THE PHOTOGRAMMETRIC DOCUMENTATION
OF EPIGRAPHS WITH SMALL FORMAT CAMERAS

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ABSTRACT:

Perfect documentation of findings is indispensable in archaeology. Besides drawings skilled photography helps to properly document specially pieces of epigraphs.
Photography is known as a very objective tool and is used for publications, but the visibility of epigraphs is strongly depending on illumination. In the area of epigraph documentation different shadows influence the objectivity. Smooth light cannot show letters very clearly.
The intention of this article is to show the best way how to photographically document epigraphs. The pictures may not be used just for publication, but have to ensure an accurate description according to photogrammetric guidelines. The digitising (scanning) of the pictures should lead to a meaningful catalogue that can easily be implemented into a database.

In der Archäologie ist die Dokumentation von Fundstücken unerläßlich. Diese wird mit Hilfe von Zeichnungen und Fotografien durchgeführt.
Die Fotografie gilt als objektives Dokumentarmittel und wird deshalb sehr gerne für Veröffentlichungen eingesetzt. Im Bereich der Inschriftendokumentation hängt die Objektivität aber sehr vom Schattenwurf ab. Weiches Aufnahmelicht kann die Buchstabenstruktur nur schlecht wiedergeben.
Die Aufgabe dieses Artikels wird es sein, die bestmögliche Vorgehensweise zur Dokumentation von Inschriftenteilen zu erläutern. Hierbei sollen die Aufnahmen nicht nur für die Publikation vorbereitet werden. Die Ausführung nach photogrammetrischen Richtlinien soll einer geometrisch formgerechten Auswertung dienen. Eine digitale Aufarbeitung soll die Erstellung einer Datenbank und eine sinnvolle Katalogisierung ermöglichen.

Introduction

For two years the documentation of epigraphs has been the matter of research. By means of the project Epigraphs of Pfaffenberg at the museum Carnuntinum in Bad Deusch-Altenburg the photographic and photogrammetric problems should be highlighted and the technique of mosaicking should be explained.
The first section is dealing with photographic demands concerning correct lighting, the second section is describing the photogrammetric basics and the third one is concerned with digitising and mosaicking.
The conclusion will deal with future perspectives and – even more important – the positive effects of the research project

The photography

For the performance of the project a Leica R5 with a 150mm Macro and a 50mm objective from Zeiss was used. Two 600 W flashlights provided enough light for taking the pictures. This photogrammetric special case required a horizontal position of the camera.

The main aim of the photography was to create an even, white background. When taking a photograph of the epigraphs only the letters and the way of processing should become accentuated.
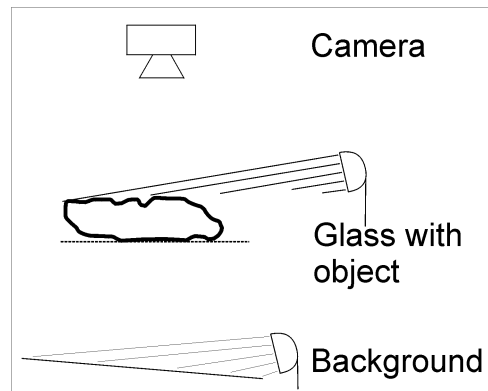

Figure 1: The horizontal situation.

The complete white background requires one f-stop over-exposure – so that the whole area under the objective is lighted in an even way. By using a compendium in front of the objective or having a greater distance between the object to be photographed and the background, blooming, which means too much lighting, may be avoided. A greater distance of the object increases the background space and makes it more difficult for the photographer to lighten the picture evenly on the one hand and elevates the point of shooting the photograph on the other. Therefore boundaries are set.

