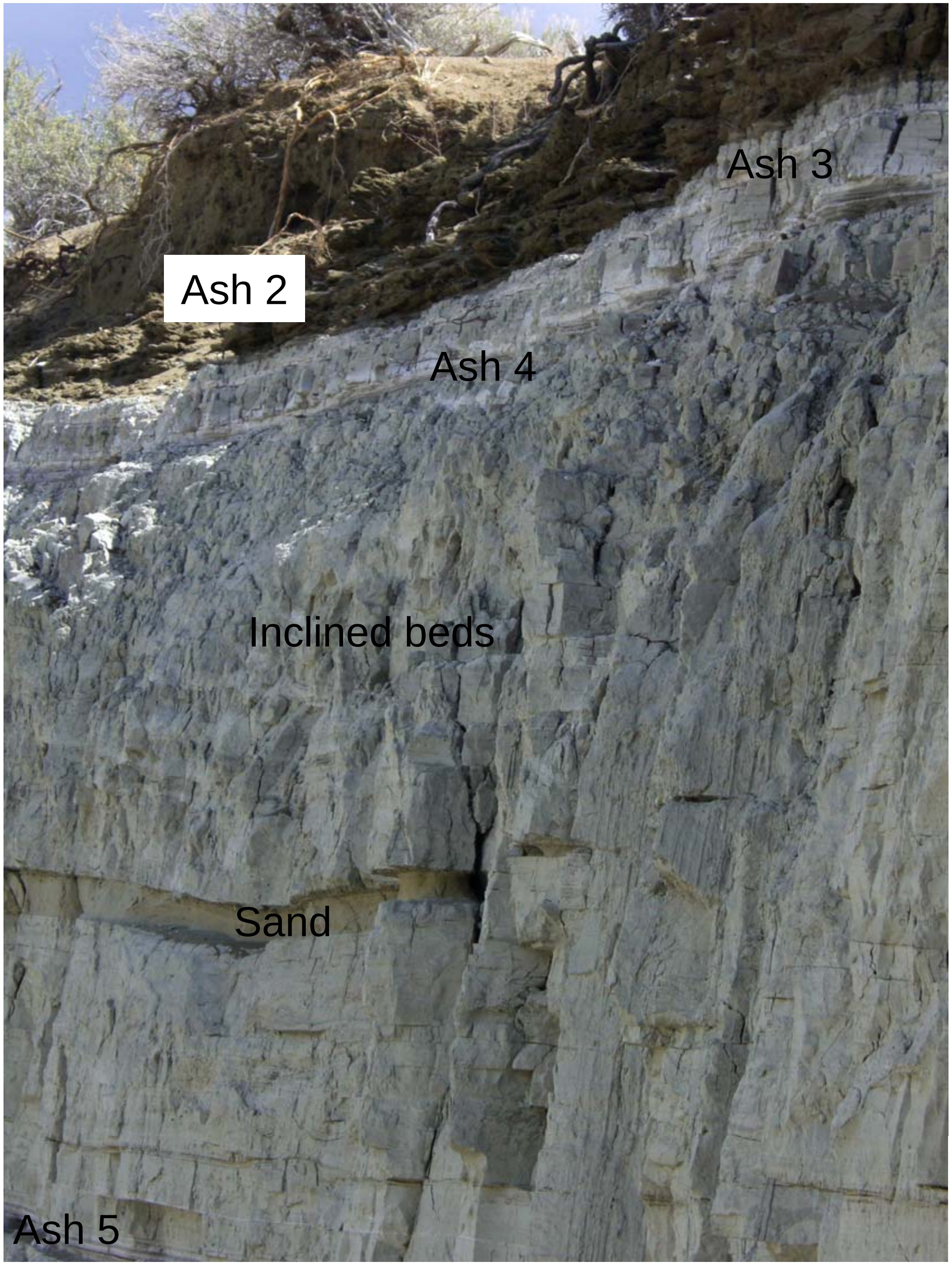


