SEDIMENTOLOGICAL CHANGES AND VEGETATION DEVELOPMENT OF THE NORTHERN UPPER RHINE GRABEN, GERMANY DURING THE LAST 15.000 YEARS

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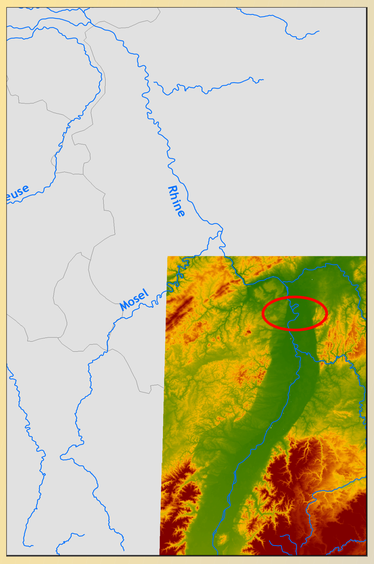


Figure 1. Research area

Summary

The Upper Rhine Graben (southern Germany, figure 1) acts as a large sediment trap in the Rhine catchment and holds a continuous Late Glacial and Holocene fluvial record. To determine the exact influence of climate and human interference on sediment supply in the downstream reaches (the Rhine-Meuse delta), the vegetation development and sedimentological changes in, particularly, the upstream part need to be quantified.

Aim of this research is to relate vegetation development in the Upper Rhine Graben (URG), thus climate change and human impact, to changes in fluvial characteristics of the Rhine.

The following observations are made:

- *Late Glacial - Early Holocene (15 - 8 ka cal. BP)*
  - *Abrupt warming and increase effective precipitation.*
  - *Closing vegetation cover, mainly Pinus, later Corylus (Bos et al., in press).*
  - *Shift from braided to high sinuous meandering system (figure 3B, C & D).*
  - *Low floodplain sedimentation rate mainly coarse silt (figure 4 & 5).*
- *Middle Holocene (8 - 3 ka cal. BP)*
  - *Temperature stable, increase in precipitation.*
  - *Dense vegetation cover, mainly Quercus (figure 8).*
  - *First human interference.*
  - *Transition to more or less anastomosing system (figure 3E).*
  - *Increase in floodplain sedimentation, mainly clay (figure 4 & 5).*
- *Late Holocene (3 ka cal. BP - present)*
  - *Large-scale human interference.*
  - *Opening vegetation cover due to deforestation (Lang et al., 2003).*
  - *Low sinuous meandering system (figure 3F).*
  - *Dramatic increase floodplain sedimentation, mainly fine silt (figure 4 & 5).*

Quantification of changes in sedimentology

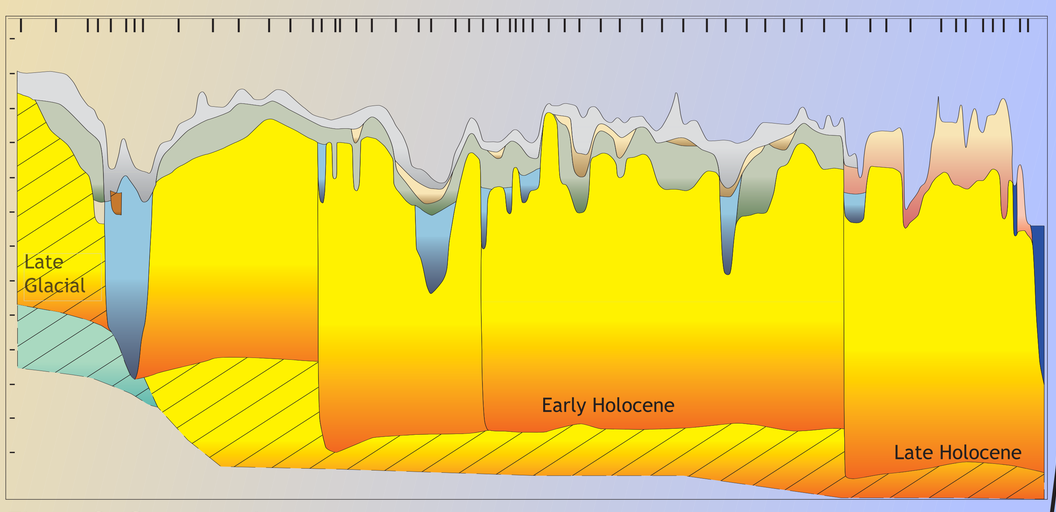


Figure 2. Cross-sections
Corings and cross-sections are made to define the thickness of the sedimentary units of each meander generation. Major classification parameters are: grain size of the sediment and developed soils recognized in the corings.

