Analysing Vienna's Underground

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Although we are in constant contact with it through underground railways, tunnels, underpasses and cellars, the underground of a city remains something abstract, elusive and difficult to grasp. While we are constantly aware of the human influence through the constructions and buildings erected on the Earth's surface, the human interventions in the ground remains hidden from our eyes, invisible. To throw a light on this impact, making the invisible visible, that was the aim of this study.

For this task, different data sets containing information on Vienna's subsurface have been combined: Almost 10,000 well cores and 70 excavation sites were available for the chosen study area in the heart of Vienna. Careful analysis of the well core data allowed to distinguish four different categories of data, depending on their certainty of representing the lower boundary of the archaeosphere, the so-called Boundary A.

The core of this study was the interpolation of Boundary A, which was achieved by using Universal Kriging. By testing two different variogram models to provide the best fit for the data, the nested variogram model proved to achieve better results by visual analysis as well as cross validation. The resulting grid was enhanced adding the archaeological data and well cores classified as "A_min".

Another main objective of this study was the estimation of volume of anthropogenic sediments and the analysis of the distribution of the thickness of artificially modified ground (AMG) in the study area. The volume of the deposits of anthropogenic origin was calculated by using the interpolated Boundary A as lower and the modern digital terrain model (DTM) as upper surface. Including only layers classified as certain anthropogenic sediments and structures, a volume of 46,515,407.26 m^3 is obtained, which equals ca. 233 times the volume of one of the four historical gasometer buildings in Vienna.

Maps of the thickness of AMG were created by subtracting the interpolation of Boundary A from the modern DTM. By a historical analysis, the areas with the highest amount of anthropogenic sediments could be linked to the historical (city fortification, Roman military camp) and natural (waterways, river terrace) reasons. Areas of negative thickness reflect modern construction measures.

Finally, comparing the results to a similar study conducted for the centre of London led to striking similarities in the results. Yet, in order to be able to make a definitive statement, similar studies would have to be carried out in other cities with a different history, ideally also on other continents. Nonetheless, the London study as well as the present thesis attempt to fulfil an important purpose: to raise awareness of a space in our environment that we perceive far too rarely – the underground beneath our cities.