

SITE RECONSTRUCTION OF ANCIENT VINDOBONA

ABSTRACT

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Archaeological and geological researches in Vienna come to the conclusion that the surface of Roman Vindobona even in the restricted area of the nowadays inner district was quite different in contrast to present Vienna. Beside the cognition of a mutation of the Danube course in a northward direction over the centuries, there are indications in changing the river beds of tributary brooks. A flood of the Danube in ancient times and a mudflow resulting from this flood in the northern area of the settlement entails a chronological division of the site reconstruction. This implicates completely new perceptions on terrain and settlement structures in Roman times. A three dimensional reconstruction of that surface should include the current developments in researching the urban area of Vindobona, that means river courses, elevations and altitudes, routes of streets, buildings of the legionary fortress and the surrounding canabae legionis and the river docksides in reconstruction. Implements in ensuring this intentions are a GIS-application, 3D-studio, altitude and geological plans of present day Vienna and new two dimensional plans of the legionary fortress and of the dimensions of the surrounding canabae legionis. In future the project should be enlarged around the whole area of the Vienna basin.

The taking place of the project is based on the cooperation of three branches of research:

Archaeology: with the results of Roman settlement research in the inner city of Vienna.

Geology: with the evaluation of drilling logs and a new digital geological map of Vienna resulting from it.

Surveying and mapping: with the establishment of a digital elevation model of Vienna.

HISTORICAL AND TOPOGRAPHICAL REMARKS

Vienna was a thoroughly important base on the border of the Roman empire. In ancient times it was called Vindobona and existed as an Roman legionary fortress from the 1st to the 5th century AD in the province of Pannonia. In flourishing times there lived 5 to 6000 soldiers within the walls of the fortress (Fig.1).

The outlines of this fortress within today's inner city of Vienna are well known, although archaeological excavations could have been made in very different qualities and only in very restricted areas during the last 150 years. It was located at a very favourable site, surrounded by the river Danube in the north, by a brook, which does not exist today, in the west and a today canalised river in the east. These watercourses will play an important role for the appearance of the model. Collecting and mapping the results of elder and new excavations led in 2002 to a provisional new reconstruction plan of the legionary fortress approximately of mid 2nd century AD (Fig.2). These mappings enabled a full-coverage acquirement of the ancient Roman altitude level inside the inner city of Vienna.

RECONSTRUCTION

First computer supported attempts to create buildings of the fortress three-dimensionally began with the reconstruction of the three archaeologically known gate-towers in AutoCAD. It based on archaeological ground plan drawings from the beginning of the 20th century and on comparable gate towers from other Roman forts and fortresses especially in Britain, Germany and northern Africa (Fig.3). In consequence of the gate-tower project a voluntary employee, Mrs. Helen Sarah Lacey from Britain, tried to place the gate-towers into the modern urban features and made little cinematic sequences of her work.

THE ANCIENT SURFACE

Last year it was R. Gietl, who tried to build an attractive three dimensional model of the legionary fortress of Vindobona in the context of the so called

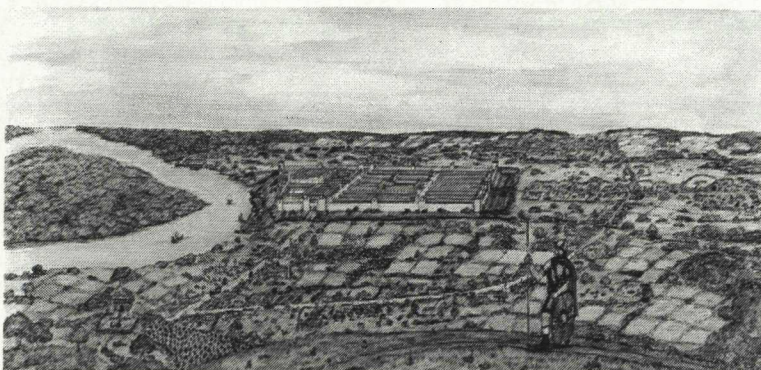


Figure 1 Imagination of landscape around the legionary fortress of Vindobona in Roman times (© Wien Museum Karlsplatz)

