Integration of Information and Interpretations of Findings into 3D and GIS in Hallstatt

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Investigation Background

After over 100 years of investigation, 60 years of systematic archaeological research in the prehistoric mines of Hallstatt, the abundant organic finds, perfectly preserved by the salty environment, provide unique opportunities for reconstructing prehistoric living and working conditions (Reschreiter and Kowarik 2019).

Since the Middle Ages evidence of prehistoric salt mining was found on several occasions and places. Since back then and especially since the beginning of the systematic excavations, different interpretations of the same things and incidents were made, each based on ground of the knowledge of the respective time.

Research Goal

Based on the extraordinary photogrammetrical 3D-reconstructions made by Daniel Brandner (2020) of the ongoing excavations (see abstract Brandner/Reschreiter: Unveiling the prehistoric salt mines of Hallstatt) the pilot-project wants to present bringing these 3D-modells and the available informations and interpretations of the findings together. What sounds to be simple, bears several difficulties. While 3D-documentation of excavation areas is done more and more often, mostly the 2D-derivates like e.g. orthophotos are taken for further analysis for example in a GIS.

But while at a "normal" excavation one could see the whole area "from above" by moving a bit to the side, this is not possible in the case of the salt mines of Hallstatt: the working space is tight, the corridors narrow, no landmarks are visible and the tunnel system is a labyrinth. It is only with the help of a documentation of the researched areas and their connections via 3D-models that the excavation and the connecting links could be made visible. Therefore it is especially helpful and one needs to work with the 3-dimensional documentation. By combining these data with a semantic network, including basic data as well as different interpretation models of the various underground sites and finds, the present large scale interpretation model of the prehistoric mines should be illustrated by showing the respective entanglement of each single element.

