Developing new techniques for 3D documentation of rock art

SVEN-OLAV JOHANSSON
METIMUR AB

JAN MAGNUSSON
CULTURAL HERITAGE SECTION, COUNTY ADMINISTRATIVE BOARD OF VÄSTRA GÖTALAND

Abstract

This project was implemented in order to test the validity of using portable scanners for 3D-documentation of rock carvings. The development project in 2000 verified the validity of this proposal and, within the RockCare project in 2001, the method was further developed. Rock carvings were scanned in Tanum, Sweden, Valcamonica, Italy and Foz Coa, Portugal. During 2002 a large rock carving site in northern Norway was scanned within the project RANE. Data acquisition can be made on-site without damaging the carvings. If needed, life-size copies can be processed from the original data. The graphical surface model can be presented from various angles and illuminations on ordinary computer screens. The data accuracy (less than 0.02 mm) makes it possible to detect even small changes of the surface over time and so far, comparative studies of results from 2001 and 2002 have been performed for the Tanum rock carvings in Sweden.

Background

There is a great need for objective and comparative documentation of important historical artefacts and monuments. The ancient rock carvings of Sweden constitute an enormous cultural treasure, but they are being destroyed at an ever-rapid rate by acid rain, physical damage and other factors. Documentation and registration is one of the most important means to preserving this heritage, but the most commonly used methods, rubbing (frottage) and plastic tracing, have been imprecise, costly and require large storage facilities. Although such methods can, when performed by skilled and experienced field staff, produce excellent representations of the originals in two dimensions, the third dimension, that reveals the topography of the bedrock, depth of figures and pecking technique, is lost. This third dimension is important for making complete analyses of the motifs and compositions as well as for dating the different components of a panel's overall composition. Furthermore, these methods can be potentially harmful to the carvings, inflicting severe damages on already badly weathered and brittle rock surfaces.

Recognising these problems, the Swedish National Heritage Board decided to develop a non-tactile three-dimensional digitising technique for documentation and monitoring of degradation rates. Jan Swantesson began the development of techniques in the late 1980s with the support of the National Heritage Board's *Air Pollution Project.* In 1989 the first prototype of a laser micro-mapping system was ready for testing in the field. The accuracy of the system was 0.2 mm and the maximum area to be measured was 40 x 40 cm, which took 2 hours to finish. Consequently the theoretical capacity of the system was 1 m² in 14 hours. This poor capacity meant that you needed more than one working week to finish even a moderately sized rock carving. The system was therefore not used for documentation purposes but to monitor degradation rates of smaller sub-areas of different rock carving sites instead.
It was this technique that revealed the rate of weathering at Aspeberget rock carving to be equivalent to 58 mm per 1000 years from 1994 to 1996, which is up to 60 times faster than the average rate of weathering of Scandinavian crystalline bedrock. This alarming figure resulted in the decision to cover the site with a protective insulating material.

In 2000, as part of the RockCare project, the Swedish National Heritage Board commissioned Metimur Co. to examine whether technological advances within the motor vehicle industry could be used for the purpose of recording rock art. The computerised methods and systems developed in the industry are objective, non-contact and capable of documenting objects with precision, in ways that make it possible to construct high-volume copying equipment at low cost. With such a system, there is no problem of physical storage apart from the preservation of computer files in digital media. In addition, the data can be processed and refined in various ways, for example by automatically generating a fairly accurate copy of an object. The data can also be combined with other types of information, such as ortho-photos, in order to bring out and identify vague details. The question was whether this technology could be further developed for the documentation of rock carvings and, if so, with what consequences. Following some demonstrations and a small preliminary study, Metimur further developed the technology on the basis of the Swedish Heritage Board's following specifications:

Measuring process

- Must not damage the rock surfaces.
- Accuracy better than 0.2 mm.
- Repeatable with high precision.
- Possible to cover at least 10 m^2 per normal working day.

Equipment

- Transportable over terrain without roads.
- Powered by a portable electricity source.
- Reliable and not sensitive to various climatic factors (temperature, lighting conditions, humidity, etc.)

Data

- Providing the necessary information for producing accurate copies (initially for indoor storage in museums etc, then maybe for outdoor use).
- Displaying graphic models of surface shapes on a computer monitor from different angles and in various lighting conditions (for museum display, archaeological interpretations of carvings, etc.)
- Detecting surface changes between different measurements over time.

NOMAD system and method

The first tested measurement system and, at that time, new type of band-laser called NOMAD, consists of two main components. One is a Faro Silver measuring arm, which is 120 cm long and manoeuvrable through seven different axes. The arm has a pointed probe which registers the position of the measurements. Attached to the arm is a scanner which emits a laser beam that is monitored by a digital camera. The camera is mounted at a precise distance and angle in relation to the laser beam. The distance to the object can be calculated from the location of the laser beam in the image plane. The lengths of the laser shafts and their relative angles determine the spatial location of the measuring arm. When the scanner is fastened to the measuring arm, the two sensors can be calibrated so they yield the same result within a margin of 0.1 mm. The probe is used to establish the object's system of co-ordinates, which can be defined as a plane or in terms of at least three points that can be identified with known co-ordinates (x-y-z). The surface shape of the object is then measured with the scanner, which registers 7000 points per second, a capacity of 1 m^2 in 35 minutes, compared to the old system's 20 points per second. So, this system has the same accuracy as the old one but it is considerably faster. The data is then fed into a computer and displayed on a monitor, either as an array of points or as a model in shaded relief.

Preliminary study

Prior to the main project a small-scale preliminary study was carried out in order to test whether or not it was possible, by means of precise measurements, to visually represent the data in the desired fashion and to make accurate copies. A small rock slab with a carving of a ship, borrowed from the Storehouse of the City Museum of Gothenburg, was scanned with the NOMAD system. The area scanned was c. 0.6 m^2. The collected data was then processed with CAD to generate a triangulated surface model that could be viewed from different angles and lit from various directions on a monitor. A milling machine was then used to model a hard plastic material (Uriol) mixed with aluminium into three different grades of finish. The first grade gave a fairly rough surface; the second was somewhat smoother; and the third produced a surface very close to the original. The completed model measured 30 x 40 cm. The test showed that it was possible to produce accurate representations of rock carvings, at least with regard to their basic shape. Still lacking is a modelling material that has the authentic colouring of rock. Using actual rock is regarded as an unsuitable alternative due to the high risk of splitting.

