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New Palaeoclimate Record from Loess-Paleosol Sequence in Upper Tagus Catchment, Central Spain

Understanding past natural climate changes helps us to understand the climate of today and how it is changing!

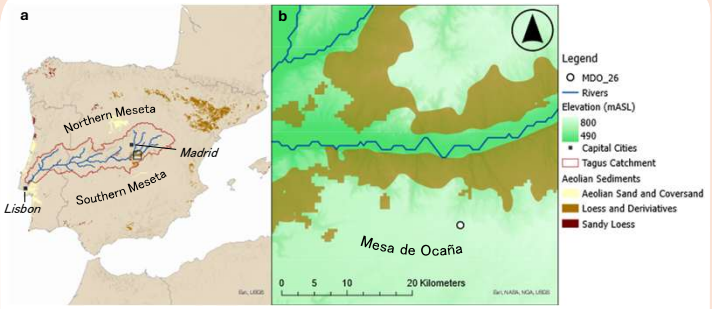


Figure 1: Study locations with labels; **a**: showing Tagus catchment in Spain and Portugal with hill-shade, capital cities and quaternary aeolian sediments; **b**: showing location of MDO site on topographical map (1, 2).

Introduction

Loess: wind-blown dust deposits, formed in glacial periods (ice ages) that often contain ancient soil layers that formed during humid times - interglacials.

Loess-paleosol sequences: record the past climate, offering a window into atmospheric processes, hydroclimate and soil forming processes through proxies and are easily datable; the drivers and impacts of ancient climate changes can be identified (3, 4, 5).

River Tagus (*ESP: Tajo, PRT: Tejo*): longest river in Iberia, heavily populated, spans an east-west arid-humid climate gradient with a rich ***palaeolithic archaeological record*** (Fig. 1).

The Mesa de Ocaña: limestone plateau above Tagus . Few paleoenvironmental reconstructions or mapped loess deposits exist on the plateau (Fig. 1).

Methods

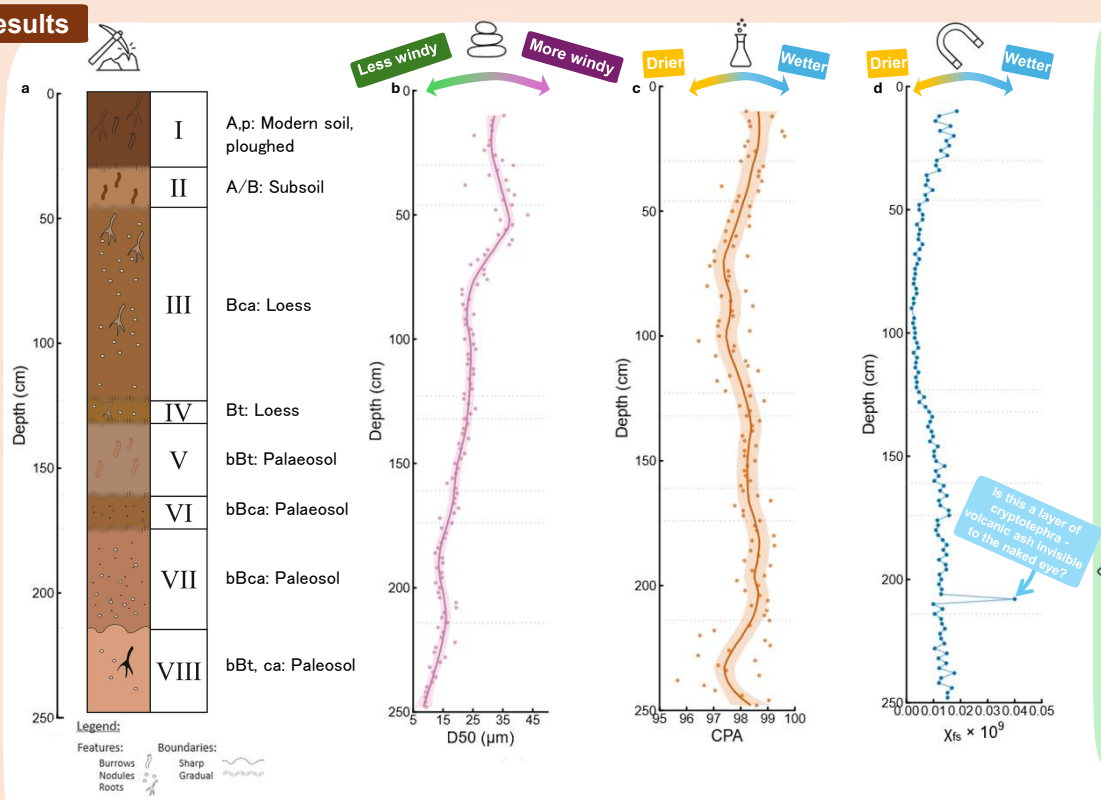
A new ***loess-paleosol sequence,*** MDO_26**,** was excavated and sampled at 2 cm intervals. Eight stratigraphic units were identified, and the following was measured:

