SAMPLES FOR PREDICTION SUPPORT OF ACHAEOLOGIC MONUMENTS

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ABSTRACT

This paper provides contributions for monumentprotection. In particular it deals with samples to support prediction of so far undiscovered archaeologic monuments by applying terrestrial measurements as well as photogrammetric methods onto

- photogrammetric and remote sensing imagery,
- handed down maps and measurements,
- historic photos and
- local known reference.

In conclusion contributions for the monument-inventory result, as well as improved monument coordinates and geometric supported interpretations of the evidence of recently by the authors discovered monuments.

1. INTRODUCTION

In view of the increasing dilapidation of handed down monuments, photogrammetry and remote sensing techniques can contribute both, permanent control (including inventory) and localization of historic objects.
The monuments, detected or still undiscovered, are influenced by specific environmental conditions. Therefore a better futural protection of the visible monuments is necessary. Also very important is a progress in aimed detections and excavations of special irretrievable monuments of historic importance.

2. MONUMENTPREDICTION

Among others, the geometric localization of so far undiscovered monuments can be supported, applying the following documents:

2.1 Traces of human activities, e.g. influences of the relief-energy (walls, etc.) activities which caused differences in vegetation-heights and -quality, in shadow, temperature and in radiation, but also in magnetism, electric, gravity, seismic etc.

In this context currently especially samples of conventional aerial photos for archaeologic detection purposes of situations of historic buildings are very famous. To image and to interprete the natural or artifical contrasts of the thermal radiation of the earth surface, an Infrared-linescanner or a CCD-sensor is needed.

In opposite to this more operational remote sensing techniques the archaeologic and even the cartographic ability of radar imagery still is a matter of research. Not yet completely solved are the proper conditions and the deepness of soilpenetration of microwaves. For dry sand deserts some scientists expect a radar penetration until 10 m! In Germany about 1 m penetration depth so far has been measured.

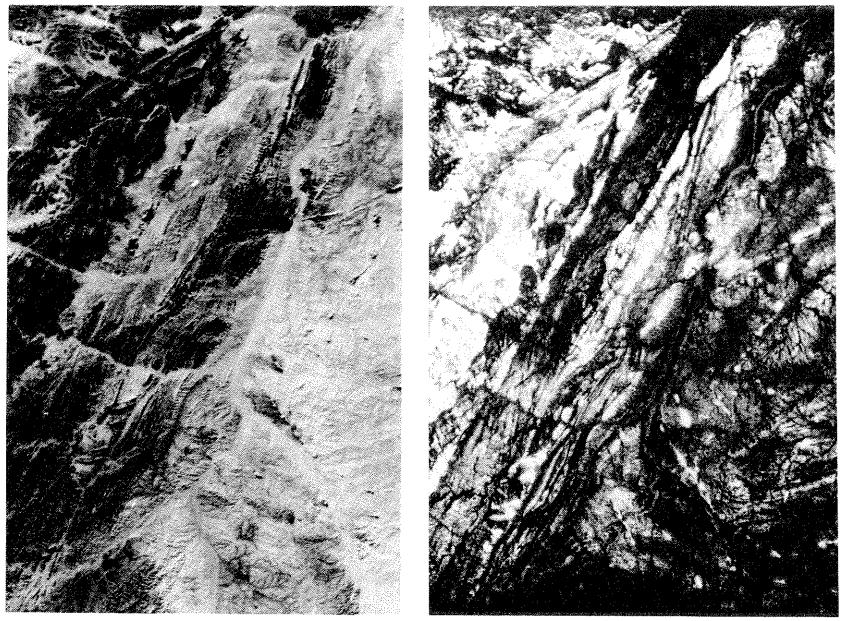

Fig. 2.1-1: Comparison of a conventional photo (left) and a radar image

The sample in Fig. 2.1-1 shows a comparison of a part of a conventional space photo of the Metric Camera-1 mission (on the left) and the corresponding SIR-A radar image, see ESA (1985). Both are space-images of the South Algerian Hoggar mountains (North-Africa). If the promising effect of soil penetration within these type of radar image can be verified, especially the situations of historic river (-Mouth)s indicate probable locations of former settlements.