Adaptation to field conditions

The NOMAD mobile laser scanning technique was tested in the field on a rock carving in Tanum in the summer of 2000 (Fig. 1). Rock 151 at Fossumtorp was selected because it is situated fairly close to a road, was well-preserved and it has already been documented with traditional casting methods, so it would be possible to make comparisons of the various methods. To enable repeated measurements over time, a reference network of fixed points was set into the rock outside the area containing carvings. The points were precisely measured (better than 0.2 mm within an X-Y-Z framework) using geodetic instruments. Once the network was established, temporary points on the rock were measured. These were arranged so that at least three of them could be reached with the measuring arm. They were measured in the same way as the network and with the same precision by Mätpartner Co., who has knowledge and experience of precision measurement in industry as well as of geodetic measuring equipment. The specially constructed field tripod was easy to set up, but insufficiently stable. This was later improved with changes in its construction. During the field test, however, it was replaced with a tripod that was normally used indoors. This had no significant effect on the outcome. Two car batteries were used as a power source. However, these had to be recharged after four hours of use. In order to avoid power spikes, the batteries were grounded with a heavy, specially constructed, cable. For shelter, an inexpensive "party" tent was used. It had a surface area of 3 x 8 m, which in this case covered the entire rock carving. Made of lightweight material, the tent was erected easily but was blown about by strong winds. Also, the plastic blue and white striped material caused the penetrating sunlight to acquire a bluish tone that caused problems for the laser scanner. Covering the tent with a green plastic tarpaulin solved this problem. Later in the day the drizzle began but the shelter served its purpose and the documentation process was not disturbed.

After measurements from position 1 were completed, checked and digitally stored, a new set of temporary points was measured with the arm-probe

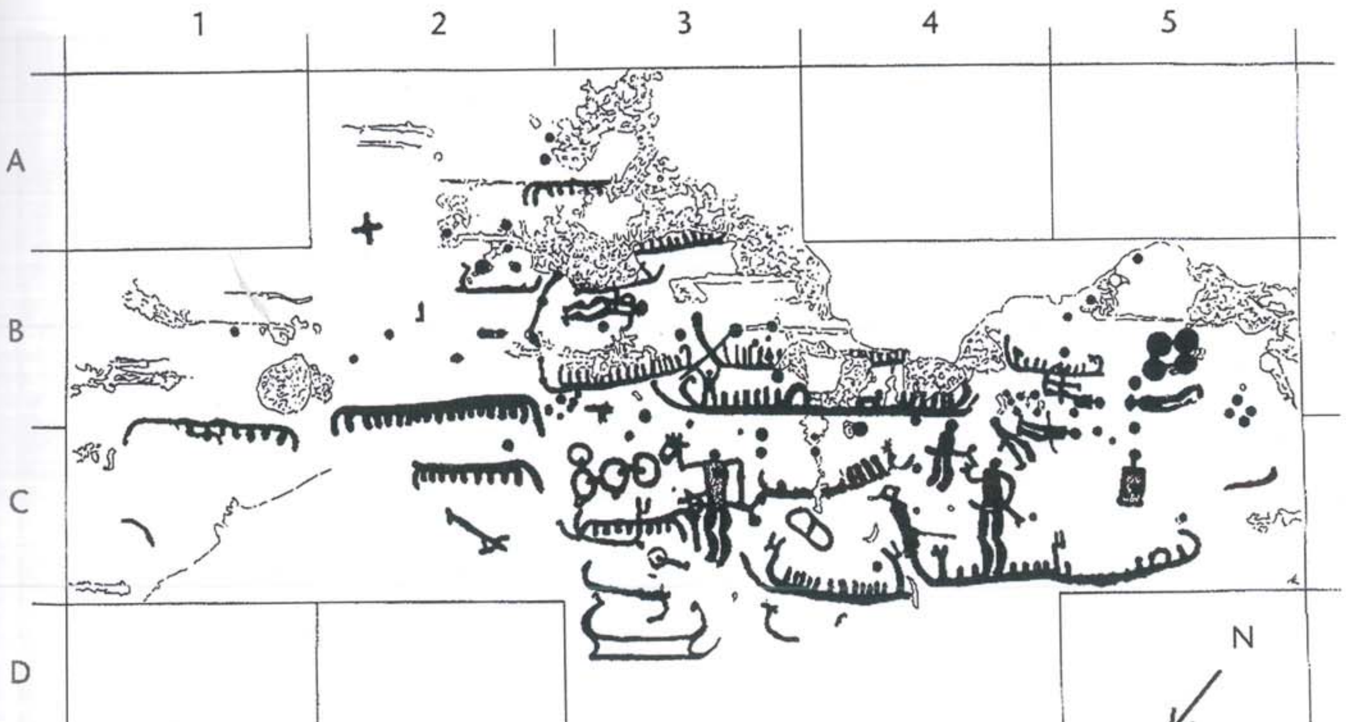


Fig. 1. Rock no. 151, Tanum, Sweden.

(Fig. 2). These points were marked with a felt-tip pen which was easily removed afterward and which served as new references when the measuring system was moved to a new position. This new position must be within the reach of at least three points. As the carved surface was c. 5 x 2 m, this procedure was repeated five times, until the entire rock surface was measured. The whole site was measured during a 12-hour working day.

During the course of the work, many people came to see what was happening. General opinion was that the carvings appeared more distinctly on the viewing monitor than on the actual rock surface. Observers were particularly impressed with the on-line presentation of measurements as the work progressed. The established measuring routines worked well during the field test. An important routine procedure was to save measured data on external storage media at frequent intervals in the event of power failure. All measured data was labelled and saved in ASCI-format on Metimur's computer network and on CDs. No further processing of the data has been carried out so far, but the results have been compared with a cast made of the same rock carving. Conclusions are not yet finalised but there are indications that castings, even though this particular one was made with great skill, are not entirely faithful copies since they do not display the exact overall shape of the rock.

ATOS system and method

The technical development within this field is very rapid and in the beginning of 2001 a new and better technique called ATOS/moiré/Fringe Projection Sensors was available on the market. The ATOS system, which stands for Advanced Topometric Sensor, was developed by GOM mbH for the car industry in order to model, manufacture and test components and assemblies with high accuracy. This new system is not based on the laser technique but can be described as an advanced photogrammetric device. The system consists of a measuring head with two digital cameras mounted on each side of a projector, a tripod, a controlling box and a PC. During the measuring process, fringe patterns of different densities are projected on the surface of the

Fig. 2. Testing the NOMAD laser scanner at rock no. 151, Tanum, Sweden.

