Improving the understanding of the Lower Guadalhorce fluvial landscape development: first dates on the river terrace staircase and alluvial fans

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Background

Quaternary fluvial archives such as river terraces and alluvial fans are the most important, potentially to be dated, landforms in the unravelling of Quaternary landscape development and climate changes. This is even more true for the western Mediterranean where terrestrial climate records are not abundant.

Objective

To improve the geochronological framework of the Quaternary landscape evolution of the Lower Guadalhorce River Basin.

Introduction

One of the so far poorly studied areas is the 160 km long Guadalhorce River situated in the province of Malaga, Andalucía in the south of Spain. The catchment has undergone a complex geologic–tectonic development history, and shows evidence of an extensive human occupation history.

Methods

The principal investigated area is the Lower Guadalhorce River valley with a flight of terraces situated between the El Chorro canyon and the Malaga Basin (Fig. 1). In this area a total of 9 terrace levels can be distinguished, from T0 (current river bed) to T8 (supposing the highest and oldest terrace level). A total of 11 locations were sampled (Fig.1) in vertical exposures of fluvial terraces or alluvial fan settings ranging from 1 to 20 meter above present day river level. Sampled sediments of the sand fraction were analysed with the latest quartz OSL techniques and IRSL feldspar methods at the Netherlands Centre for Luminecence dating.

