Reconstruction of the Holocene water-level history for Little Molas Lake, Southern Colorado

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Importance

• Water is a vital resource and continued climate change has affected its abundance

• Drought in the west has also had major ecological implications (i.e. fires)

Gregg Basin, part of Lake Mead Reservoir, South Western U.S., Near Las Vegas, NV

Aerosols from 2012 Summer wildfires over the Western U.S.

Photo's courtesy of Google Images
Statement of the Problem

• The purpose of this project is to generate the Holocene water-level history for Little Molas Lake, Southern Colorado, using various lake sediment analyses.

• The generated lake-level history will be pivotal in helping us determine what drives moisture-availability in the western United States.
Motivation for the N-S Transect

Is there a North-South precipitation dipole in the western U.S.?

If so, what drives this on centennial to millennial timescales?

Little Molas Lake, Southern CO
Small glacially-scoured bedrock lake
Subalpine forest
3330 m elevation
5 ha surface area
Methods: Lake selection

- Need a small tectonically stable lake with a gradual lakebed slope and no inflow/outflow sources.
- LML fits the criteria.

Critical factors to consider:

- Slope of lake bottom
- Surrounding topography
- Inlets/outlets
- Other
Methods: Identify paleoshorelines

- Using geophysical surveys and core extraction along an appropriate transect. These initial steps were conducted by Shuman and colleges in 2005.

Map subsurface – lake-level story

Collect cores across major sediment units
Methods: Date paleoshorelines

- Extraction of charcoal (carbon source) for Accelerated Mass Spectroscopy (AMS) radiocarbon dating from paleoshoreline sediments.

Core from Hidden Lake, CO

Hypothetical dates (cal yr BP)

- Slumping event
  - 2000
  - 2020

- Extended drought
  - 2800
  - 3200

Date top and bottom interval to constrain timing of the event

Core picture courtesy of Shuman
Methods: Sediment analysis

- Weighing, sieving and burning core sediments to measure grain size and loss-on-ignition (LOI).

Grain Size procedure:

1. Weigh + Sed
2. Wet Weight
3. 110 °C overnight
4. Weigh
5. Water
6. Dry Weight
7. Weigh
8. Soak
9. Sieve
10. 110 °C overnight
11. Weigh
12. Fine Sediments
13. Sand w/ organics
14. Weigh
15. 550 °C 2 hours
16. Large Organics
17. Sand w/o organics
18. Weigh
Little Molas Core Data Results

- **High** density, **high** sand, and **low** LOI – indicate **low water stand**
- **Low** density, **low** sand, and **high** LOI – indicate **high water stand**
- Radiocarbon dates plotted with *Bchron*
- Units listed correlate to the inferred units from the GPR profile
There is evidence of regional coherence or in-phase behavior at:
13 – 5.5 ka

At 5.5 ka there is a switch to anti-phased behavior
+ means high water stand
- means low water stand
Discussion and Conclusions

• Potential driver of in-phase behavior in the Early Holocene (13-5.5ka)?
  – More data needed
• Driver of anti-phase behavior after 5.5ka?
  – El-Nino frequencies increase after 6.0ka
  – Spatial trend
• Future study
  – Analyze the rest of the cores in the LML transect to complete the lake-level history
  – Obtain more radiocarbon dates to better constrain timing of events

Map: Cayan (1996)
Future Study

• Analyze the rest of the cores in the LML transect to complete the lake-level history
• Add more radiocarbon dates to better constrain timing of events
• Examine early Holocene lake-level rise to determine spatial extent

Figure from Shuman et al., 2009
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References


Questions?