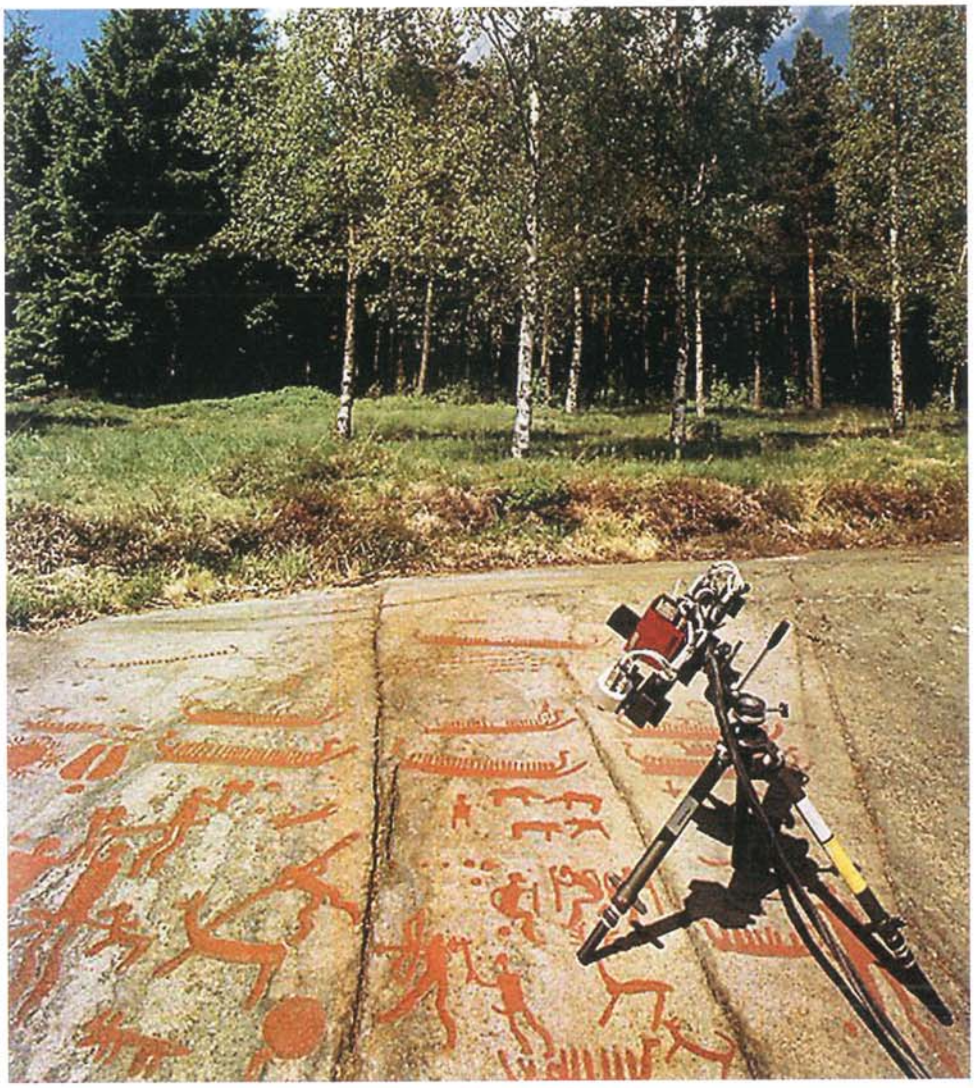


Fig. 3. Testing the ATOS video scanner system in field conditions.

object. These patterns are recorded in stereo by the video cameras and each of the recorded 439000 points is calculated into 3D-coordinates with a maximum accuracy of 0.02 mm. The ATOS-system can collect 33000 points per second compared to the NOMAD system's 7000 per second and the point-laser's 20 per second. Another great advantage of the ATOS system is that you can instantly view and evaluate the collected data, which allows you to accept the data or reject it and re-measure. The digitised point-clouds can be saved as STL, Surf or Ascii files. In order to position individual data collections of larger objects into one point-cloud a common co-ordinate system must be established. This is performed using a pattern recognition technique called Tritop: with adhesive targets the system calculates the corresponding sensor positions and transforms the different data collections directly into a local co-ordinate system established by a digital camera before the start of the actual surface digitisation.

Both laser and moiré methods generate a very accurate, dense, three-dimensional array of points representing a given object. However, there is no difference between the two methods with regard to processing the data. But moiré technology, as employed in the video scanner ATOS system, is easier to adapt to outdoor field conditions than the laser scanner as the measuring equipment is lighter and more portable (Fig. 3). The ATOS also significantly increases the accuracy, precision being better than 0.05 mm compared with NOMAD's 0.2 mm, and covers considerably larger areas. On the other hand, although their level of precision remains too low, hand-held laser-based systems are continually being developed.

Fieldwork

In order to apply the method developed for industry to outdoors settings, certain adjustments had to be made, which are summarised in the table below (Table 1).

In June 2001 most of the problems regarding adaptation to the field, described above, had been addressed and the ATOS technique was ready to be fully tested in the field. In four working days data was collected from four sites with a total area of 37 m^2 (averaging 9.2 m^2 per day), which must be considered as a very encouraging result considering the stormy conditions that prevailed for two of these days. In addition a roof slab (3.2 x 2 m) of a dolmen stone coffin, containing over 50 cup-marks in a state

Problems	Solution	Limitations
The measuring head needs to be absolutely stable during exposure.	A stable and easily operated tripod must be used.	Difficult on long and steep slopes. Stormy days should be avoided.
The lighting conditions must be absolutely stable during data collection.	A large moveable and lightweight party tent with a dark fabric must be erected over the equipment.	Even in a tent the lighting conditions can vary on a day with changing weather conditions.
The equipment is sensitive to moisture and dust.	As above.	We experienced no disturbances due to this problem.
An absolutely stable power supply must be provided during the whole working session as voltage peaks can destroy computers.	A power supply designed for computers (Honda) and a device between the generator and computer must be used.	Common small gasoline generators cannot be used.
Sites are often situated at some distance from the nearest road and the equipment is heavy.	A strong back-up team should be available. Equipment should be as light as possible.	Sites situated far from roads (max 500 m) cannot be measured unless a helicopter is used.
Moist conditions on object surfaces.	Surfaces must be cleaned and dried before measurement commences.	No work can be performed on rainy days.

Table 1.