For visualising the letters "hard light" was avoided at first. "Hard light" was said to increase shadows of the surface structure – which would make it more difficult to recognise the actual inscription. Actually the opposite effect is the case. "Soft light", which had been created by using an enlightening umbrella, was not able to accentuate letters. Deep structures within the stones were far more rendered than the epigraphs itself. In order to avoid this effect standard reflectors, a large lighting distance and a flat streaming angle were used. Using this technique it was possible to create a punctuate source of light which decreased the shadows of the inscriptions and delimited it from the surface of the stone.
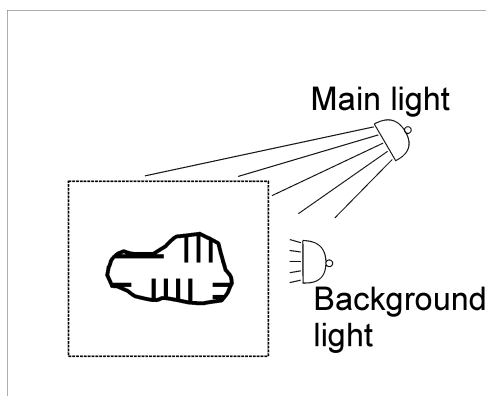

Figure 2: The guiding of light

Another problem was the incidence of light. Is the source of light shining normally on the epigraphs some parts of the letters cannot be visualised. The best effect for a complete presentation can be gained when using an angle between 45 and 225 degrees. Deviations of this angle depend on the arrangement of the epigraphs and their letters.
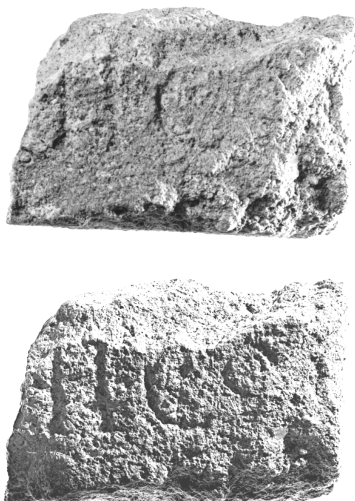
Picture 1: above- soft light
below-- hard light

Photogrammetric basics

When documenting epigraphs photogrammetric basics have to be kept in mind in order to make later mosaicking possible. A special photogrammetric situation is used: The negative is a scaled map of the surface of the stone when the plane of the picture is parallel to it.

A bubble is used to horizontalise the surface of the stone and the plane of the film. This is checked regularly before shooting a picture.
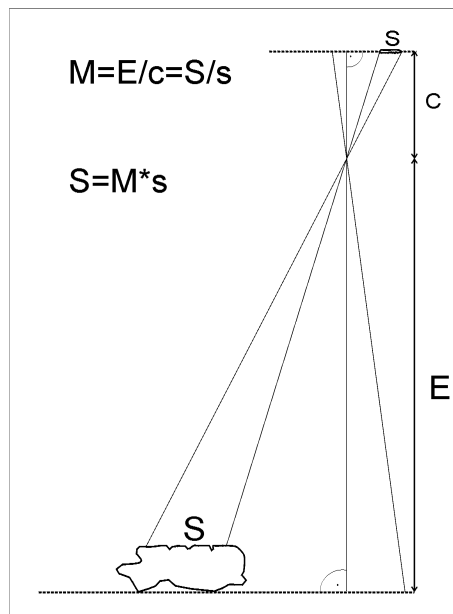

$$M = E/c = S/s$$

$$S = M*s$$

Figure 3: The photogrammetric special case

In the plane of the stone surface a printed scale is exposed too. Making reference to the scale and the surface allows to combine several epigraphs – thus mosaicking is possible.

Mosaicking

Before being able to concentrate on mosaicking photographs have to be scanned. In this case the pictures were scanned directly from the black and white negative film.
Keeping up grey values and sharp definition plays an important role when digitising.
Grey values are kept up by defining a black-point and a white-point on every picture. These two points are references for the brightest and darkest pixel in the digital picture. The scope within these points should stay as closely to the original as possible as far as the grey-shadowing is concerned. As a supplementation a grey-shadowing histogram should be calculated before digitalising. This histogram must not contain gaps – on the other hand it must contain the whole range from 0 to 255. If any deviations are to be found the black- and white point have to be reset and the histogram has to be adapted to the new conditions.