2.2 Monumentprediction supported by historic and recent maps and measurements:

Historic maps and measurements often indicate geometric inaccuracies and not sufficient identical points. Therefore this type of maps, as well as mostly historic texts, are only of entertaining value. To transform the situation of topographic details of historic maps into the actual situation, local varying scales must be taken into account, as well as changes in the orientation. To overcome this problems, all available maps and aerial photographs, which can contribute to the transformation should be digitized and then interactive searched for optimum fitting, including ground-control point - as well as texture-information. Of course this method is still in an experimental stage. Therefore nowadays an analog (piecewise) fitting of historic to recent maps or/and to (rectified) aerial photography seems to be a sufficient method for local monument verification.

Fig. 2.2-1 shows a sample for the combination of a historic map with a reduced recent aerial photography to determine the situation of a former French camp.

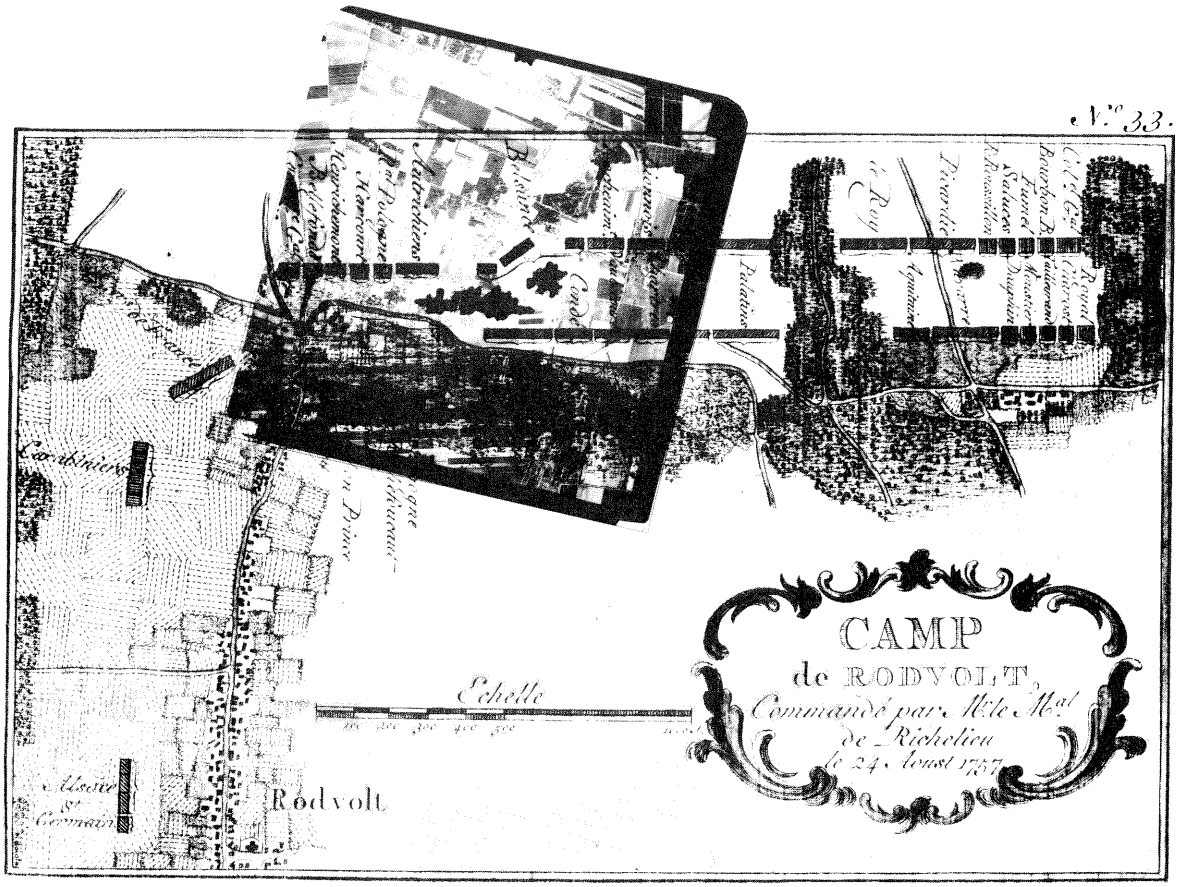

Fig. 2.2-1: Analog Fitting of a reduced recent aerial photography with a historic map of the year 1757 (town Rodewald, F.R.G.)