Parish	Number	Name of site	Remarks
Tanum	151	Fossumtorp	The entire panel. With reference screws for monitoring from the Nomad data collection
Tanum	505	Prästgården	The entire panel
Tanum	21	Southern Aspeberget	The entire panel. With reference screws for monitoring
Tanum	255	Fossum	The east part. With reference screws for monitoring from earlier data collections by Swantesson
Kinneved	21	The Slutarp dolmen	The entire roof slab. With reference screws for monitoring

Table 2.

of imminent degradation, was scanned for monitoring of the degradation rate. The panels scanned in Sweden during 2001 were (Table 2).

In September the ATOS technique was also tested in Italy and Portugal. During three and a half very long working days, five sites were scanned in Valcamonica, Italy. For one and a half days the downpour of rain halted all attempts of fieldwork. Thanks to excellent field assistance from our Italian colleagues it was possible to scan 38 m^2 (11 m^2/day and 1.4 sites/day). This must be considered to be an absolute maximum of what is possible to achieve. After Valcamonica the equipment was transported to Foz Côa in Portugal where the rainy conditions were replaced with very hot and dusty circumstances. The hot and arduous conditions were intensified inside the protective tent, where temperatures could exceed 50°C. Nevertheless, during five days the team succeeded in collecting maximum resolution data from 5 sites containing both carved and filiform (very finely carved) figures. The scanned panels in Valcamonica and Foz Côa were (Table 3).

Since the finalisation of the *RockCare* Project several more panels have been recorded using the ATOS scanner. The Slutarp dolmen, Tanum 255 and Tanum 21 were re-sampled in 2002 and 2003 in order to determine their degradation rates. A rock carving in northern Bohuslän, Hogdal 205, was scanned in

Place	Name of site	Number	No of panels	Remarks
Valcamonica	Bedolina		1	The entire "Map Rock"
Valcamonica	Garden of CCSP		1	Carved stone
Valcamonica	Cemmo	1	1	Part of the carved boulder
Valcamonica	Paspardo		2	Both entire panels
Foz Côa	Penascosa	3	1	The entire panel
Foz Côa	Penascosa	4	2	Scanned twice with different resolutions
Foz Côa	Penascosa	5a	1	The entire panel
Foz Côa	Penascosa	5c	1	The entire panel

Table 3.

2003 due to the development of a large shopping centre in Nordby. And most important, 110 m^2 of a unique panel in Kåfjord, within the World Heritage Area of Alta in the very north of Norway, was scanned during 2002. The Kåfjord panel is very fractured and brittle and will therefore not be displayed to the public. The data collected from this site will be used for the development of 3D virtual reality screenings of the panel at Alta museum, while the original is being preserved for the future under an insulating cover.

Evaluation of data collection in the field

It is always difficult to adapt sophisticated high-tech equipment developed for indoor use to rough outdoor conditions. The equipment must be protected from moisture, dust and extreme temperatures. Lighting conditions and the camera rack must be absolutely stable during data collection and a stable current supply must be provided. In spite of these limitations and difficulties the ATOS/GOM equipment has proved to be very reliable despite rough external conditions. In order to avoid changing lighting conditions night-work could be considered.

Prior to the data collection in the field it is important to decide the optimal point-density in relation to the purpose. Measurements that are too dense vis-à-vis the purpose means small areas of data capture per exposure and, in turn, slow and expensive fieldwork. Therefore, it should be decided if some sections are of higher scientific interest demanding a higher point density than the rest of the panel.

Applicability and utility of the ATOS technique

At present the ATOS system offers the most optimal technique for the depiction of rock art that is available at an almost reasonable price level. The approximate price of data collection varies between 300 and 800 EUR per square metre depending on the point-density and size and location of the measured panel. This price level makes it an exclusive technique for use only on carefully selected rock