Research Methods

With ArcGIS-Pro it is now possible in an easy manner to connect and bring together 3D and GIS data, the only prerequisite to fit it in the landscape is that the 3D-models are georeferenced – an aspect which is also not that simple considering the fact that the mining shafts where the fixpoints are placed are constantly shifting due to the pressing mountain and geology around.
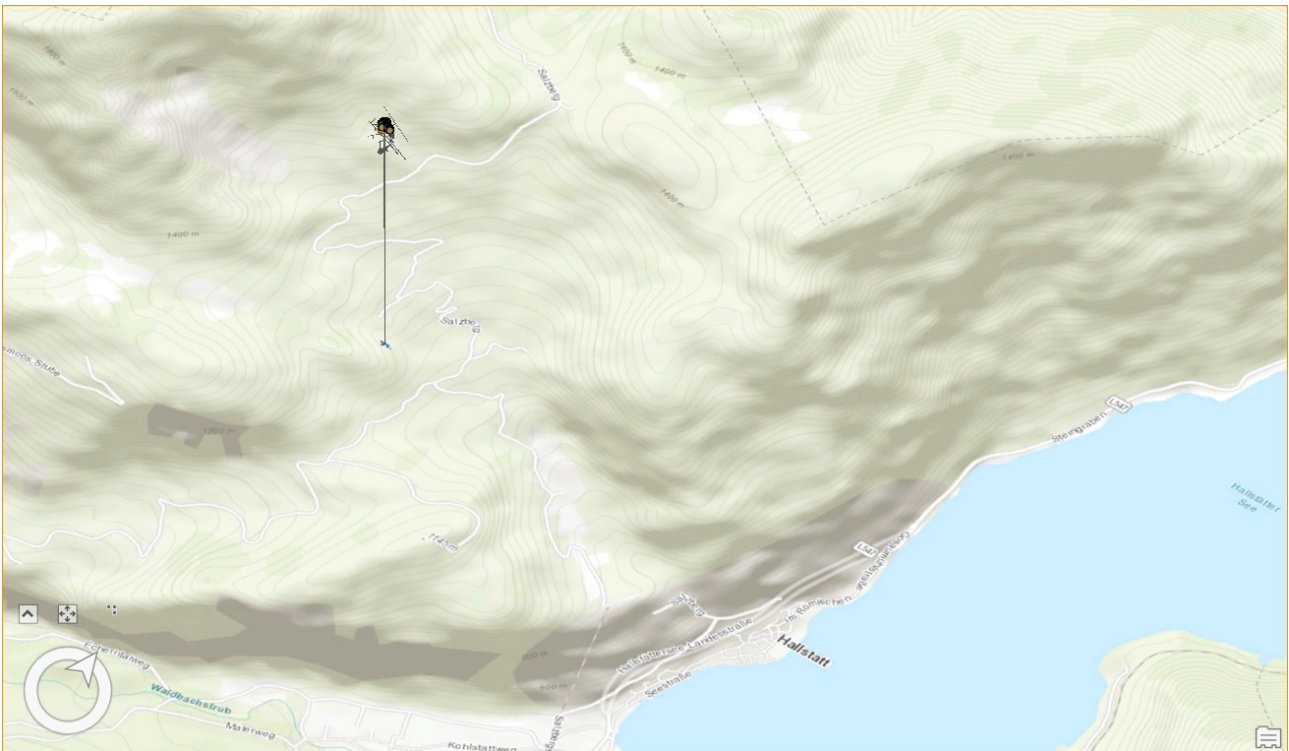
Fig. 1: The (3D-)documentation of "Altes Tuschwerk" imported in ArcGIS-Pro
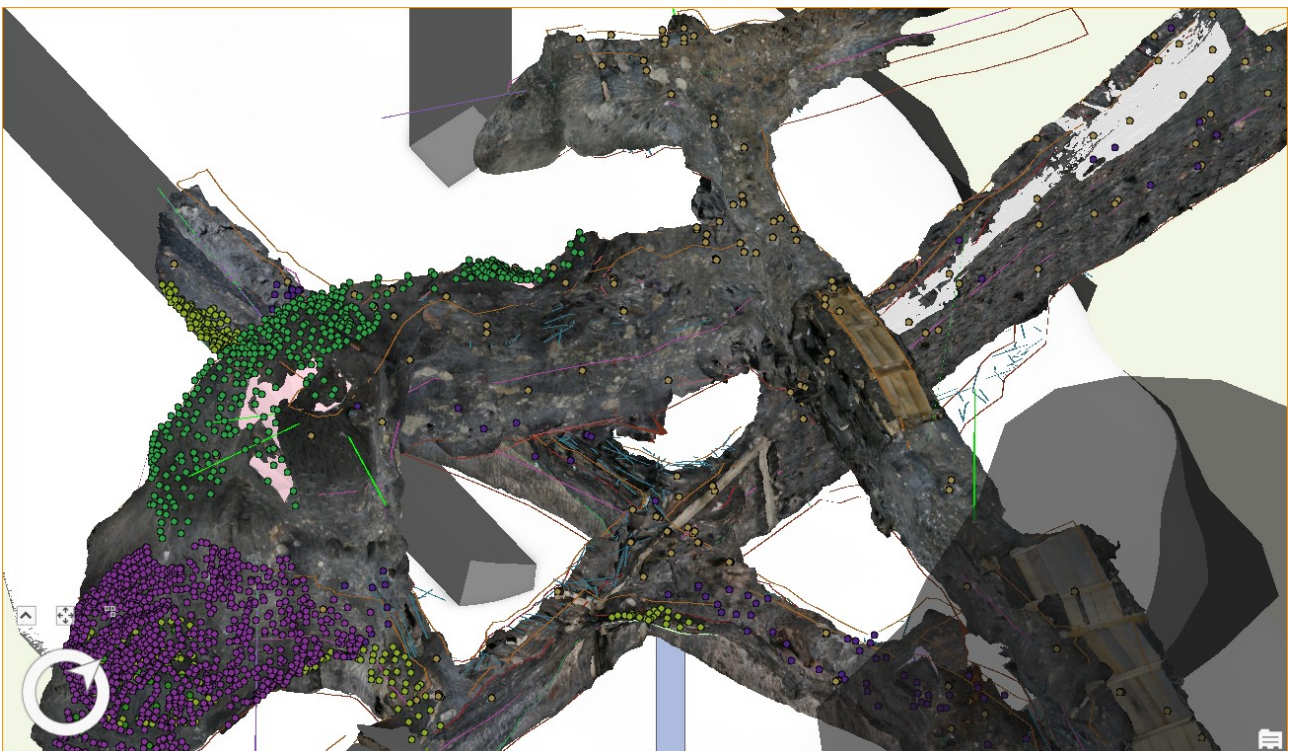

Fig. 2: Close up of the different 3D-models with finds etc. in ArcGIS-Pro

But furthermore the position of the findings with their (in-)accuracy needs to be included, as well as the most important aspects: all observations related to them like material, conservation state, analyses conducted including their respective results etc. and the actual interpretations.

Observations and interpretations should be integrated with the help of CIDOC CRM and its extensions in a semantic network and linked to their geographical location. CIDOC CRM (Doerr et al., 2020) can model the

semantics of the relations between finds, observations, analyses and interpretations in relation to the structures where these finds were made. Much can be gained in terms of new insights into the findings and structures from explicitly stating the observations in a first step, differentiating them from the interpretations in a second step, and positioning them in their 3 dimensional context and the material structures where they have been deposited as a final step.

Use Case

The use case to be presented is the question of the location or interpretation of the presumed Bronze Age entry via vertical shaft to the "Christian von Tusch Werk". While the interpretation of the feature in question is indicated by vertical offsets on the walls, only the collapsed remains of the entrance constructions were found, e.g. wooden beams and stair parts, ropes of flax and organic remains stemming from the use of these ropes. By bringing together the 3D-models with the position of the finds and their informations and interpretations, the situation should be clarified by this approach. But primarily the use case is taken to develop a method of connecting semantic networks with GIS- and 3D-data in order to be able to answer enlarged and/or more complex archaeological situations.

References

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