2.3 Monument prediction using historic and recent (terrestrial) photos:

As a representative sample for monument prediction supported by a historic photo, in Fig. 2.3.-1 an image of the year 1885 is shown, according to Pernice and Winter (1901):

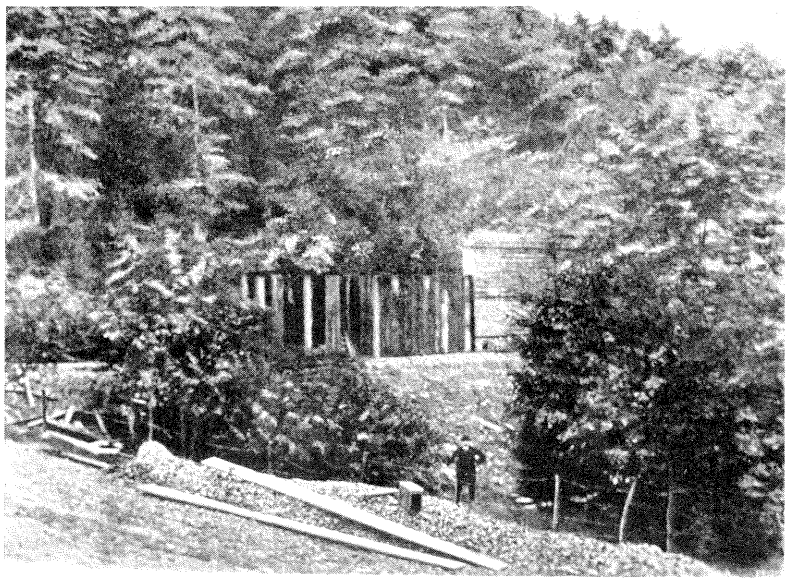

Fig. 2.3.-1: Historic photo from 1885 of positioning a commorative stone (City of Hildesheim, F.R.G.)

Fig. 2.3-2: From the historic position of this erratic block (pos. 5 in Fig. 2.3-3) the arrow (via the letters "EIM") and the above the arrow engraved "7.6 M" destination, point the actual position 6 (in Fig. 2.3-3) of the commorative stone of Fig. 2.3-1

In the center of the foreground of Fig. 2.3.-1, just beside the imaged person, a commorative stone is visible, which is an important monument for the history of the town Hildesheim (F.R.G.) and has been buried at the person's position in the image, which correlates with position 6 in Fig. 2.3.-3. In connection with a historic map and recent terrestrial measurements this image was evaluated applying a bundleblock adjustment approach, using the MOR program according to WESTER-EBBINGHAUS (1986), which has already been published and reported by SCHUHR et al. (1984).

Recently the resulted position could be verified, introducing the distance "7.6 M" and the direction indicated by an arrow on a visible monument (see Fig. 2.3-2), which is situated on position 4 in Fig. 2.3-3 today, calculating the historic position of this erratic block (position 5 in Fig. 2.3-3).

The mentioned investigation has been carried out to localize the proper position of excavation of the legendary Hildesheim treasure of about 90 pieces of roman silver (pos. 3 in Fig. 2.3-3).

Because of a lot of surrounding discoveries accompanied the excavation of this treasure, including a large chest, there is a great doubt, to catagorize this treasure as a separate finding. In Fig. 2.3-3 the excavated area is hatched according to v. COHAUSEN (1870). As the ensemble of this treasure obviously has been divided into two parts, the short distance from a "tomb" (pos. 1, Fig. 2.3-3) and the slightly southly direction of the excavation place (pos. 3 in Fig. 2.3-3) give reason to predict the missed part of this treasure within the tomb (pos. 1 in Fig. 2.3-3) or near position 2, half the way of position 1 to position 3. In any case starting an excavation of the whole area is overdue.

