The Heidelberg Basin Drilling Project
– Exploring one of the most complete successions of mid-continental Quaternary in Central Europe –

SCIENTIFIC DRILLING HEIDELBERG BASIN

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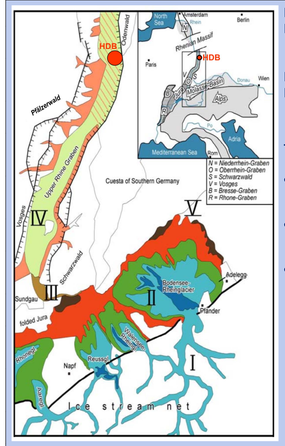
Aim

The Heidelberg Basin (HDB), located in the northern part of the Upper Rhine Graben (Germany), hosts one of the thickest and most complete successions of Plio-/Pleistocene sediments in continental Mid-Europe. Since Late Pliocene / Early Pleistocene, the River Rhine has acted as the only drainage system that connected the Alps with Northern Europe, especially the North Sea. The ongoing subsidence of the Upper Rhine Graben offers a unique potential for continuous sediment accumulation and preservation. Especially the Heidelberg Basin, as the distal sediment trap for alpine sediments, defines a key location to understand the glacial evolution of the Alps since Late Pliocene. With the aim to establish a reference profile of Quaternary stratigraphy of the region north of the Alps, that must be discussed in the context of the 4-D basin evolution, the Heidelberg Basin is investigated by new cored boreholes at three different locations. Each borehole is between 300 m and 500 m deep.

Location



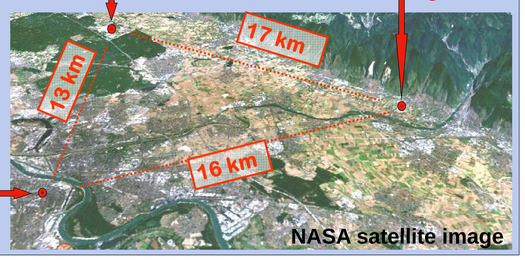
I – inneralpine ice stream net during last ice advance
II – landsystem of glacial basins at the alpine margin (blue – covered by ice during the last advance; green – Würm maximum; red – Riss maximum; dark brown – most extensive ice advance)
III – Hochrhein Valley
IV – Upper Rhine Graben resp. lowlands (green – alpine input; orange – local input; hatched – mainly local, but with alpine signal)
V – classical alpine type region of the Quaternary

The location of the HDB provides most suitable conditions:

- any location just north of the Alps provides few potential for sediment preservation
- any location close to the North Sea is strongly affected by multiple sea level changes
- the Heidelberg Basin serves as most distal trap for fine sediments of alpine origin in the Upper Rhine Graben

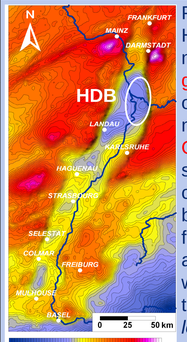
Viernheim, 350 m

Heidelberg, 500 m

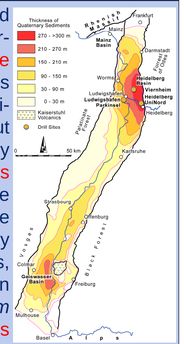


Ludwigshafen P34
Ludwigshafen P35
Ludwigshafen P36
each 300 m

Geophysical Pre-Site Surveys

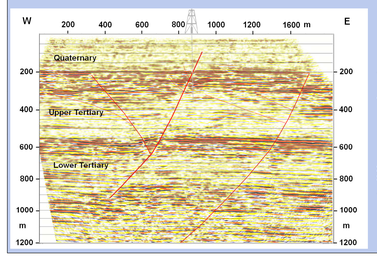


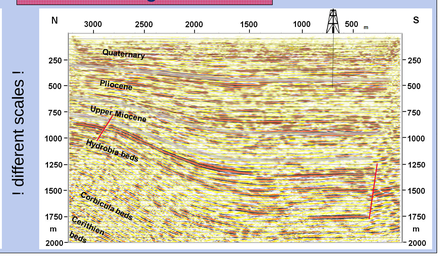
Prior to the research boreholes in Viernheim and Heidelberg geophysical pre-site surveys were performed. In the area of the HDB the strongest negative gravity anomaly of the entire Upper Rhine Graben is observed (*top left*), hinting at anomalously thick sediment deposits. Although rough information about Quaternary thickness was available from industry seismics (*top right*), new reflection seismic profiles contributed significantly to the decision about the borehole locations. In the city of Heidelberg for the first time the depocentre of the HDB, as indicated by additional subsidence compared to its surroundings, was mapped (*bottom right*). At the Viernheim location the seismic survey revealed several faults (*bottom left*). But these faults are mainly restricted to depths greater than 225 m.