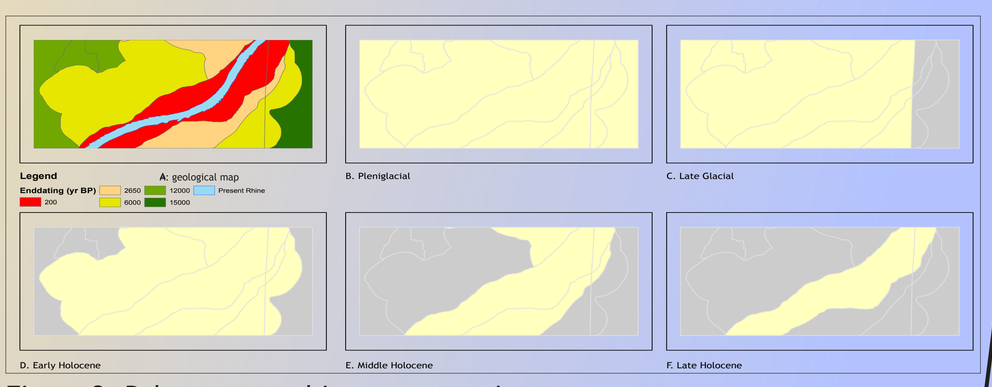


Figure 3. Palaeogeographic reconstruction

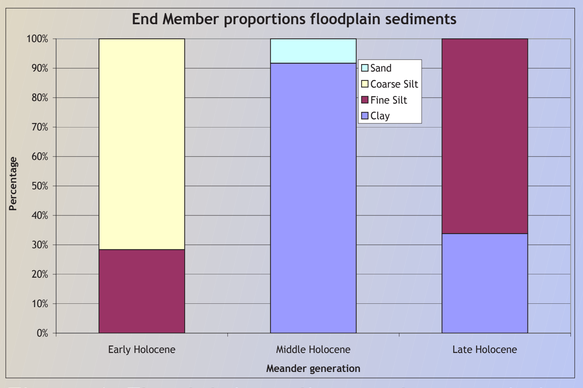


Figure 4. Floodplain sediment characteristics
Early Holocene floodplains deposits consist of predominantly coarse silt, changing to clay in the Middle Holocene and shifting to fine silt in the Late Holocene.

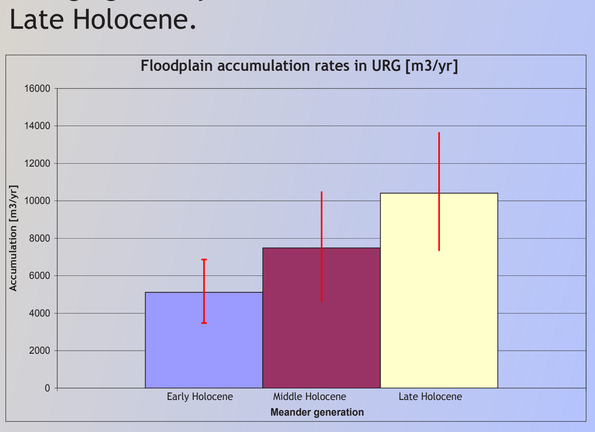
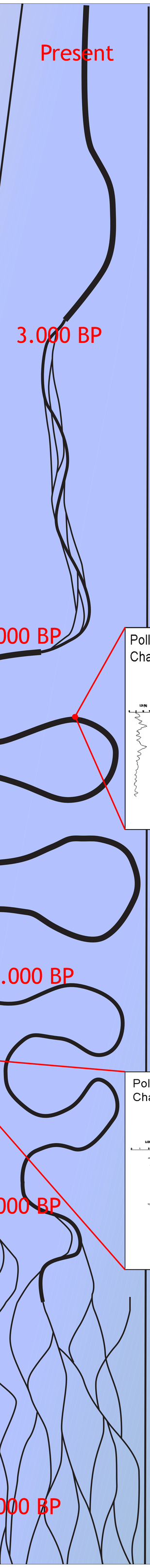


Figure 5. Amount of floodplain sediment trapped in the URG doubled during the Holocene



To quantify sediment budget, time control is essential.
We used palynology to obtain a chronological framework.