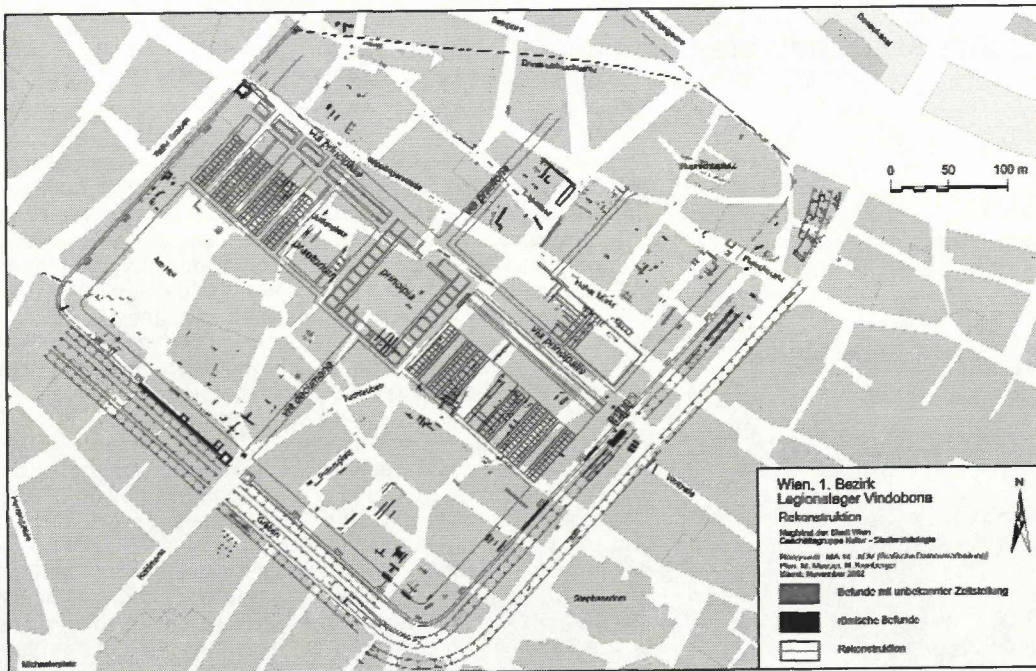


Figure 2 Vindobona - legionary fortress, approximately of the mid 2nd century AD (Map based on MZK MA14-ADV)

"Science week", a yearly open air event of the Universities to bring science nearer to the people. In this context the cooperation was born, the aim was the reconstruction of the ancient conditions around the Vienna fortress and its three dimensional rebuilding. But soon problems occurred concerning the ancient landscape, available maps and technical possibilities. The archaeological researches and the parallel carried out geological evaluation of drilling logs in Vienna come to the conclusion that the surface of Roman Vindobona was quite different in contrast to present Vienna.

The most outstanding result from the cooperation with the geologists was the recognition of a flood of the Danube in ancient times and a mudflow resulting from this flood in the northern area of the settlement. This fact required at least two stages of the ancient model: The rectangular fortress and its surroundings before the mudflow and the reduced settlement after the flood.

A three dimensional reconstruction of that surface should include the current developments in researching the urban area of Vindobona, that means river courses, elevations and altitudes, routes of streets, buildings of the legionary fortress and the surrounding canabae legionis (military suburb) and the river docksides in reconstruction. For this a suitable elevation model of Vienna as a basis to reconstruct the ancient surface and to build up the architecture was necessary.

Such elevation models have already existed since the 19th century. The advanced measurement systems of the surveying departments of the Habsburg monarchy led, beside an exactly measured land register, also to detailed altitude plans

and models (Fig.4). But the technical prerequisites improved over the times, and finally the department of surveying and mapping of Vienna has made a digital elevation model of the city, which they made available for our purpose.

Three main sources have been available to produce the ancient surface:

- altitude level points of the ancient Roman surface from certain excavations
- evaluated drilling logs from the whole area of the inner city defining the water courses
- the digital elevation model of the inner city

The current working was a very educational one, because you pushed on problems you didn't expect before, you have been forced to logical solutions and finally you have more questions than answers. One of the results of this finding process is, for instance, the fact of three ditches around the fortress, a fact which has not been so clear before. These three ditches also seem to have intentional drainage function in direction to the Danube river in times of inundation of the brook west of the fortress.

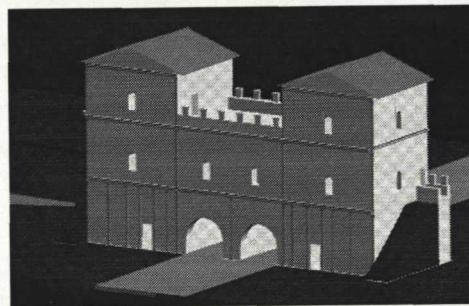


Figure 3 Three-dimensional reconstruction of the gate towers in the legionary fortress of Vindobona

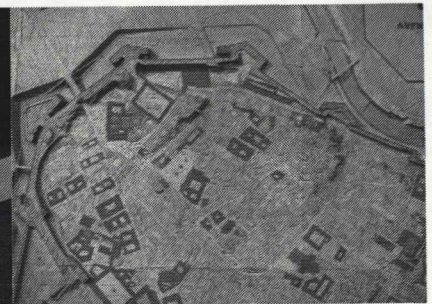


Figure 4 Relief-map Vienna - inner district (Otto von Altvatter 1858) (© Wien Museum Karlsplatz)

To form the river beds, to reconstruct their ancient courses, to hold in mind also Roman canalisation and docks is one of the most difficult tasks of our work.

TECHNICAL PROCESS

To create a site model we had to look for data with z-values and we found an archaeological map showing the contour lines of Vienna's 1st district, used by F. Kenner, the leading archaeologist of Roman Vienna around 1900 (Fig.5).