after Bartz 1974

Basin modeling: Poster A70

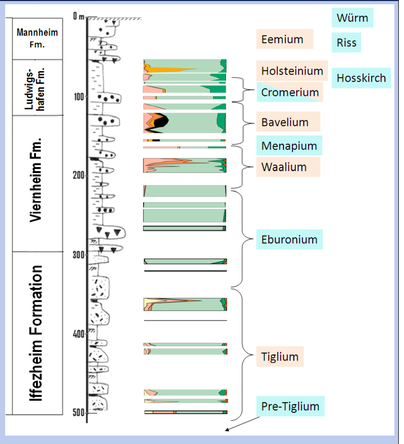


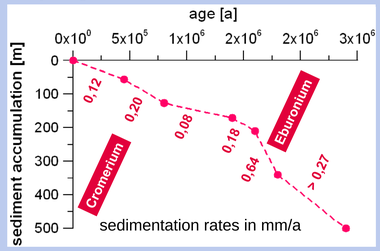


! different scales !

Completeness / Resolution of Sediment Successions

First investigations of the core material confirm that the depocenter of the basin is located close to the eastern main fault of the Upper Rhine Graben. The pollen data of the deepest borehole 'Heidelberg' (*right*) revealed a pollen assemblage at 500 m depth that is interpreted as Tiglium. In the sense of climate stratigraphy, the sediment succession seems to be complete. Glacials and interglacials are found in superposition along one profile – a unique situation for western Europe. The combination of several boreholes in the HDB even improves the situation. Preliminary estimations of the sedimentation rate (*bottom*) suggest, that it is not constant throughout Quaternary, but always high.





Both figures: Heidelberg

- Tertiary elements
- warm loving trees (dry soils)
- warm loving trees (wet soils)
- Abies
- Tsuga
- Conifers
- Herbs
- Ericales

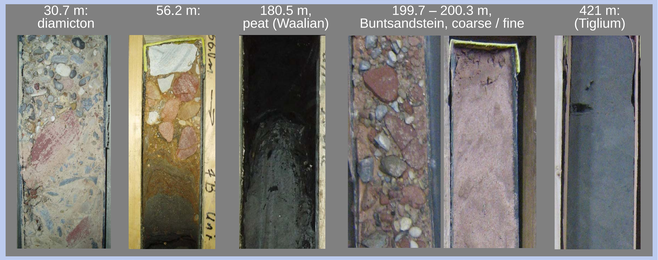
A/S ratio: Poster A73

Core Material

At all three borehole locations core recovery and core quality are good. More fine sediments were found than expected prior to the drillings. Therefore, a sufficient amount of appropriate material is available for detailed laboratory investigations.

Sediment properties: Poster A71

Heidelberg

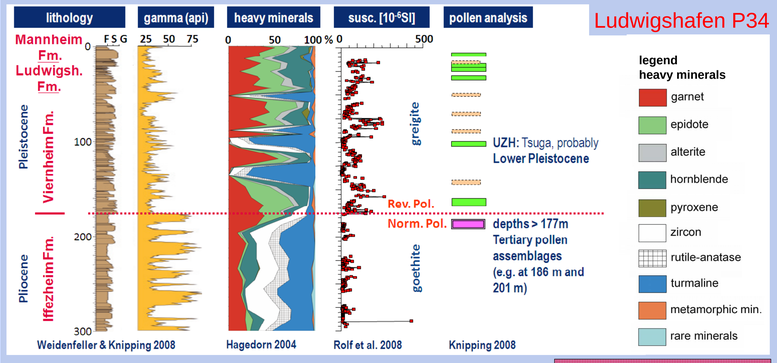


Viernheim

Future Activities

The new core material and the complementing geoscientific data will be investigated by an interdisciplinary approach that combines methods from geology, geophysics, geochronology, palynology, sedimentology etc. as it was (preliminarily) already successfully done with the cores of the Ludwigshafen P34 borehole (*bottom*). These efforts will results in a reference profile for the Quaternary north of the Alps that can be discussed in the context of the 4-D basin evolution and the control of sedimentation by climate and tectonics.

Ludwigshafen P34



Discussion: Poster A71

References / Further readings

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