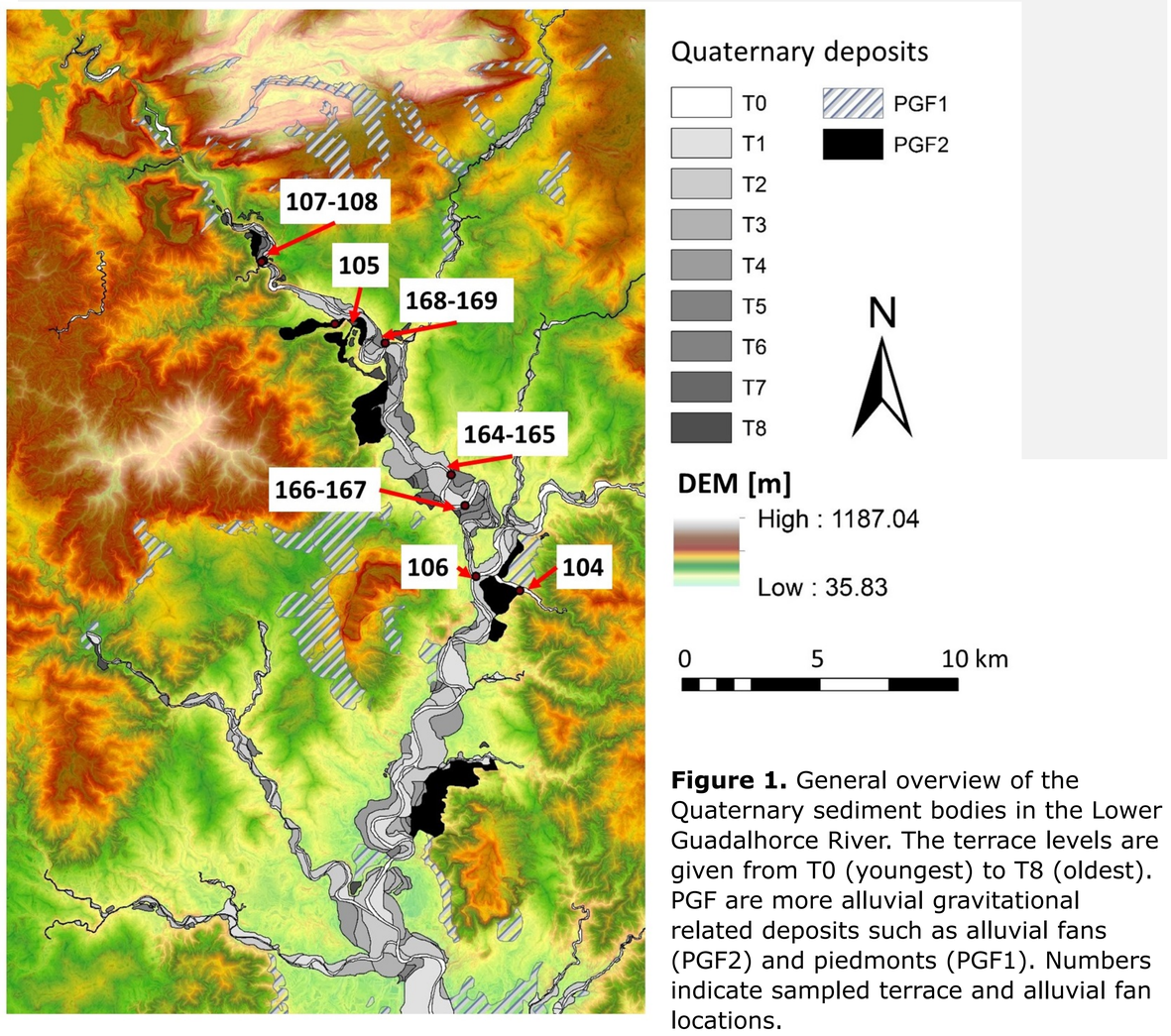

Figure 1. General overview of the Quaternary sediment bodies in the Lower Guadalhorce River. The terrace levels are given from T0 (youngest) to T8 (oldest). PGF are more alluvial gravitational related deposits such as alluvial fans (PGF2) and piedmonts (PGF1). Numbers indicate sampled terrace and alluvial fan locations.

Results

Both Quartz and Feldspar signals were quite poorly developed, often with a questionable validity (Table 1). Burial ages, inferred as important aggradation phases, are estimated in MIS 4, 5d and 6. The same holds true for the 2 sampled alluvial fans, indicating only fan buildup activity, interfingering with fluvial activity, in MIS 4 and 6.

Table 1. Quartz (Q) and Feldspar (F) ages including validity estimates (Likely OK indicated in green, NCL protocols). Location heights given above local river level (a.l.r.l.).

Sample code	Setting (a.l.r.l.)	Q_Age [ka]	Validity		F_Age [ka]	Validity
NCL-2207164	T2-T3 (6 m)	102 ± 10	Questionable		133 ± 18	Likely OK
NCL-2207165	T2-T3 (6 m)	181 ± 21	Rubbish		155 ± 15	Likely OK
NCL-2207166	T0-T1 (1 m)	0.10 ± 0.01	Questionable			No material
NCL-2207167	T0-T1 (1 m)	0.18 ± 0.02	Questionable			No material
NCL-2207168	T3-T4 (19 m)	83 ± 8	Questionable		214 ± 21	Minimum age
NCL-2207169	T3-T4 (19 m)	88 ± 5	Questionable		117 ± 14	Underestimate?
NCL-2211104	Alluvial Fan (2 m)		No Signal		50 ± 7	Likely OK
NCL-2211105	Alluvial Fan (20 m)	54 ± 4	Saturation		146 ± 19	Likely OK
NCL-2211106	T0-T1 (1.5 m)	0.30 ± 0.12	Questionable			No material
NCL-2211107	T2-T3 (7 m)	99 ± 15	Questionable		103 ± 5	Doubtful
NCL-2211108	T1-T2 (2 m)	97 ± 7	Likely OK		92 ± 21	Likely OK