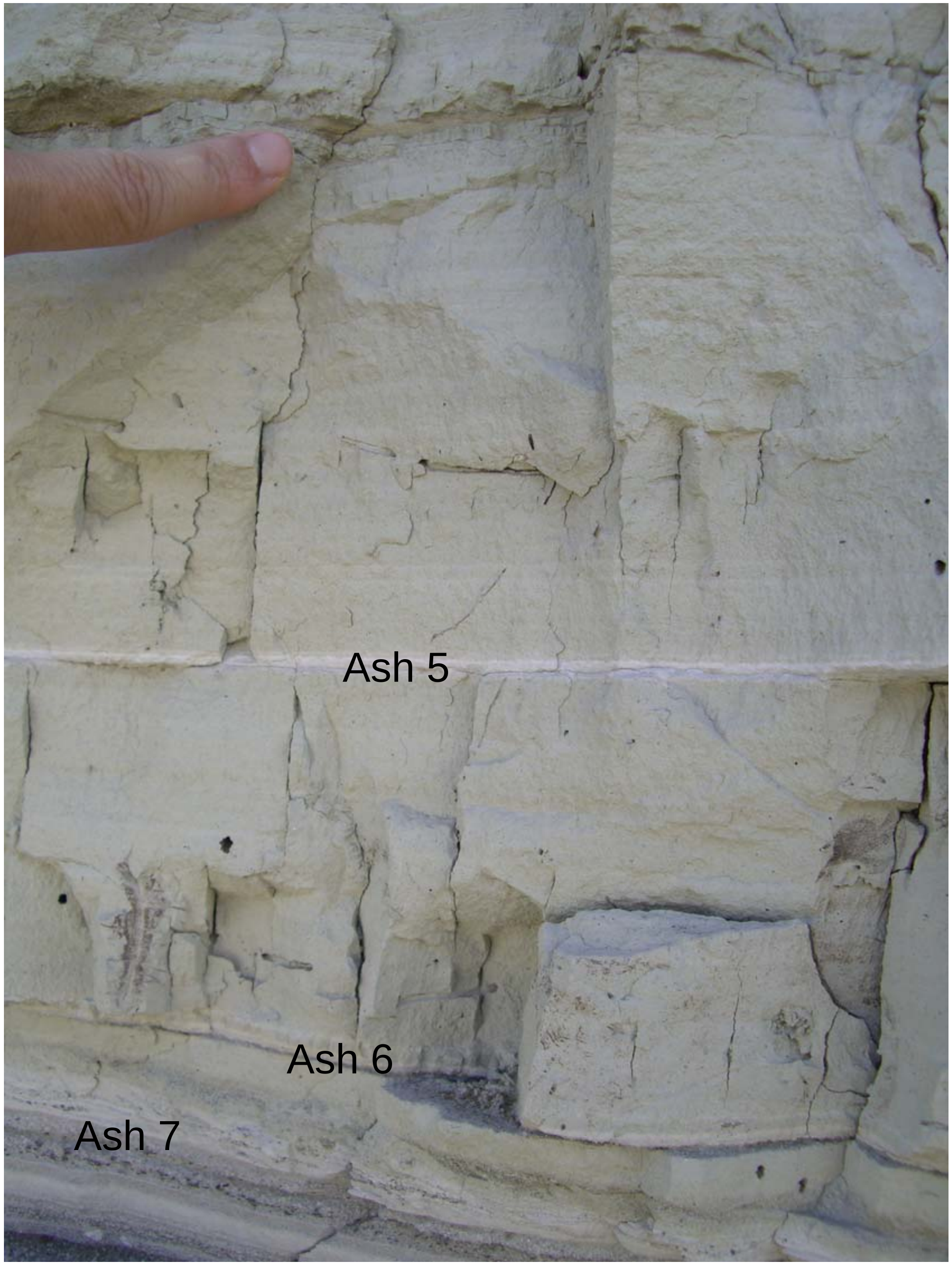


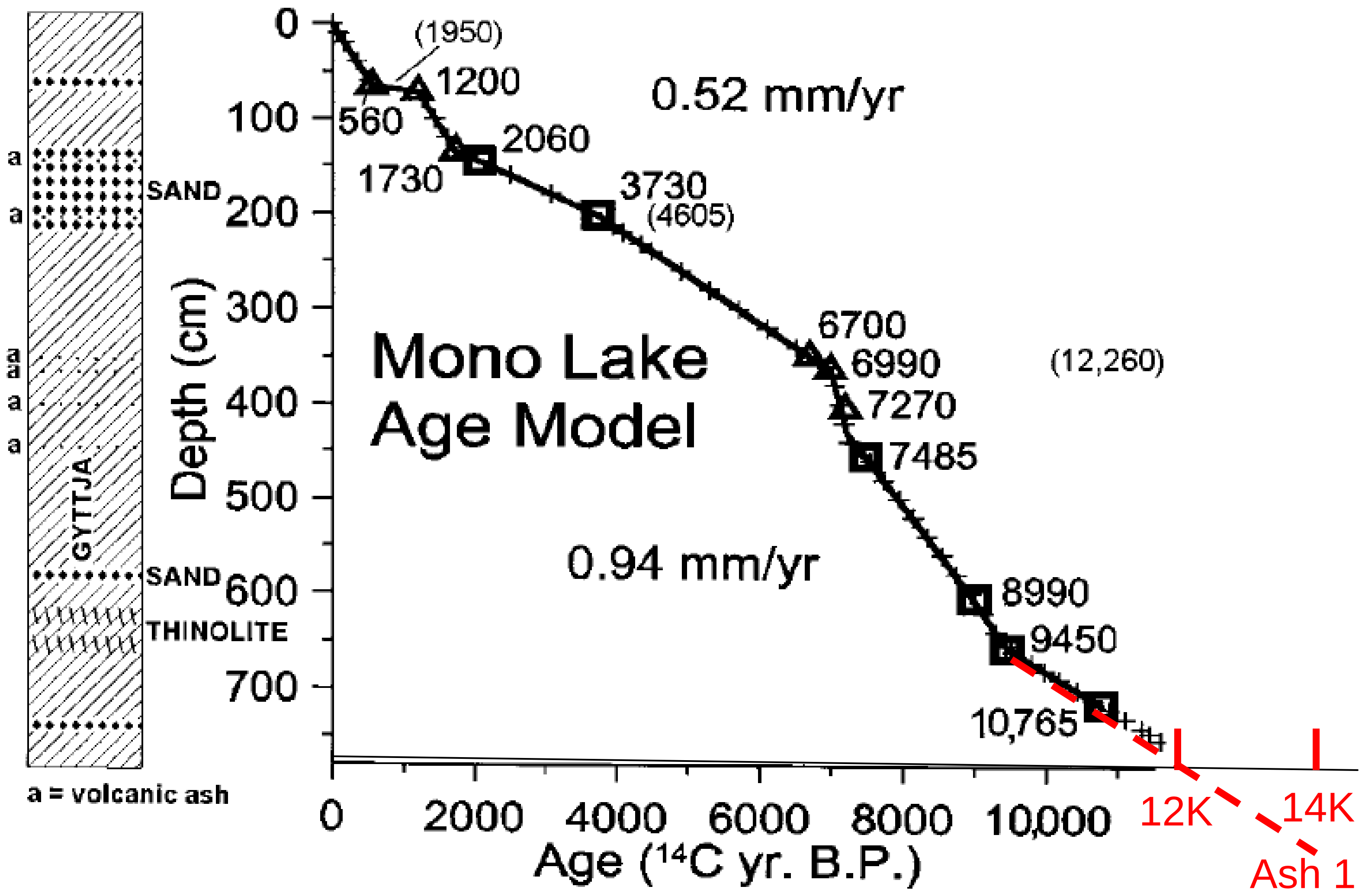
Evidence for a dramatic lake level drop at Mill Creek