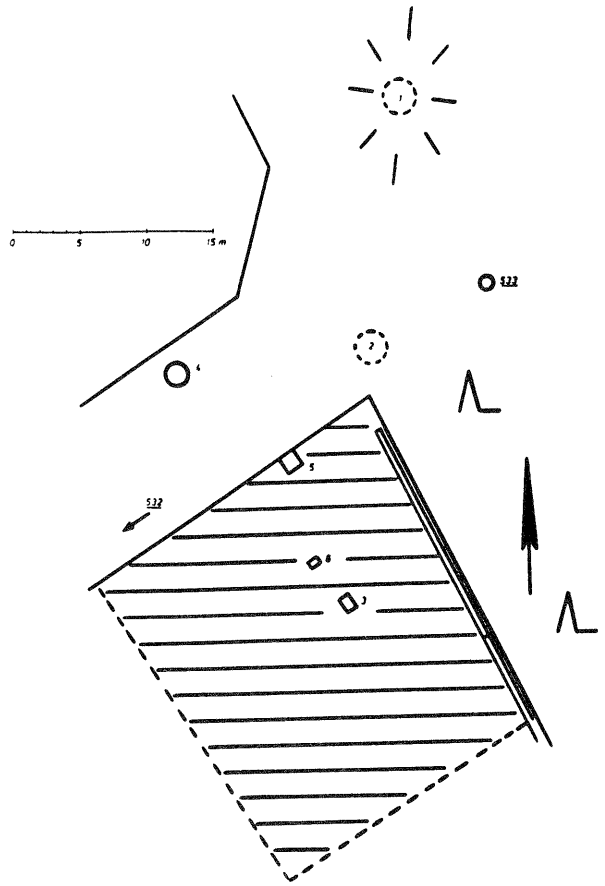

Fig. 2.3-3: The surrounding of the excavating place of the Hildesheim silver treasure (F.R.G.), see text

3. INTERPRETATIONS OF DISCOVERED MONUMENTS

3.1 Inventory

For a serious investigation of the reason for the increasing monument disintegrations it is absolutely necessary, to start with an inventory to document the recent conditions of the monuments.

Fig. 3.2-1 is a first example for the inventory of a facade of a temple in Derneburg (F.R.G.), which has been interactive evaluated by A. SCHUERING, using a MAPS 300 device. This work is based upon a bundle blockadjustment of the four facades, introducing image coordinates, measured in Rollei 6006 Reseau imagery assigning a point accuracy of about $\pm$ 0.5 cm.

To judge the success in (e.g., chemical) monument protection, a futural permanent repeating of the (photogrammetric) documentation of the monument condition is definitely necessary. The best way to realize this seems to establish a monument-cadastre.

3.2 Correlation of monuments with existing buildings or reconstructions

In Fig. 3.2-1 an enlarged part of the evaluation of a column has been correlated with a monument, which was found near the temple and, because of the proper geometric fitting, with high probability was part of an existing column and does not belong to a former building on this place.

