DIGITAL DOCUMENTATION OF ROCK CARVINGS: adding depth to Scandinavian petroglyphs

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In Issue 9, we featured a link to some 3D animations of Swedish rock art created by Mette. In this article, she describes some of the techniques she has used in her work.

Due to problems with the preservation of most rock carvings, it is important nowadays to document as much information as possible, because they may fade away in the future. It is also important that the documentations are as realistic as possible. A problem with the methods used in some parts of the world, such as tracing and rubbing (Figure 1) is that the carvings are presented in a flat view, in two dimensions (2D), length and width. The methods omit information such as depth of carvings, pecking marks and processes of carving. But such details are very valuable, and should be registered, documented and presented! These details generate a more realistic view of the carvings and, by their documentation, the science of rock art can be developed even more, and new questions generated for future research. Furthermore, future scientists can rely on records which give them a better understanding and experience of carvings which may have eroded away.

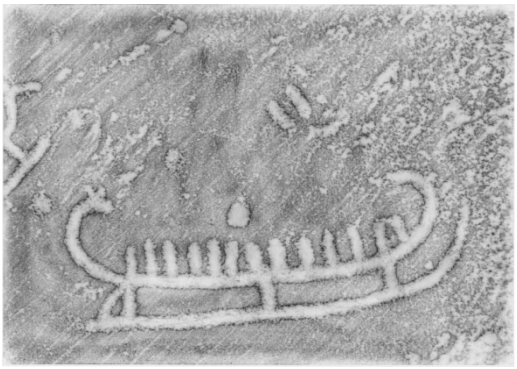

Figure 1: Rubbing of ship from Brastad 5, Bohuslän (image: Mette Rabitz).

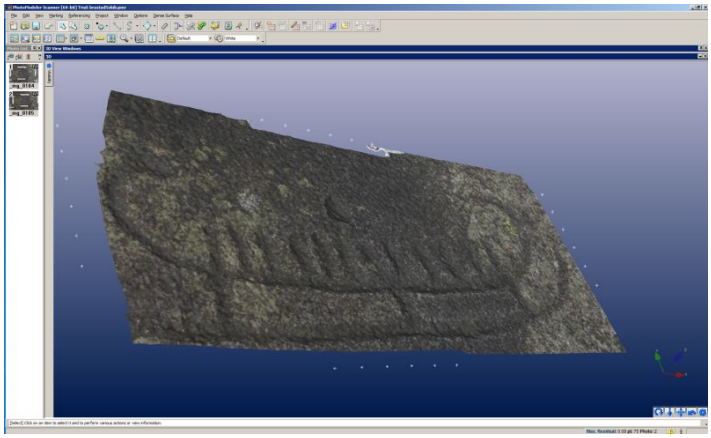

Figure 2: 3D-model of ship from Brastad 5. (image: Mette Rabitz)

The use of 3D-methods makes it possible to also record in a third dimension, depth. In the last decade, some digital methods have been applied to the documentation of rock carvings; laser scanning and white-light scanning. These methods result in very exact digital copies of a scanned surface, which makes it possible to create 3D-models, and measure down to millimetres at the computer. The limitation of the method is that the documentation-process is very time-consuming both concerning data collection, but also the after treatment of data demands enormous servers, and cannot be done on standard computers. The equipment for collecting data is also very expensive, and needs controlling by technical experts. Another problem is that the equipment is far from portable, and needs huge amounts of power. Many rock carving sites often lie far away from transportation possibilities, and some sites are difficult to reach, without hiking or climbing. Therefore one has to consider other methods which fulfil the needs for documentation of rock carvings. One method, which have been known for many years as stereo-photogrammetry, also called photogrammetry (Figure 2), has been used in the car-industry and building-industry, in order to create exact digital copies of objects, and also in order to be able to measure down to millimetres, and study details close-up. All one needs for data collection is a camera, possibly a tripod, and if needed photo-equipment such as a flash. Photogrammetry solves the portability, power, and processing problems experienced with laser- and white-light scanning. Another important fact is that photogrammetry much cheaper, and easier to work with compared with the other 3D-methods.

In my Masters thesis in Prehistoric Archaeology, I did a critical analysis and discussion of the available documentation methods, which have been used to document rock carvings from Southern Scandinavia. The thesis is available (in Danish!) at: http://www.metterabitz.dk/localities/ma-thesis/ In the work, I experimented with photogrammetry as a documentation method, and tested the method upon carvings from Bohuslän in Sweden, and Østfold in Norway. Photogrammetry is 3D-documentation based upon pictures, so in the data collection photo-equipment is needed, and software is needed for processing the data. I used Canadian software from EOS, called PhotoModeler Scanner. The software analyses all the pictures, and creates a fine-meshed point cloud, in which one is able to study the carvings close-up. In this sense it is possible to study pecking marks, but this depends on the condition of the carving. If the whole rock is photographed, it is possible to do a 3D-model of the whole rock itself, and thereby present the slope and the topography of the rock. Because the data is based upon photos, one is also able to present the 3D-model in realistic colours, which present the rock as it looks with areas attacked by algae and lichen, and geological features. In this way, other scientists as geologists and biologists can also use the models in their studies.

In some cases I found new carvings, or details which could help in the discussion of unclear images. It was also possible to do a virtual cut-through of carvings, and study the depth of the carvings. In the software which I used, it was possible to visualize differences in level, in colours (Figure 3).

