Climate and Human impact synergies in Mediterranean Mountains: The Late Holocene records of the Iberian Range karstic lakes (NE Spain)

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Climatic variability on the Iberian Peninsula

- In the context of the IP, the IRHP, the MCA and the LIA are the main Holocene rapid environmental changes during the last millennnia and they had a strong impact on the hydrological cycle
- These oscillations specially control the water availability in Mediterranean areas.

Introduction

- The **IRHP** (2600-1600 yr BP) is the **most humid period** in the last 3500 yr (Zoñar lake).
- The **MCA** (IX- XV centuries) has been detected as a relatively **arid period** (Estanya, Zoñar lakes).
- The **LIA** (1300-1850 yr AD) is characterized by a **significant increase in aquifer recharge**, indicated by several records from karstic lakes (La Cruz, Taravilla and Zoñar lakes).

Introduction

- during these periods seems to be significant latitudinal variability...
- we need to integrate studies from different areas (lakes) at different latitudes

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We are studying several lakes on the Iberian Range, at the East of the IP.

Introduction

Location and
Geological
settings

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Introduction

Location and Geological settings

On the Iberian Range

- Large **carbonate** areas affected by endo- and exokarstic processes develop
 - ... travertine-dammed lakes
 - ... circular funnel-shaped depressions
- If these depressions intercept the regional aquifer, relative **deep lakes** occur.

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- These systems are very sensitive to regional hydrological balances.
- In response to climatic changes, they present large variations on water properties (water table levels, chemistry, biota, etc.)
- So, climatic, environmental changes and the possible human impact are recorded in the sediments

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La Parra lake

Introduction

Location and Geological settings

La Parra

- Doline system near Cuenca

- 1000 m asl.
- 1 ha area
- 17 m depth
- Holomictic

Inputs: Mainly groundwater and runoff water.

- Outputs: Irrigation wells
- 500 mm av. precipitation

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La Parra lake

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La Parra lake

11 sedimentary facies (3 main Units)

A) Detrital

1) Silts

Facies A

Facies B

Facies C

Facies D

Facies E

2) Sands

Facies F

Facies G

Facies H

3) Gravels

Facies I

Facies J

B) Laminated

Unit III: 1st lacustrine deposits → Increase of water table

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- Laminated facies changing to coarser silts:

- Rapid water table levels changes;

- Littoral and shallower environment deposit .

Unit II: Detrital fine facies

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- Increase of fine siliciclastic inputs
- Implies:
 - Higher lake levels
 - Higher local anthropogenic impacts (erosion).

Bottom Unit I: Coarser facies deposition

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- Coarser facies at the center of the lake:
- Implies shallower levels and an increase on proximal detrital inputs

Medium Unit I: Fine and Laminated facies

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- Higher lake levels.
- Laminated facies: as trends to anoxia at lake bottom

(similar pattern than nearby La Cruz lake)

Top Unit I: Dominancy of fine massive silts

- Laminated facies disappear
- Relative drop of lake levels during recent times

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Age Model

Age vs Depth cal yr AD

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Several geochemical proxies used to reconstruct the history of the lake.
(Detrital inputs, Organic productivity, REDOX stages)

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During the late IRHP (300-500 AD), occurs the onset of lacustrine sedimentation, with a rapid change on detrital input (Ti, Si fast rise & drop of water table around 425 AD)

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The DA (550-900 AD) start with high clastic inputs (Ti, Si) towards the lake and coarser facies occurs (lower lake levels), that change to fine facies (higher lake levels)

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- During the onset of the MCA (900 AD) Ti content is low and coarser carbonate facies with detrital OM are deposited.
- High values of Sr/Ti, Ca/Ti and TOC suggest a shallower palustrine environment.

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During the LIA (1300-1850), laminated anoxic facies occur. Sr/Ti, Ca/Ti and TIC have high values around 1500 AD → Higher lake levels (similar pattern La Cruz lake).

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On recent times, detrital input proxies decrease and Ca/Ti increase slowly (as well as TOC and TIC) → Relative drop of lake levels

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To do list...

General
Conclusions

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To conclude...

- A high short-term variability: The lake dried out 1600 yr ago and now is 17 m deep
- Large hydrological changes rather than T° changes
 - RP:
 - Increase humidity at the end of the RP (La Parra)
 - A significant latitudinal component exists: RP wetter on the S and dryer towards the N
 - In the Iberian Range (and in the IP)
 - The LIA is a wetter stage
 - The MCA is a drier period

More studies are needed and in progress

Lake comparison

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EL TOBAR LAKE

6 long cores from
two Sub-basins:

- **Holomictic**: shallower (12 m depth)
- **Meromictic**: funnel-shaped (20 m) → Has a permanent saline anoxic monimolimnion

EL TEJO LAKE

It's a doline, deeper than nearby La Parra lake (28 m depth), tendency to meromixis.

- Presents laminated sediments, probably varves in origin,

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Thanks

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That's All!

Thanks for your attention

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Core Platform at El Tejo lake.
Sometimes, logistics are not so easy!

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