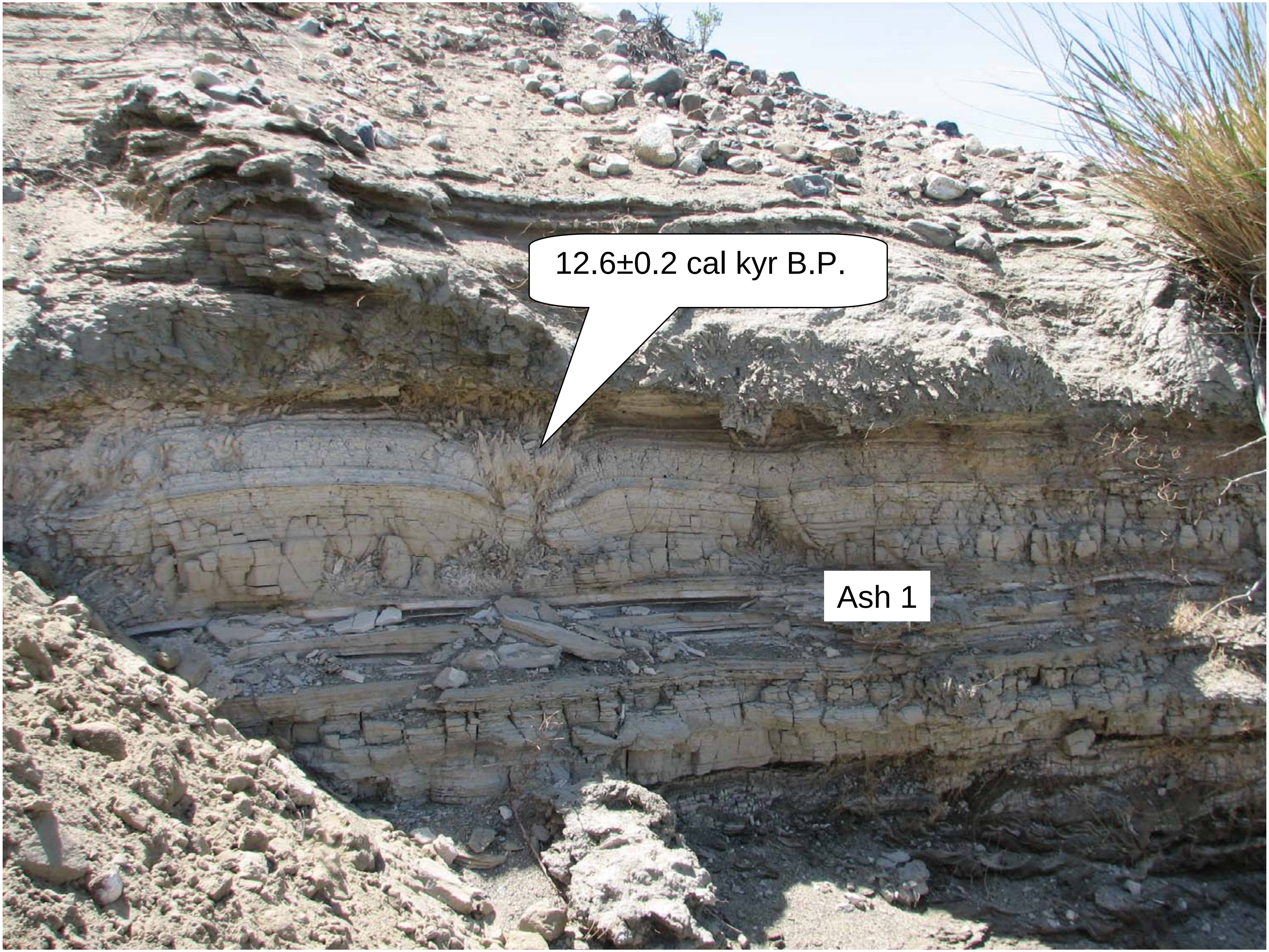

Ash 4
Ash 5


Ash 3
Ash 2
Ash 4
Inclined beds
Sand
Ash 5


Ash 5
Ash 6
Ash 7



Davis, 1999, QR

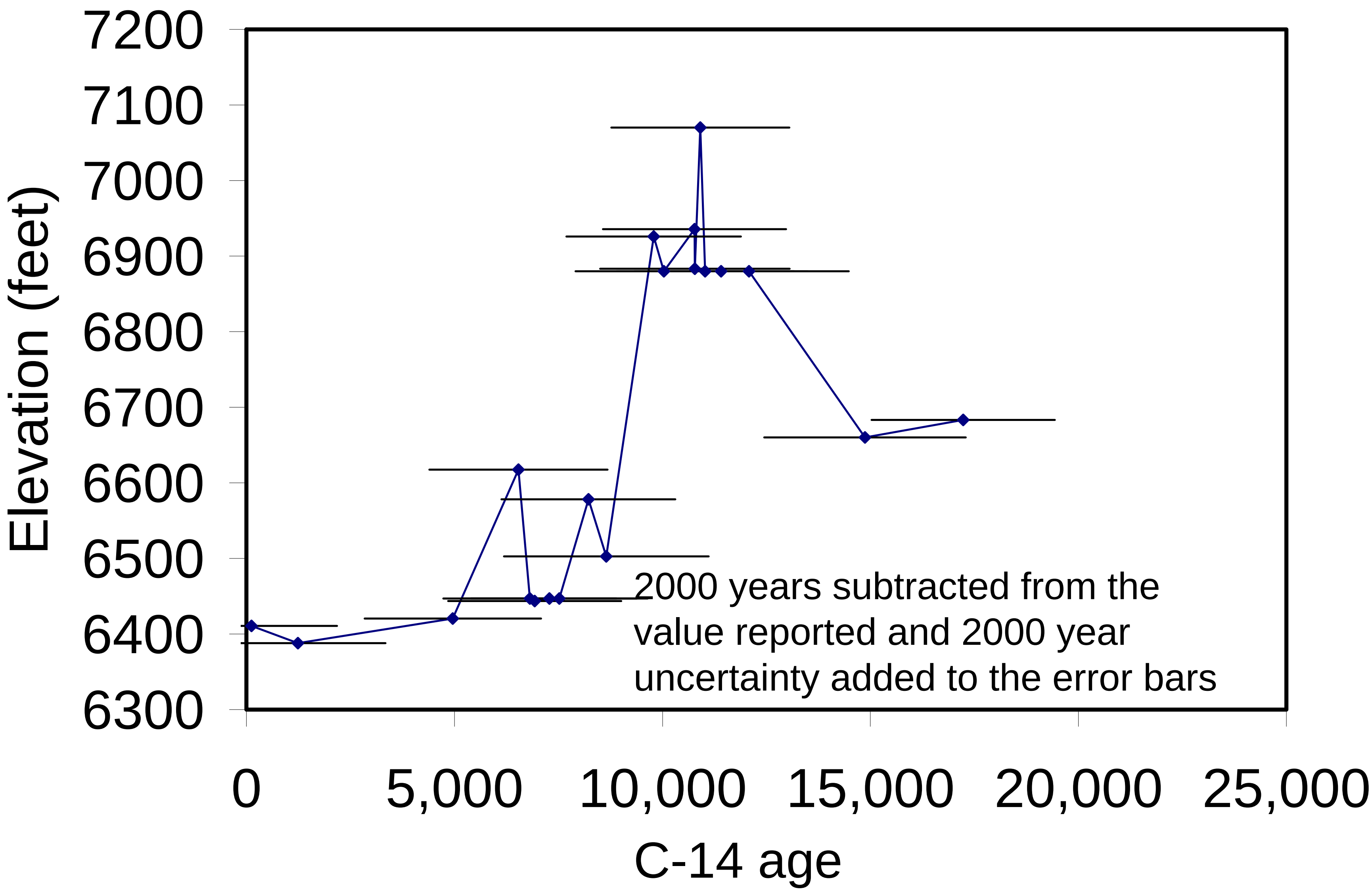

12.6±0.2 cal kyr B.P.
Ash 1

Crystal Shape
Evidence for Cold Conditions

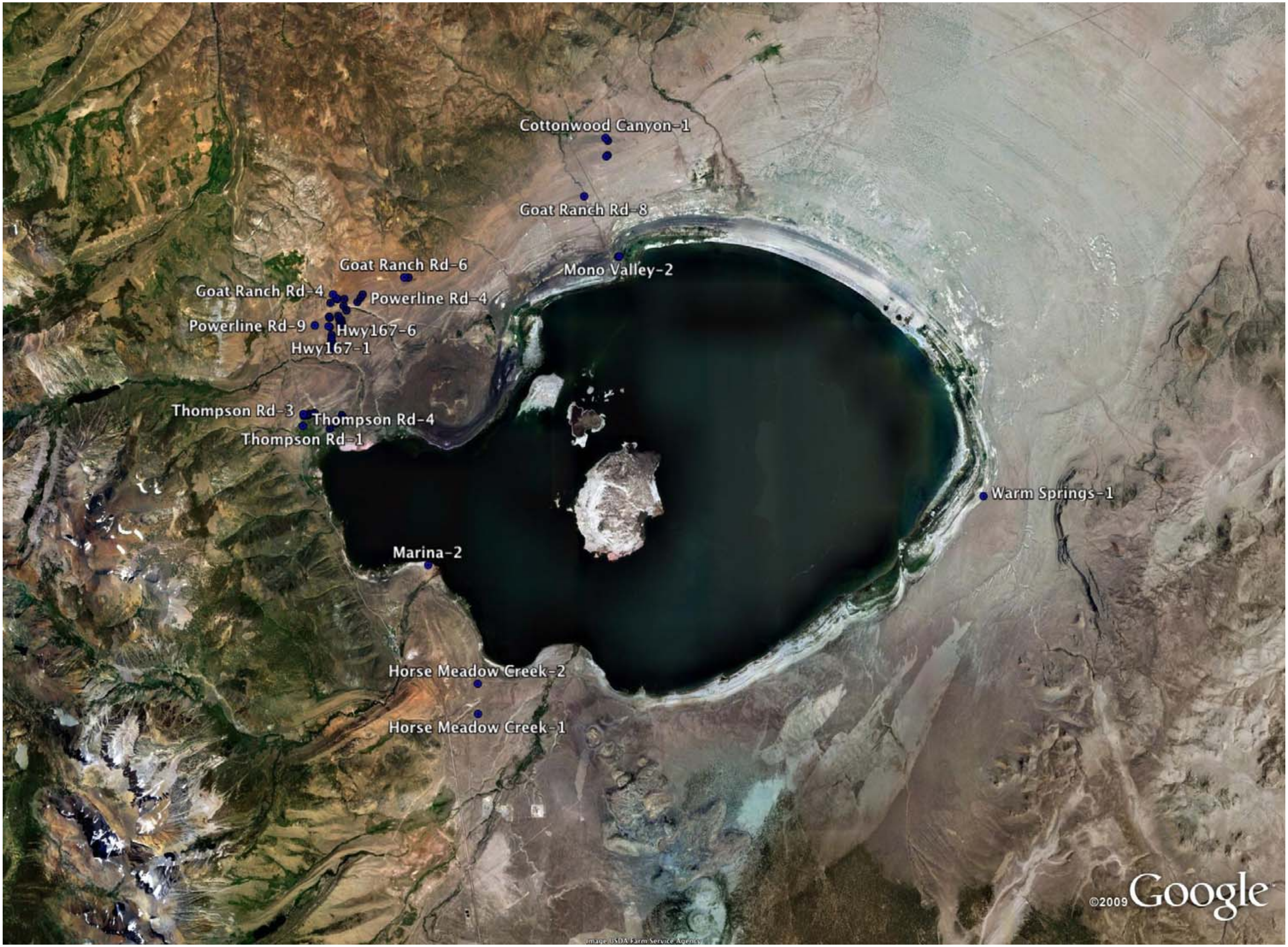

Dropstone in tufa


KONA

Tufa tower age-elevation data from the Mono Basin



From Benson et al., 1990, PPP



Cottonwood Canyon-1
Goat Ranch Rd-8
Mono Valley-2
Goat Ranch Rd-6
Goat Ranch Rd-4
Powerline Rd-4
Powerline Rd-9
Hwy167-6
Hwy167-1
Thompson Rd-3
Thompson Rd-4
Thompson Rd-1
Warm Springs-1
Marina-2
Horse Meadow Creek-2
Horse Meadow Creek-1
©2009 Google

Summary

- Lake Lisan and Mono Lake appear to have an amazingly similar history of lake level responses to abrupt climate change
- Most of our previous efforts on Mono Lake sediments were focused on 25-70 kyr; currently working on a variety of strategies to establish a reliable record of the Mystery Interval and Younger Dryas
- Current hypothesis is that the channel between ashes 5 and 4 represents the “big dry” of the Mystery Interval and the rise following is the wet part of the mystery oscillation
- The Younger Dryas was cold and wet in the Mono Basin, and our working hypothesis is that all the thinolite tufa towers were formed very quickly during the Younger Dryas
- Once we get a reliable and precise chronology for the deglaciation of the Mono Basin, we plan to compare these two lake records in detail