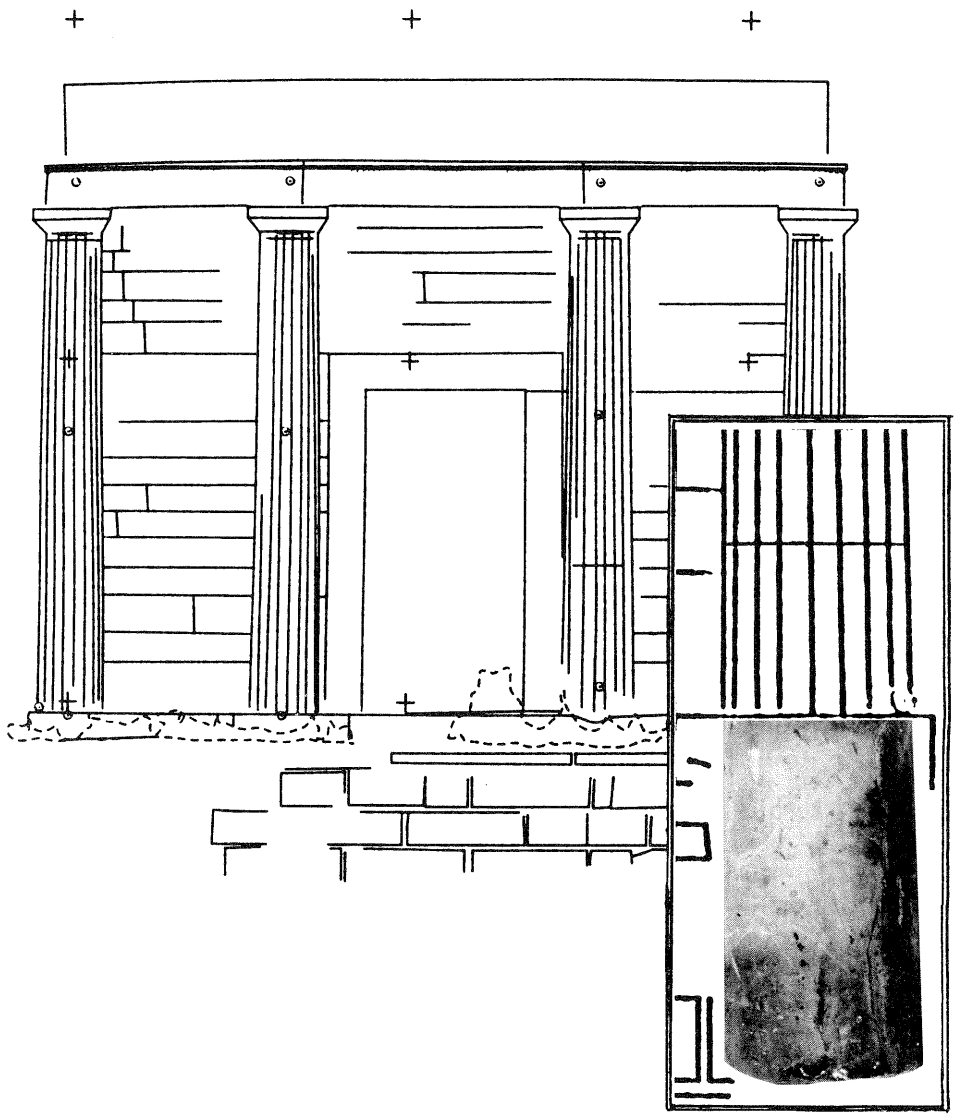

Fig. 3.2-1: Result of an interactive evaluation of a facade and correlation of an enlarged sample part with a recently discovered monument (Derneburg, FRG)

It is so far of valuable interest, as there seems to exist a connection to LAVES, a famous former German architect.

An initial correlation of the monuments shown in Fig. 3.2-2 with an existing reconstruction-plan according to H. HERBRECHTSMEIER identifies them as parts of a destroyed portal of the former castle of the City of Varel (F.R.G.). From the existence of these monuments recent investigations, which deal with almost undecorated facades of this castle, completely have to be changed. The ensemble consists of 4 monuments. One of them shows the figure of an an angel. The other three stones carry the so-called Bentinck Rose, for which the 5 petals are typical.
The two largest stones are built in a symmetric manner. A comparison with existing portals within this region assigns, this two monuments have basically framed a large heraldic figure, which is still searched for.