Every time the scanner is used sharp definition is lost. This effect can be compensated by means of a subsequent filtration. This filtration is called " unsharp masking ". This filtering boosts the edges of grey shade jumps and tries to adapt the picture closer to the original.

If there is the chance to scan a grey picture with more than 8 bit depth this method should be used in any case. The larger grey factor volume of the picture avoids gaps in the subsequent processing like the equalising or normalising of the histogram.
The photographs of the project Pfaffenberg were digitised with a depth of 10 bits and 2700 dpi (dots per inch), in order to be excellent material for further research.

Single stones are put together to mosaics with the help of the computer. As a preparation all the coefficients of grey of the single stones are adapted to a certain mean of grey. This avoids the occurrence of differences and a homogenous basis for printing is provided.

An additional information on the homogenousness of the different parts of the stones is gained by the place of discovery, the different kind of stones and its structure. By means of archaelogic processes epigraphs can be formed from single fragments. Drawings of these reconstructions show the position and alignment of the epigraphs.
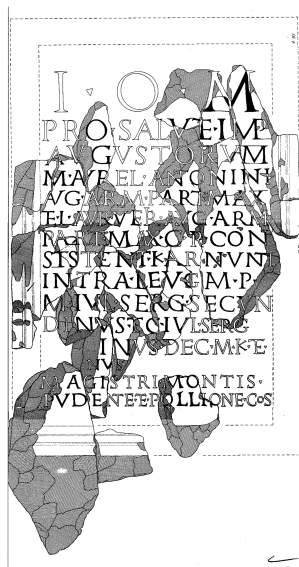
Picture 2: Drawing of a reconstruction.

A special manual process is used when it comes to actual mosaicking. Therefore a software which makes it possible to work on different layers is used. The steps are as follows:

- The drawing of a reconstructed mosaic is put into the first layer.
- A photography of the greatest part of this epigraph is put into the next layer – the level
  which is above the drawing layer.
- With the help of the drawing the photography is scaled equally into both directions of the coordinate plane and turned into the required position.
  The scale which is exposed too is adapted to this process.
- The photography of the next part is put into a separate layer above the others. The scale of this part is adapted to the scale of the preceding part. The picture is turned if there is a great deviation from the drawing.
- All individual scales are replaced by a single one which is the main reference for all –
  this is the final scale for the epigraph.

Inaccurate painting is compensated by adapting only a single pictures scale to the drawing. The correctness of the final scale can be checked by looking at the height of the individual letters of all parts. Before putting all levels together the decision must be made if the drawing, which can be seen in the background, should be eliminated or not.

Digital epigraphs should be stored as large as possible because various distortion (turnings) of the picture lead to diminution's in the quality. A later use in print may be limited because of this!

Picture 3: The result of the mosaicking.

Conclusion:

The research project of Pfaffenberg shows that with the help of the photography, the photogrammetry and digital processing archaelogic findings can be prepared and worked on successfully.
Problems concerning correct lighting were solved after having undergone several time consuming tests.
The close co-operation with Prof. Ioan Piso from the museum Cluj in Romania and his excellent knowledge on the area of epigraphs made it possible to come to the expected results in very short time.
The preparation for publishing is only the first of several benefits. Taking into account the photogrammetric special case and the scale the stone and its letters can be discussed in any detail. On the other hand digital information on the kind of stone, its surface structure, the location of its finding and the plan of reconstruction make it easy to store the whole information in a database. The organisation of the depot can be simplified and the searching time for single parts of stones in the total number can be kept to a minimum.

As a vision for the future the laser-scanner for the macro area should be mentioned. With this technology real, and what is even more important, three dimensional copies of findings can be produced. As a consequence of this a world wide availability via the internet would be possible, not to mention the fact that information stored in such way cannot be destroyed and important parts of various cultures can be saved for the future!

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