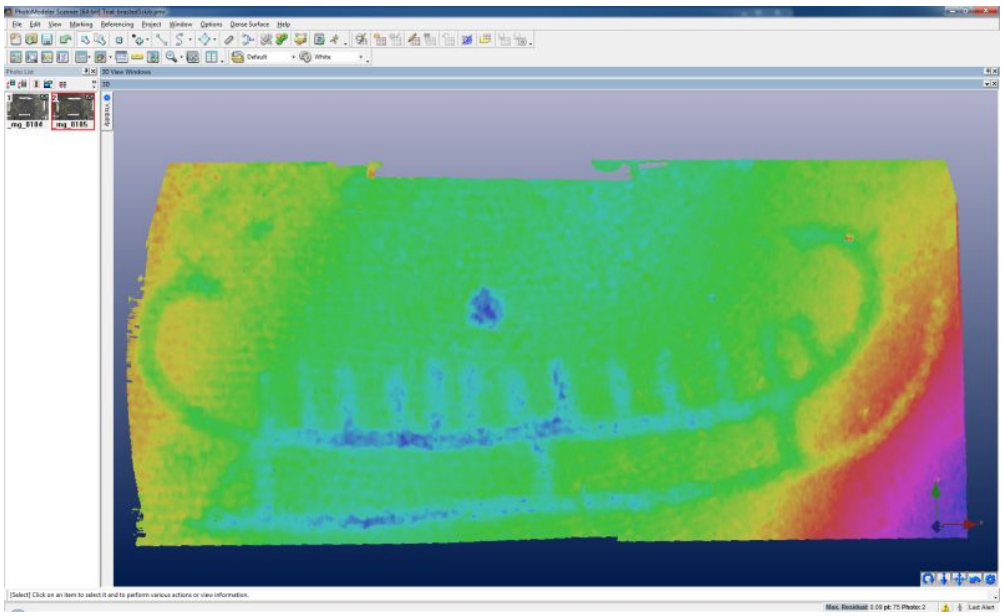

Figure 3: Screenshot of work process in PhotoModeler Scanner of a ship motif from Brastad 5, Bohuslän. The two photos in the margin to the left are the only data needed to create a 3D-model. The colour shows the difference in surface level. Pink is highest level, blue is lowest. Thereby it can be presented that some part of the ship and crew lines are deeper carved than others. (Photo: Mette Rabitz).

Another example is a little horse carving from the Brastad 1 (Figure 4, right). It appears evenly carved, but by examining a cut-through, it can be seen that two legs are more deeply carved than the others (Figure 5, below). Were some legs not finished, or was it made this way on purpose in order to symbolize something? By focusing on depth and carving process it is possible to study new areas in rock carvings, and possibly develop our knowledge about the use of the carvings and the practice of making them.

When using the traditional 2D-methods, the results will lack the topography of the rock itself - the canvas on which the carvings were placed. These details are also important, for example, where ship motifs are placed in or above formations looking like channels, where water flows, so the ships look like that they are sailing. The ships can also be carved, where the rock slopes down, so water overruns the carvings.

I think documenting with 3D methods gives a good opportunity to present the carvings to the audience as realistically as possible. The digital record also allows sharing of the information with a remote audience, allowing the carvings to be experienced virtually, which gives scientists much more information and detail, compared to flat pictures. See one of my animated 3D models at: http://www.metterabitz.dk/wp-content/uploads/2013/05/Masleberg.mp4

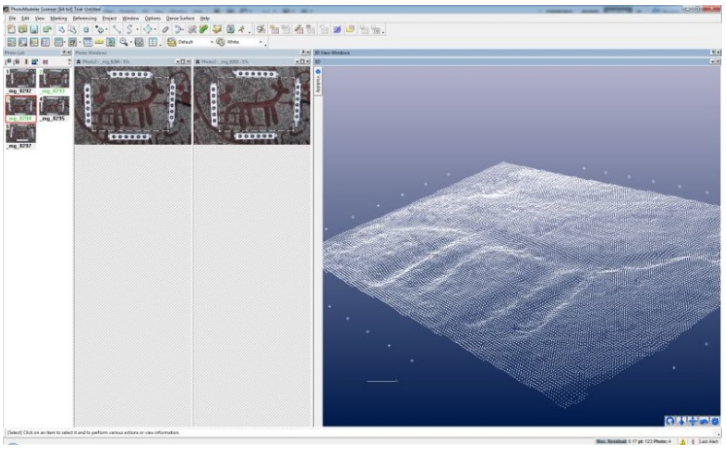

Figure 4: Fine meshed point-cloud of small horse from Brastad 1 (image: Mette Rabitz).

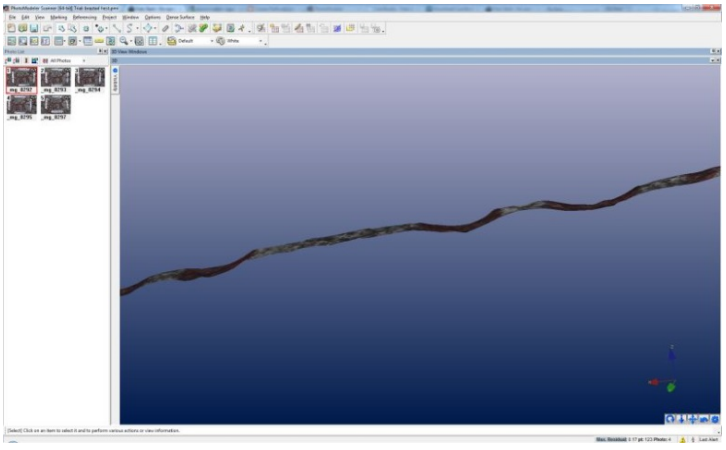

Figure 5: Virtual cut-through of legs of the horse from Brastad 1 (image: Mette Rabitz).

Another advantage with documenting with photogrammetry is that, as long as one has useful data, one can always decide later what to do with them in the software. One can study pecking marks in the point cloud, or twist and turn the 3D model in order to investigate details, but one could also animate the 3D models, as I did.