Human Impact on Biochemical Cycles and Deposition Dynamics in Karstic Lakes: El Tobar Lake Record (Central Iberian Range, Spain)

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1 Objective

Research Framework
Water availability and soil erosion are two of the most significant environmental problems for historical and modern societies. Recent climate and global changes impact natural reserves especially in the Mediterranean region characterized by a fragile hydrological and environmental equilibrium and a long history of human impact in the landscapes.

Objectives
- To reconstruct the evolution of a mountain watershed in the Iberian Range (NE Spain) during the last millennium using the sediment sequence from Lake El Tobar.
- To evaluate the relationships between lake hydrology and sediment delivery with natural (climate) or anthropic (land use changes) causes.

2 Location

Lake El Tobar (40°52’N, 3°56’W; 1200 m above sea level) is the largest karstic lake in the region (16 ha surface area). The basin was developed by dissolution (collapse) of the evaporitic Keuper facies (Upper Triassic).

3 Material & Methods

- Compilation of historical documents
- Aerial images land-use analysis
- Comparison with instrumental precipitation data series
- Bathymetric and seismic survey
- Lake El Tobar sedimentary and geochemical sequence study

4 Results

- The sedimentary sequence is mainly a combination of:
  i) Laminated dark grey to black silts interpreted as baseline deposition in the distal, anoxic, deep areas of the lake basin
  ii) Massive to banded light brown silts deposited during periods of intense sediment delivery from the watershed (flood events)

5 Discussion

- It is composed of two subbasins:
  i) A circular deep meromictic basin (12 ha, 20 m depth), TDS = 19116 ppm
  ii) A shallower holomictic basin (12 m depth, 14 ha) with fresher waters, TDS = 408 ppm

6 Conclusions

- We consider two main mechanisms to explain the occurrence of the six large depositional events we have documented:
  i) Lake hydrological events (H1). H1 represents the establishment of recent lake morphology and dynamics ca 1200 AD, likely as a result of increased sinkhole activity during a humid phase. H2 occurs after the construction of the La Tosa Canel (1967) connecting the lake with a freshwater reservoir.
  ii) Sediment delivery events (S1) characterized by higher TIC, TOC/TN, Ti, Ca/Ti and lower Mn/Co, Br/Ti and Sr/Ca ratios and associated with increased occurrence of detritic layers. The four S events (16th century, late 18th century, mid and late 19th century) correlate well with regional episodes of increased flooding but also with periods of anthropogenic changes in landscape management.