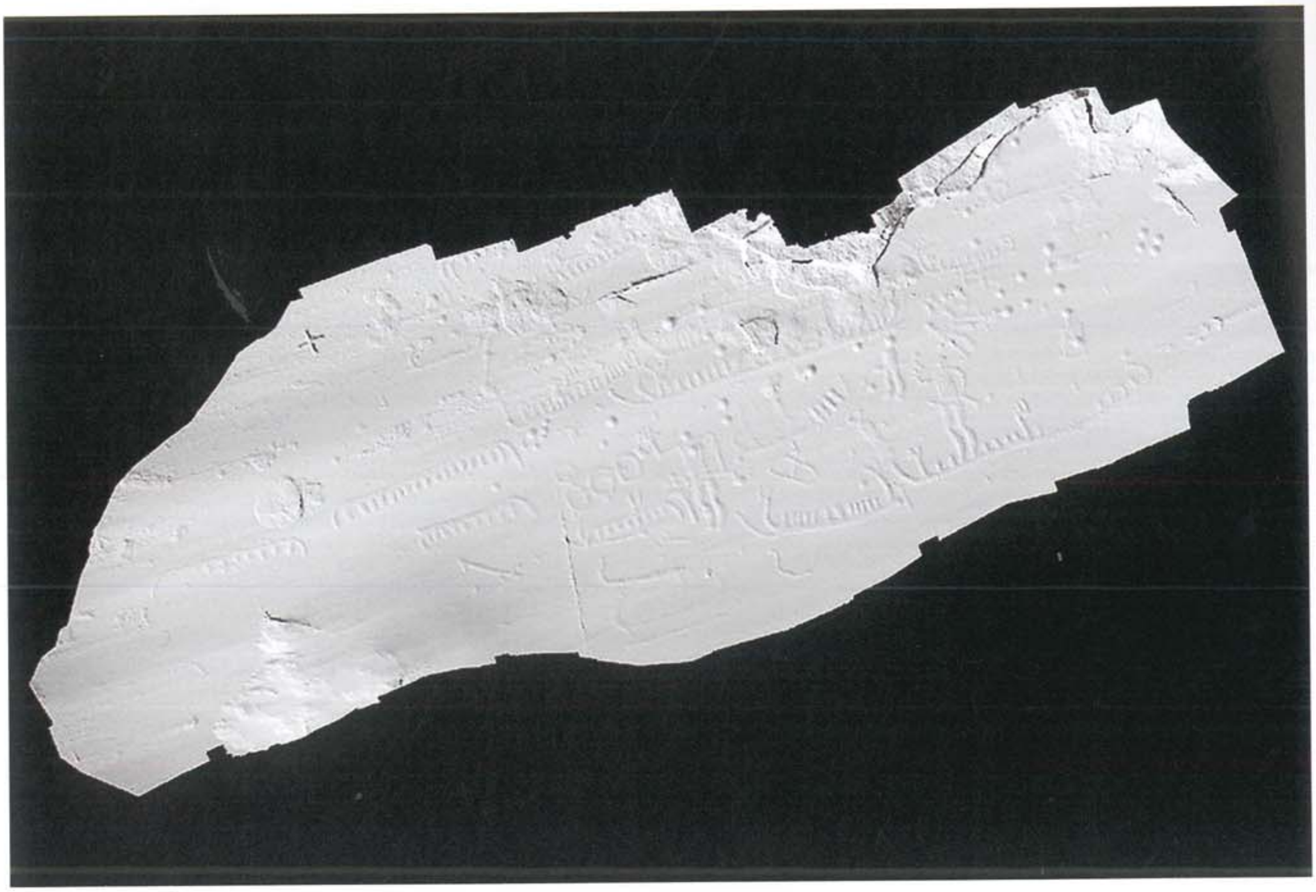


Fig. 4. Resulting image from computerised processing of data from rock no. 151, Tanum, Sweden.

carving panels. For the great majority of sites 2D techniques, such as rubbing and plastic tracing, remain the only accessible standard solutions.

The present data processing methods meet high expectations as do products for the end user. The documentation is stored in a computer data file containing a very dense array of measuring points within an X-Y-Z framework. The data can then be processed so that accurate representations of the rock and its shape can be generated automatically (Fig. 4). Substantially less space and expense is required to store the data than is the case for castings and frottage, but these records can be combined with the computerised data, for example colour ortho photos, which can increase the likelihood of detecting carvings that are not visible to the naked eye. Also, the data can be displayed in various projections and lighting conditions so that even vague outlines emerge with sharp contours.

Processing of the collected and often very large basic data files demands a powerful workstation as well as the appropriate software, like different CAD and GIS programmes, which in turn demand well educated operators. However, the large number of applications of this data, more than compensates for these drawbacks.

Overall, the benefits of the ATOS system can be summarised as follows:

1. The high precision 3D data is the most optimal way to safeguard a rock carving for future research.
2. Detailed scientific studies and analyses of indistinct figures, pecking techniques and superimpositions can be performed at all times of the year.
3. Replicas can be manufactured using computer-controlled milling cutters or 3D copying machines.
4. Different types of virtual images and recorded programmes can be produced for display to the public on 3D screens in museums. False 3D images of protected and covered sites can also be produced for display in computerised guiding and information programmes on small handheld computers rented to visitors in major rock art centres.
5. High precision monitoring of degradation rate can be performed by repeated data collections from the same site. This high precision also means that results are yielded much quicker than with other methods. The only disadvantage is that you need at least three reference marks in order to calibrate the different measurements with each other and calculate the degradation. But these reference points are, of course, a serious intervention to the monument and therefore the advantages of the use of this method must at all times be carefully weighed against this intrusion.

Future plans

The results of this project demonstrate that measurements must be made with great density and precision in order to produce faithful computer or physical models. Rapid development of measuring equipment that meets such demands is currently taking place. There is also a rapid development of computer hard- and software that can process data at greater speeds and lower costs than previously. The technical difficulty lies in adapting such systems to outdoor settings. The technical challenge is that there is no large market for such systems, which means that most costs are absorbed in the production of a single model. The advantage, of course, is that the site or object can be safely documented for the foreseeable future with less risk of damaging the rock than traditional methods. The measurements are objective and precise to within 0.05 mm, making it possible to detect degradation processes within relatively short time intervals. This rapid detection of wear and tear makes it possible to take effective measures in good time. Also, related research can be accelerated through the distribution of the computer model over great distances. However, the most important advantage of this method is that it is so accurate and efficient (covering over 10 m^2/day), so it provides good reason for extensive documentation of rock carvings before they are subject to further deterioration.

For further information we recommend Metimur's home page www.metimur.se

Rock carvings in Denmark – the current situation

GERHARD MILSTREU
TANUMS HÄLLRISTNINGSMUSEUM, UNDERSLÖS
TRANSLATED BY WILHELM OTNES

Abstract

Denmark's tradition in archaeology is its pride. Unfortunately this statement is not true for the field of rock carvings. This field may be small but it is of great importance. During the last ten years several European countries have conducted comprehensive work, including documentation and presentation to the public, to protect prehistoric art. Sweden has been at the forefront of these developments. Denmark, however, has only just begun documentation and registration work on ship iconography in metal and rock contexts.

The history of research

Interest in Scandinavia rock carvings has a long tradition. The first published carvings were copied by Petrus Adolphi, Oslo, Norway, who sent his drawings of a rock carving, the so called *'Shoemaker'* from Bohuslän, Sweden to Ole Worm in Copenhagen in 1627. At that time Norway, Bohuslän and Scania, Halland and Blekinge belonged to Denmark. The first survey of the Danish material came in 1875 in a book by Henry Petersen, *About Rock Carvings in Denmark*. Interest in rock carvings then grew and resulted in a number of publications that were mostly descriptive in nature. As is characteristic of such an old tradition, many amateurs have contributed to the overall picture of Danish prehistoric art. In 1969 P.V. Glob published a revised and updated survey, *Rock Carvings in Denmark*. Rock carvings continue to be found in Denmark today.

Physical geography

Denmark is a low-lying country of less than 200 metres above sea level. For this reason its highest points can be described only as large hills. All of the Danish hills were formed during the last Ice Age, which lasted for over 80,000 years and ended about 15,000 years ago. During this glacial period large stones and boulders were carried southwards by the ice – but without engravings!

In the middle of the southern Baltic lies the island of Bornholm, 150 km east of Sjælland (Denmark) but only 80 km north of Poland and 40 km south of Sweden. Bornholm is the easternmost large island and its geographical nature is different from that in the rest of Denmark. Bornholm was formed over millions of years by the tremendous rupture and upheaval of bedrock and thus consists of granite and gneiss cliffs (Fig. 1). In this sense it can be considered as an

Fig. 1. Vivebrogård, Jylland. Apart from at Bornholm there is no bedrock in Denmark. But there are many small stones and boulders bearing almost all types of engravings. Photo: Gerhard Milstreu and Flemming Kaul.