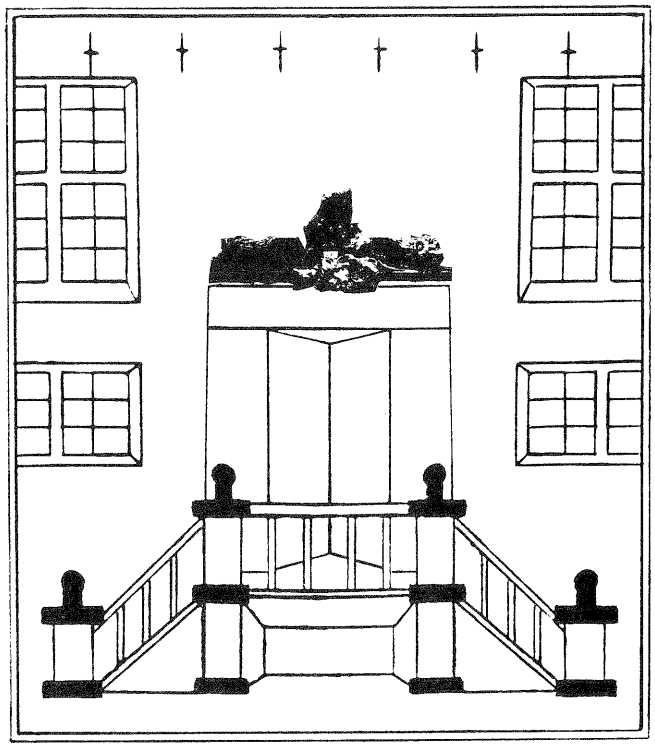

Fig. 3.2-2: First result of the correlation of parts of a portal of a former castle with an artist's reconstruction (City of Varel, F.R.G.)

3.3 Correlation of the arrangement of existing buildings with standard situations:

According to. H. KRAUSE the recent arrangement of the buildings within the City of Hildesheim (F.R.G.), as an example, indicates the characteristic situation of a Roman castle, see Fig. 3.3-1. The authors are not in the possession of any conclusive arguments for this theory and mention this sample with high reservations.

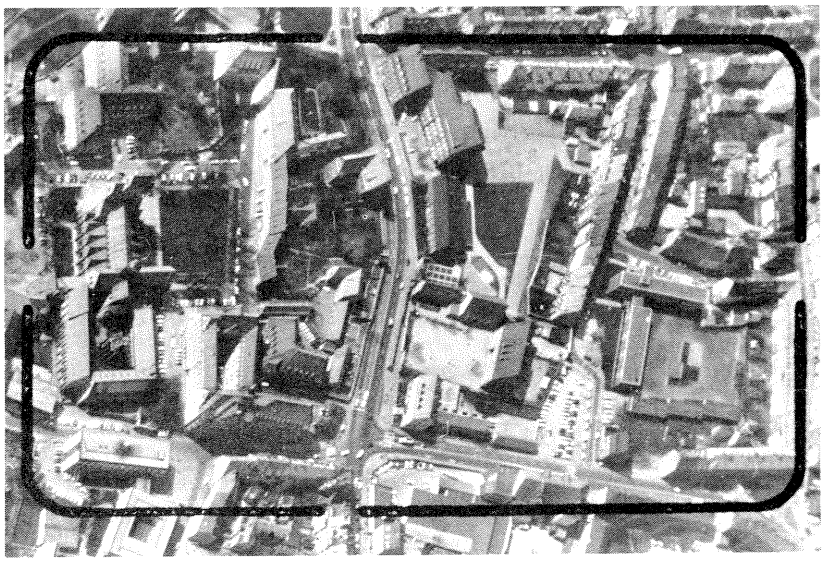

Fig. 3.3-1: The City of Hildesheim, a former Roman castle?

3.4 Correlation of different objects

Figure 3.4-1 shows a Roman coin of the year 7 B.C., found in Adulia (Africa), showing the legendary Roman centurion "P. QUINCTILI VARI", in comparison with the inscription of a silver ladle of the Hildesheim treasure, excavated in 1868.

Fig. 3.4-1: Correlation of a coin legend with the inscription of a historic casserolle

Especially the corresponding characteristic scription of the sequence of the letters "TI" (I above the T!) in both samples, indicated by the arrow, with great probability leads to the result, both objects are related.

4. CONCLUSION

Samples for the contribution of cartography, photogrammetry and remote sensing to inventory and detection of monuments, as a basis for further monument protection are dealt with. it is liked to emphasize, valuable documents for this purpose were especially (imaged) local indications,historic maps and photos, but handed down texts only with low priority.

The quality of the verification of the situation of so far undiscovered monuments can only be judged by excavations or excavation-substitutes.

5. REFERENCES

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