Magnetic susceptibility: how easily a sediment is magnetised, relating to changes in **wind strength** or **hydroclimate,** depending on the environment (5).

Grain size: a proxy for **wind strength;** stronger winds move larger grains (4).

Geochemistry: measured via XRF, tells us the degree of **chemical weathering** a sediment was exposed to through derived indices, such as the Chemical Proxy of Alteration (CPA) (3) which acts as another proxy for **hydroclimate** - and a sediment's **provenance**!

Results



Lower CPA and χ_{fs} indicate III and IV have undergone less weathering than other units and indicates a cool, dry climate.

Magnetic results (Fig. 3) show the site's magnetic susceptibility relates to hydroclimate, not wind strength (5).

Changes in grain size do not always align to unit boundaries: they reflect winds that deposited primary loess (4). Humid periods then transform loess into soil, changing the chemical and magnetic properties (3) - these climate records are super-imposed on each other.

Unit VIII has different properties to the other units and its sharp boundary with Unit VII indicates a portion may have been removed by an erosional event. It may come from a different sediment source or was deposited by different processes.

High magnetic values at 208 cm may indicate an invisible layer of volcanic ash from a far away eruption (6).

Figure 2: MDO_26. **a:** Stratigraphic log with sedimentary units (I-VIII) and brief descriptions from field observations, **b**: D50 (median grain size), **c**: Chemical Proxy of Alteration (CPA) (smoothed) and **d**: χ_{fs} , a derivative of magnetic susceptibility measurements. b&c smoothed with shaded areas represent 95% confidence intervals.

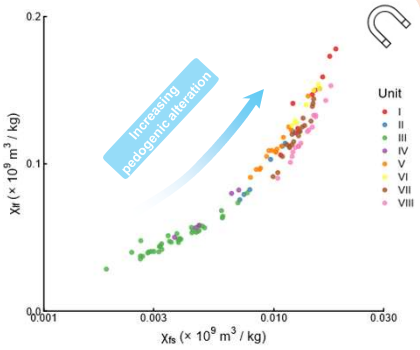


Figure 3: χ_{fs}: an isolate of unweathered loess's magnetic susceptibility, against χ_{fs}: low frequency magnetic susceptibility, *after* (5).

What's next?

- The sequence will be **dated,** and climate changes will be related to global and local processes, records, and the region's archaeology to understand both the **drivers *and* impacts** of climate changes.
- Further analysis on the sample containing the cryptotephra layer.
- Analysis of the *anisotropy of magnetic susceptibility* will be completed on oriented samples throughout the sequence - giving a proxy for **wind direction**!
- More sites, to the west, will be sampled to build a **regional-scale reconstruction** of the east-west **climate gradient** to identify its drivers and variations

References

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