Fig. 2. At Bornholm the bedrock very often 'peeps out' in the fields, and have thus been called "girl-stomachs". It seems that Bronze Age artists preferred that 'canvas' for inscribing their important message. Photo: Gerhard Milstreu.

extension of Sweden. Bornholm is a particularly important area of Danish rock carvings. In the rest of the country we find engravings only on smaller stones and boulders (Fig. 2).

Images and signs

The majority of Danish rock carvings consist of single images or signs. Only a few stones exhibit more than a few different figures and it is only on the ice-polished rocks of Bornholm that we find larger compositions (Fig. 3).

Cup-marks

The most common sign is the cup-mark found, which is found at about half of the sites. It often occurs with other signs with the exception of handprints. The cup-mark is found on more than 1000 Danish boulders and rock outcrops and small versions (smaller than the size of a hand, the so-called 'pocket cup-stones') occurring on over 250 stones. The many thousand cup-marks

Fig. 3. Madsebakke, Bornholm is the biggest panel in Denmark with 17 ships, cross-in-circles, footprints and cup-marks. Photo: Gerhard Milstreu and Flemming Kaul.

are found all over Denmark in varying concentrations and dimensions – from 2 to 12 centimetres in diameter and from a few to 100 millimetres deep (Fig. 4).

Cross-in-circle and circular signs

Apart from the cup-mark and ship, the most common of the Danish rock-carvings is the circle in a variety of forms (Fig. 5). About half the carvings fall into this category, when cup-marks are excepted. Usually, these signs are interpreted as sun symbols (Fig. 6). The simplest of the wheel-signs consists of a plain circle. Its special position in relation to other figures implies its interpretation as a solar symbol. This is most evident on the *Engelstrup* stone, Sjælland, where it is located between a male and female figure. It may express sexual attraction. There are also several instances where the cross-in-circle symbol occurs in pairs and when two pairs are found together they have been interpreted as carriage wheels. It is well known that two-wheeled wagons (with or without teams of stallions) were symbolised across Europe by cross-in-wheel signs. Besides the four-armed cross-in-circles, other wheel-signs with 8 spokes are known.

Fig. 4. Ringeby, Bornholm. This large boulder, with about 230 cup-marks, is an integrated part of the peasant culture to day as it was during the Bronze Age. Photo: Gerhard Milstreu.

Fig. 5. Lille Strandbygård, Bornholm. A very beautiful panel in the middle of a field. Its position makes it is extremely vulnerable to damage during fertilisation. Photo: Gerhard Milstreu.

Fig. 6. The Chariot of the Sun from Denmark is well known. Last year we found "The football of the Sun" – the stone is rounded and pecked with double cross-in-circle motifs displaced 90 degrees and with cup-marks inside each section of the cross. The bottom is levelled which indicates that it was intended to stand. Is this some kind of ritual Sun Sculpture? Photo: Flemming Kaul.

Fig. 7. Brændegård, Bornholm. Several footprints on an extremely weathered surface. Photo: Gerhard Milstreu.

Fig. 8. Lensgård, Bornholm. This panel was excavated in 1999. The farmer is very proud of the carving and takes care of it. Photo: Gerhard Milstreu and Flemming Kaul.

Footprints

A common sign in Scandinavian rock carvings is the footprint. This image type includes both paired and single bare feet, sometimes with all of the toes carefully indicated, sometimes without. Footprints are known at ten localities in Denmark (Fig. 7).

Ships

The favoured pictorial motif in Scandinavian rock carvings is the ship (Figs. 8 and 9). Cup-marks excluded, depictions of ships comprise over 25% of the Danish carvings, while the corresponding figures for Sweden and Norway are about 50% and 60% respectively. It shows the paramount interest of the engravers in the ship, something that separates them from contemporaneous carvings in the rest of Europe.

Carvings of ships are found throughout Denmark but are most numerous in northern Sjælland (Fig. 10) and northern Bornholm. As early as in the beginning of the early Bronze Age, the ship appears engraved on the blade of a curved sword from *Rørby*, Sjælland.

Fig. 9. (Left) Kirke Hyllinge, Sjælland. It was quite common to re-use the old sacred stones in the first churches. (Below) Detail of the ship and several cup-marks. Photo: Gerhard Milstreu.

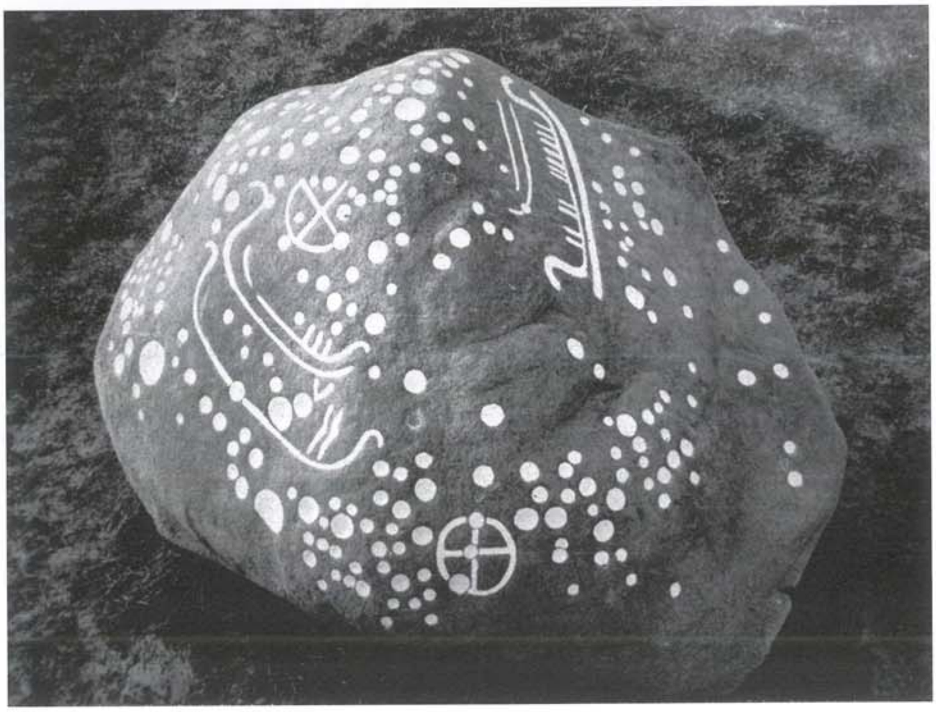


Fig. 10. Hyllingebjerg, Sjælland. One of the biggest boulders with four ships, cross-in-circles and about 240 cup-marks. Photo: Gerhard Milstreu.