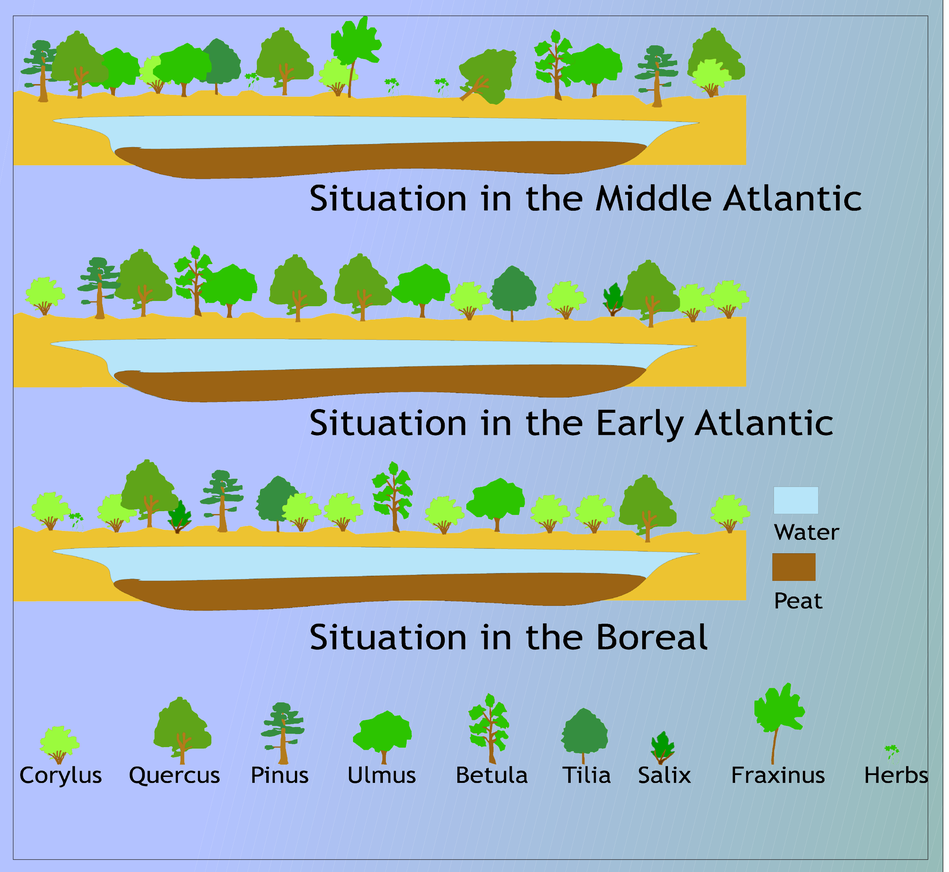


Figure 8. Regional vegetation development in the URG
During the Boreal (9 - 8 ka cal. BP), forests were dominated by *Corylus* while other species such as *Betula*, *Quercus* and *Pinus* were also present. During the Early Atlantic (8 - 7 ka cal. BP), *Quercus* became dominant and *Ulmus* values increased. More herbs (Non Arboreal Pollen or NAP) appeared in the landscape in the Middle Atlantic (7 - 6 ka cal. BP), which is interpreted as the beginning of human interference (Bos *et al.*, in press; Dambeck, 2005).

