FROM FLOODPLAIN TO ABYSSAL PLAIN » DEPOCENTER MIGRATION OF A LARGE EUROPEAN RIVER

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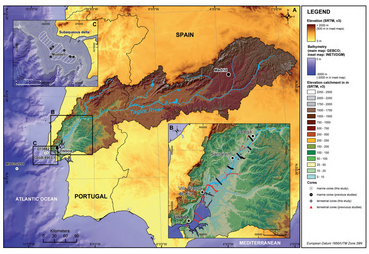
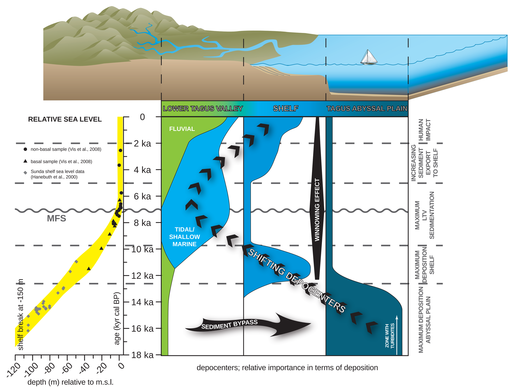
BACKGROUND

This study presents the quantification of sediment transfer in the late Quaternary Tagus River depositional system based on land-sea correlation. Depocenter migration (see figure right) was dominantly controlled by relative sea-level rise and Holocene climatic aridification. The terrestrial depocenter is located in a bedrock confined setting with a fixed connection to the Atlantic Ocean, where the subaqueous delta and mudbelt form the marine depocenters.

Methods include terrestrial and marine boreholes (see figure below), radiocarbon dating, paleogeographic and sea-level reconstruction, and 3D sediment-volume modeling.



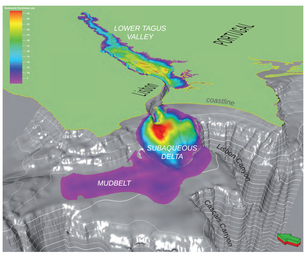
DEPOCENTER MIGRATION

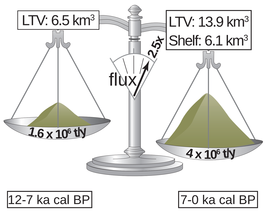


SEDIMENT VOLUMES

Sediment volumes were quantified using 3D spatial models generated with Petrel software (see figure below). The sediment volume is represented by the cell heigth between 3D surfaces.

Due to its bedrock-confined setting, the sediment volume of the terrestrial depocenter could be determined robustly. In the marine depocenter, hardly any sediment leaves the system across the shelf break and the onset of deposition is closely related with infilling of the Lower Tagus Valley. This allows for a relatively robust estimate of Tagus sediment volumes on the continental shelf.





The volume of stored sediment and the sediment flux have increased over time (see figure above).

A similar timing of the weakening summer monsoon (end of African Humid Period), decreasing forest cover, increasing sediment yields and up to ~2.5 times higher sediment fluxes, implies a causal relationship between the above observations. Added to these natural causes, another part of this study has demonstrated trippled land-sea sedimentation rates due to human impact in the catchment during especially the last millennium.

CONCLUSIONS

1) the deep incision of the Lower Tagus Valley and the efficient sediment bypass show that besides catchment size (upstream control) and sea level (downstream control) the width of the shelf is an important downstream control on incision depth and width through fluvial gradient and landward extent of regressive erosion;

2) the utilized multi-disciplinary and multi-proxy approach has clearly demonstrated the shelf region-being at the confluence of terrestrial and marine processes—to be extremely sensitive to developments in the terrestrial and marine realms. The detailed study of sediment transfer has shown to be of great value for the interpretation of sedimentary successions on the continental shelf;

3) a (semi-) quantitative approach using sediment budgets provides a 4D reconstruction of sediment supply and deposition. Sediment budgeting is a powerful tool to link erosion with deposition on a basin scale, to identify its changes through time and to link land and ocean depocenters.

This study underlines the importance of an integrated land-ocean study and the quantification of fluvial-marine sediment fluxes to identify effects of e.g. climate change and human impact on depositional systems from source to sink.

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