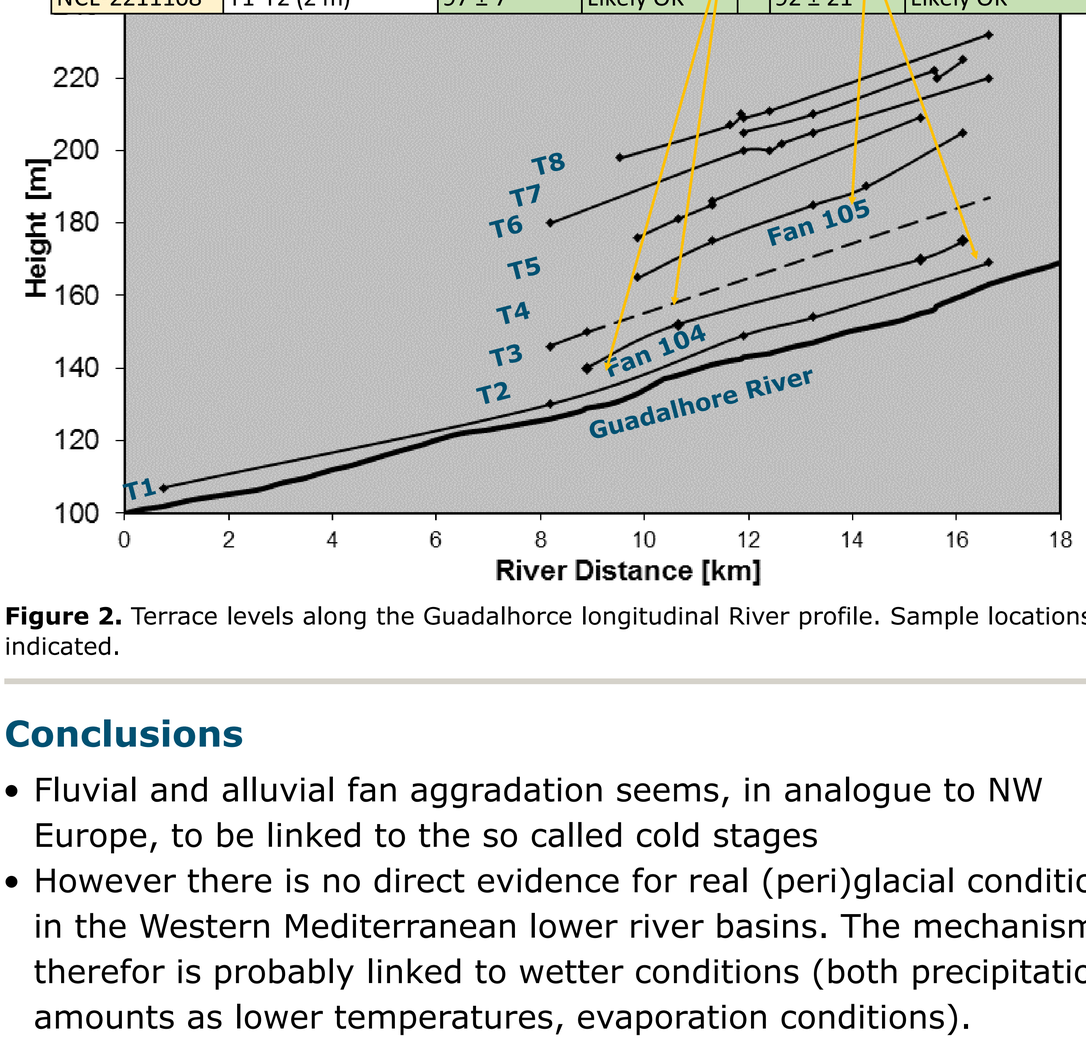

Figure 2. Terrace levels along the Guadalhorce longitudinal River profile. Sample locations are indicated.

Conclusions

- Fluvial and alluvial fan aggradation seems, in analogue to NW Europe, to be linked to the so called cold stages
- However there is no direct evidence for real (peri)glacial conditions in the Western Mediterranean lower river basins. The mechanism therefor is probably linked to wetter conditions (both precipitation amounts as lower temperatures, evaporation conditions).
- Remarkably, no terrace level found (yet) for the MIS 2 cold stage.
- Finally, the lowest and youngest terrace level, although with poor reliability, points towards a historical aggradation phase of only 600-100 years ago.
- Not surprising, the incision that formed these lowest - youngest terrace levels is clearly linked to the installation of the reservoir lakes just upstream of the El Chorro area, trapping the upstream sediments and providing more controlled clean water discharge.

References

Schoorl, J.M. & Veldkamp, A., 2003. Late Cenozoic landscape development and its tectonic implications for the Guadalhorce valley (South Spain). Geomorphology 50 (1-3), 43-57. https://doi.org/10.1016/S0169-555X(02)00207-6

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