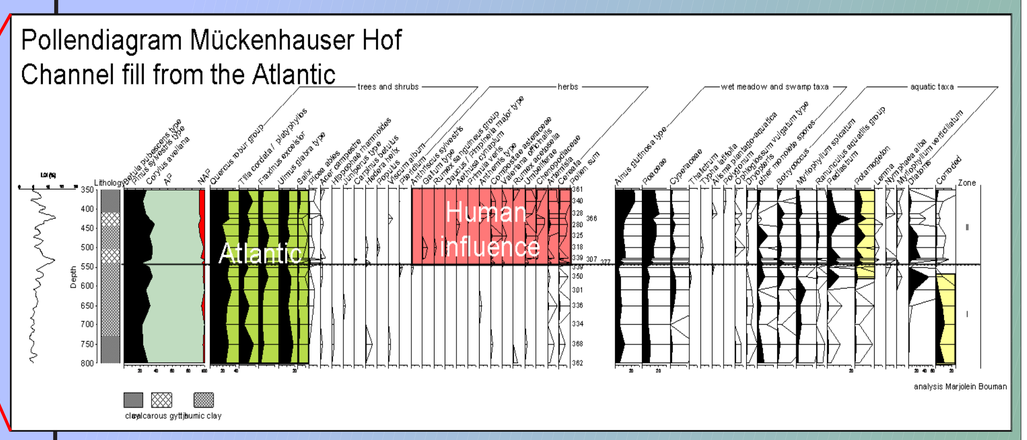


Figure 7. Pollen diagram Mückenhauser Hof
The palaeomeander Mückenhauser Hof was abandoned during the Early Atlantic.

- The deeper part of the profile shows higher values of corroded pollen grains and the presence of *Myriophyllum spicatum*, which indicates flowing water. When the corroded values diminished, *Nymphaea alba* appeared and the sediment changed to gyttja. This indicates stagnant water, thus a calm depositional environment.
- The presence of *Quercus*, *Tilia*, *Fraxinus*, *Ulmus* and *Salix* indicate an Atlantic age (Bos *et al.*, in press). The diagram is subdivided into two zones, with low values of NAP (I) and with higher values of NAP (II), suggesting human interference. This indicates that this palaeomeander was filled during the Middle Atlantic (Bos *et al.*, in press).

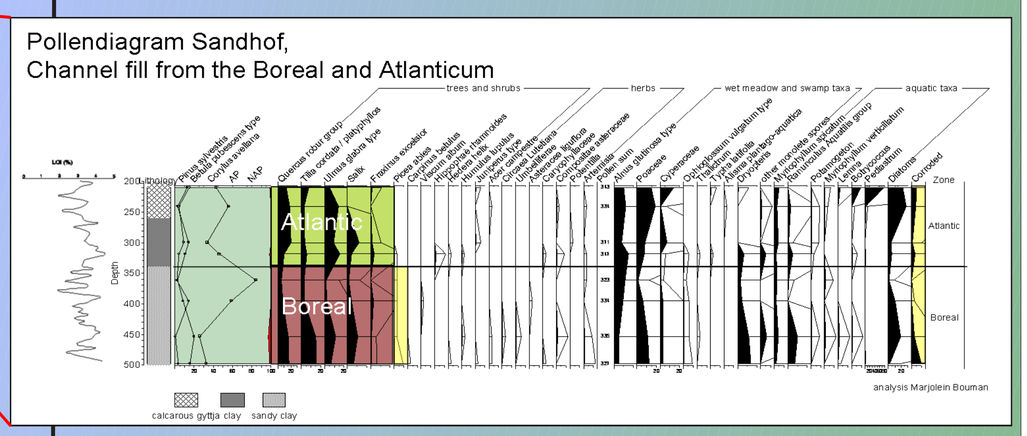


Figure 6. Pollen diagram Sandhof
The palaeomeander Sandhof was abandoned in the Early Boreal.

- In the lower part of the diagram values of *Corylus* are very high while the percentages of *Quercus* are much lower. This indicates a Boreal age (Bos *et al.*, in press). The higher values of *Tilia* and *Picea*, are probably caused by fluvial transport (indicated by corroded pollen & sandy clay).
- In the upper part of the diagram *Corylus* percentages are declining while *Quercus* increases, indicating an Atlantic age (Bos *et al.*, in press). The transition coincides with a sedimentological change.

References:

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