By digitising the contour lines of this map and triangulating them we generated a first DEM (digital elevation model) that reflects the topographic situation about 100 years ago. In a second step we started to compute and to model this DEM using the archaeological reconstruction of the legionary fortress. The result was a DEM of the fortress area, that was quite exactly in his ground plan, but with z-values of modern Vienna. It wasn't useable for archaeological aims because the present-day surface of the 1st district is totally different compared with the Roman age surface. Today the majority of the fortress is a couple of meters under the modern surface, but some other parts were dug away during the Middle Ages or in the 19th century and now there we walk under the sandals of the Roman soldiers. To solve this problem we tried to include new sources of height data which reflects the third dimension of the terrain surface in Roman age.

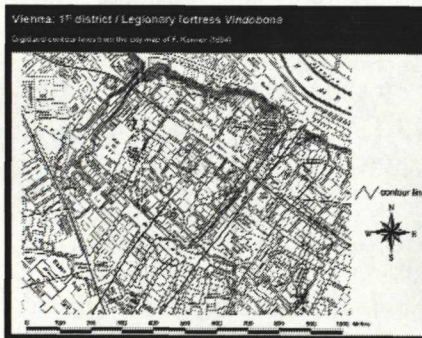


Figure 5 Digitised contour lines from the city map of F. Kenner 1897

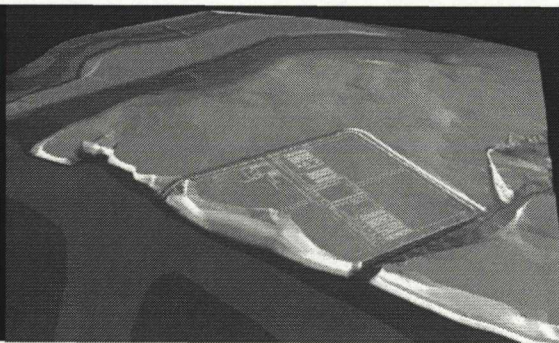


Figure 6 Vienna: 1st district - Legionary fortress Vindobona 3D scene: SCOP; DEM superimposed by the archaeological reconstruction, vertical exaggeration factor: 1.5 - View from North

First of all we started to collect every three-dimensional coordinate which was ever recorded during an archaeological excavation in the legionary fortress or in the canabae legionis over the period of the last 150 years. As we have different Roman surface levels between the time of occupation in the 1st half of the 1st century and the late antiquity, we selected as far as possible points from the oldest Roman layers for this DEM. The height data of the single excavations has different precision: from the 19th and the beginning of the 20th century we have only old archaeological diaries with rough sketches and vague values. Over the last 150 years the land surveys became more and more accurate and in contrast to the oldest data we have modern excavations in the fortress area surveying with a precision of a few centimetres.

Our second source of three-dimensional data were about 2100 geological profiles taken from bore drills analysed by the Viennese company "DonauConsult" on authority of the city of Vienna. They are only a small part of over 50.000 profiles which form the public "Baugrundkataster" of the department of Geology of the city of Vienna (MA 29). In every profile the geologists documented the level of the deepest human-caused layer. Normally this indicates more or less the arrival of the Romans. But sometimes the bore drills penetrated deep medieval cellars or pitches, which have destroyed the Roman layers and for this reason one has to discuss about this data from case to case.

Another geological source are the borderlines of the alluvial plains. They show us the range of possible river movements around the fortress since the last glacial period.

The third and last source is still the archaeological reconstruction of the fortress, of the ancient street system and other buildings.

On the base of this data our team composed of geologists, a civil engineer expert for DEM's and archaeologists started to edit the points, to filter accidental error in reference data and to model the ancient surface. We used a software called SCOP, which the department of Geodesy made available to us. SCOP is designed for interpolation, management, application and visualisation of digital terrain data, with special emphasis on accuracy. SCOP aims at high quality of interpolation.

It has been developed and continuously improved over the last 30 years from the Institute of Photogrammetry and Remote Sensing of the Technical University of Vienna. With this software it is possible to modify easily the height and the position of every mass point or break line. Additionally we can give different weights to our data, depending on their accuracy. That means for example that the coordinates from recent excavations

have more influence on the interpolation process than their older and less exact neighbours.

During this process we have found out numerous new details about Roman Vienna: For example that inside the fortress the ground fell away from northwest to southeast for about 3,5 m. Further we think that we can locate the harbour of the Roman Danube-fleet. The process is just going on in discussing with river management engineers about the ancient course of the Danube and the brooks surrounding the legionary fortress to reach a higher accuracy in the outlying districts of the DEM. We want to use the results for example to analyse visibility or as a starting point for a GIS of the territory of Roman Vindobona (Fig.6).

Further we will update the DEM in regular intervals with new data from recent excavations to improve its quality and it will be used as surface for a new generated 3D-Studio model of the legionary fortress of Vindobona.