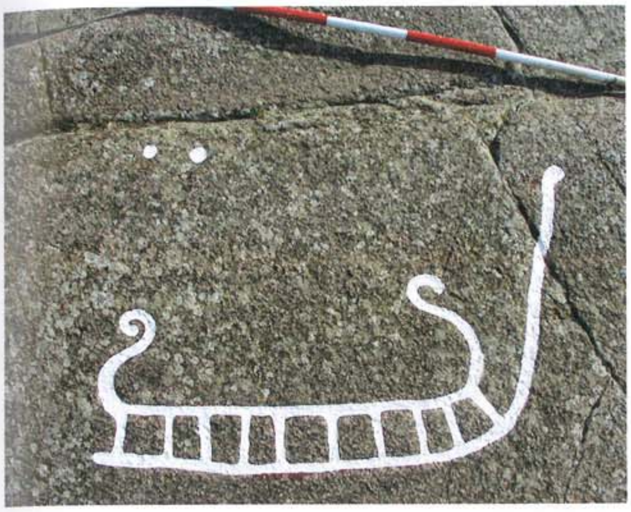


Fig. 11. Madsebakke, Bornholm. One of the biggest ships from the late Bronze Age. Photo: Gerhard Milstreu.

It is possible that this type of ship, with an inwardly curved stem and stern, was depicted on rocks during the early Bronze Age, period I and II. It seems that other types, where the stem and stern are provided with 'heads', first appear in period III-IV. The largest concentration of rock-carvings on Bornholm is situated at *Madsebakke* (Fig. 11), on a furrowed rock surface. 18 ships of very different types can be seen here, together with footprints, cross-in-circle symbols as well as circles, parallel curved lines and numerous cup-marks. It would seem that the Danish ships, excluding those from Bornholm, belong to the early Bronze Age and the first period of the late Bronze Age, while the Bornholm ships continue into period VI and the Celtic period (the Hjortspring type).

Handprints

One of the most peculiar motives of the Scandinavian rock carvings is the hand with open fingers and parts of the arm, pointing to four short parallel strokes. In contrast to other motives this one is – with two exceptions – always found alone on smaller, usually split stones, several of which have been found in or near graves from the Bronze Age period IV. This small group consists of 23 Danish stones, of which 18 are found on Sjælland (Fig. 12). In addition two are known from Østfold, Norway and two from Bohuslän, Sweden.

Men and animals

Animals and men comprise below 5% of the Danish rock carving's repertoire. The very schematic crew-strokes in boats are not included in this calculation. Well known examples include the scene on the large *Herrestrup* stone where a man, depicted with outstretched arms and open fingers, is seen facing an animal (possibly a horse). Above his hip is an oblique stroke that makes him strongly phallic. He is armed with a sword. A phallic man is also seen with a woman on a circular, flat stone disc from *Maltegård*, Sjælland. Undoubtedly we see in this unique piece a depiction of the "sacred wedding", a scene that is also found in other Scandinavian rock carvings. A man and a woman are also depicted on the *Engelstrup* stone. They stand beneath the ships on each side of a circle (probably the sun). Another man turns his back to this couple but probably belongs to the same scene. To the left, above the larger ship is a third male figure, apparently phallic. Above the ship at the very right is an animal (possibly a horse). Women are relatively seldom seen on the rock art of the Scandinavian Bronze Age. It is therefore noteworthy that women comprise about one third of all human representations in Denmark, while they are almost unknown in other areas.

Fig. 12. Grevinge Kirke, Sjælland. Two stones bearing handprints were incorporated into the tower of the church. Photo: Gerhard Milstreu.

A new research project – ship carvings in rock

In 2001 the Research Centre of Marine Archaeology in Roskilde started a research project called *Ship Carvings in Rock* in co-operation with the National Museum in Copenhagen and Tanums Hällristningsmuseum, Underslös.

If we exclude cup-marks the ship is the most common object depicted in this religious visual art. The Scandinavian research material is comprised of tens of thousands of ships carved into solid rock or onto loose stones and hundreds of ships portrayed on bronze artefacts, such as razor blades. In 1996–7 a complete survey of ships depicted on bronze artefacts from the Danish Bronze Age was made, thanks to the Research Centre in Roskilde. *Ships on Bronzes* (Flemming Kaul 1998) is a published registry of ships on bronze finds. A registry of all Danish ships depicted during the Bronze Age will not be complete before the ships on the rock carvings are included. On account of this, the Research Centre of Marine Archaeology introduced the project *Bronze Age Ships in Rock* in August 2000, in order to provide documentation and registration of all ship pictures in Danish rock art. This project is not only a prolongation of *Ships on Bronzes*. Rock carvings are primarily earth-bound artefacts in a landscape that includes other finds, and it seems important to register and study these relationships, not forgetting their topography and geography.

The renewed documentation work on Danish rock carvings will consist of several phases that will be developed by Tanums Hällristningsmuseum, Underslös. The present author will be responsible for the documentation work. A considerable part of the work will take place at Bornholm, the only part of Denmark with carvings on the bedrock. Moreover this island has the largest number of exposed rock-carved ship images in the country. Around selected carving sites there will be comprehensive archaeological investigations that may reveal activities related to the carvings. One has to consider whether particular details in the landscape, as well as the time and place of sunset and sunrise during the year, may have influenced the position and direction of the carvings.

Fig. 13. Madsebakke, Bornholm. To take good photographs is very important – but not always very easy. Photo: Flemming Kaul.

The image as a source of archaeological information

The use of the rock carvings as a source of archaeological information seems to have been – with a few exceptions – marginal throughout the history of research in Denmark. The approach to Danish rock art has been mainly esthetical and its information value has been underestimated. Serious research is scant. In the recent 10–15 years there has been growing interest and understanding of rock art as a decipherable message. The carvings' value as a source, equally important with other historical sources, is now being recognised. Our archaeological history is becoming *visible*. The starting point of this change is electronic. The digital revolution is of great importance in the history of research as it has made it possible to gather and file copies of this ancient world of pictures in great quantities. This allows a more solid and comprehensive survey and understanding of this visual material alongside other archaeological information. We still do not completely grasp the full consequences of this. Pictorial mass communication became a pivotal source of information in the 20th Century. This has influenced the traditional views of specialists, who gradually began to acknowledge the picture as a source of archaeological information and interpretation, not less valid than other sources. This has enhanced the demand for developing suitable methods and techniques in research as well as for teaching.

People often believe that anyone can understand a picture, but this is not the case. The informational value of rock art is extensive. Their simplified shape gives a clear interpretation of the underlying message. Part of the iconography may immediately be related to the other finds from the same period. By comparing and contrasting these sources, carvings and finds can provide each other with more information on the contents of the pictures and the meaning of the finds. However, it remains difficult to interpret rock art. The carvings were created in a social and historical setting and the moment of their creation was unique. The experiences of people today do not coincide with those of the rock-carving artists. So, although they greatly improving our knowledge, there are limits to their use as a source.

Conclusion

Denmark has – with energy – embarked on the endeavour of electronic registration and filing of the archaeological source material consisting of ship iconography. This is the beginning of a bright future for rock art research in Denmark that will benefit much from international collaboration in this field.

Southern Scandinavian rock art in the landscape

Observing the observers

JARL NORDBLADH
GÖTEBORG UNIVERSITY, DEPARTMENT OF ARCHAEOLOGY, GOTHENBURG, SWEDEN

1. Introduction

From the 17th century onwards, antiquarians and early archaeologists left their learned and safe milieu – the library and archive – to make outdoor observations. Movement and presence was necessary in order to bring "home" objects, notes, measurements and drawings. Thus, Sweden was furnished with ancient monuments and finds, archaeological regions came into being and dispersion and density patterns provided different spatial values. Antiquarian activities created new material worlds, which did not exist in that manner before. Places were held together by social uses. However, geographical notes were firstly aimed at retrieving the ancient places, rather than incorporating them in an overall, archaeological, spatial framework. How early travelling used a trained eye to produce documents and thematic atlases is discussed as well as how this apodemic, self-experienced voyage affected the contents of sites. Geography became an indispensable property without which archaeology could not get along.

Introduction

Landscape became a major category rather late in archaeology. Suddenly, in the 1980s landscape was seen as a strong reference not only for the understanding of location and arrangement but also as a scene for actions and – on a larger scale – a creation resulting from human life: a transformation of the earth and its elements. Furthermore, landscape characteristics could add information to archaeological materials of a symbolic nature, such as rock art, which could reinforce interpretations and explain phenomena in special contexts. Topography and the interplay of bedrock, plains, water, sky and vegetation offered a background both for a historic situation but also for the understanding of the discovery of the ancient monuments and remains during our times. Geography has become an indispensable property without which archaeology can not get along.

Initially landscape was often seen as an unproblematic concept, as a normal fact. The process was to delimit a piece of terrain and provide the space chosen with adequate vegetation and climate, relations between water and land and so on and then to furnish this area with human activities and constructions. Everything was supposed to have happened within this created box. Physical reconstruction became the norm for both spatial and locational understanding. However, during the course of research, landscape appeared to be a problematic concept as it was loaded with many, often conflicting, properties. The ever growing literature on archaeology and landscape clearly shows this dilemma. From questions of physical setting landscape demonstrated answers on planning, ideology, symbolic distances, visual and other sensory sensations. Landscape became more and more a social matter. Of course we are all the time left with the fundamental and unsolvable problem of the relations between what was once there and current observations. It could even be the case that the more objective we try to be (according to the rules given), the more time dependent we become.

This article is not dealing with the concept of landscape through time but rather with specific appreciations of land, terrain, setting and place in relation to the structures of discovery and observation. Instead, travelling as a method of gaining direct outdoor situated knowledge is discussed. Rock art became a specimen for academic interest and explanation in Sweden during the 17th century, resulting in a special kind of movement through the terrain that was very much different to that involved in the initial use of petroglyphs. It is interesting to observe early colleagues and their establishment of certain techniques, planning, collecting and forming information. The petroglyphs are still used, but by us for quite different reasons, such as cultural tourism, school education, heritage and research. These reasons are not necessary the same as those given when archaeology was invented. What future uses there might be are quite difficult to imagine.

To look for and to find

The 17th century provided for a more developed and structured antiquarian mission because of a thorough investigation of the land and properties of Sweden. Earlier, the church, trade and the military had explored the country according to their activities and needs. These organisations were distinct from each other but to common people in the countryside they all represented power and control from outside and far away. As knowledge and education were traditionally connected with the church, antiquarian activities were also grounded in the church's administrative system, with entities such as episcopates and parishes, but there were also more traditional civil divisions of land such as county, hundred and, as the smallest entity, the single farm. Land surveyors of the state and the antiquarians of the crown travelled the length and breadth of the country. Taxation of land resulted in new, upsized and graded records of the terrain in the form of economic maps, on which ancient ruins of monuments were now and then indicated as obstacles for farming which allowed a reduced tax. Probably the antiquarians, employed at a collegium or academy in Uppsala or later in Stockholm, were seen as representatives of the state, with special passports, duties and rights. The antiquarian interest was focused mostly on impressive monuments and cemeteries, runic stones, ruins of castles and old church buildings. Artefacts were seldom seen and the collection of specimens at the collegium was very limited (Arne 1931). Another argument regarding which social system the antiquarian belonged is that they were most often the guests of local vicars, where a library might be available and from whence place-knowledge could be gathered in an educated form that would be usable for writing the travel book.

It is important to point out that travelling antiquarians are not the first contact between ancient monuments and a system of administration. In 1666 the first of several general antiquarian investigations were introduced, conducted via the archbishop and the bishops and parallel with the same commission by the county governors (Ståhle 1960). The same kind of surveying had occurred in Denmark several decades earlier, and it is highly probably that this was the model for the Swedish campaign. The questionnaire relied on the relationship between the local deans and vicars and the state antiquarian organisation. It does not necessary include travelling and probably most officials of the church just asked their congregation about the state of ancient monuments. The answers to the antiquarian authorities were quite uneven in quality, varying from detailed accounts with pen drawings to complete silence.

Observation and the trained eye

What happened in antiquarian history can never be completely known and there has been a strong tendency to place all known efforts into ascertaining this knowledge into one, deliberate mission: archaeology. As prehistoric remains don't disappear completely, there must be some sorts of reflections on the passing of times and the place of your own life. Memory generally seems to be replaced by different forms of history, both local and formed by strangers, called academics. Sometimes this has survived in documents, such as law texts, place names, border agreements or even myths about hiding-places for treasure (Jensen 2002). Phenomena such as these are affects resulting from the original situations, a kind of echo or by-product, which point at something other than themselves.

There are accounts of individual exploration expeditions already at the end of the 16th century, which present a new method of gaining knowledge: the apodemic, which represents a scientific practice involving predefined movement in space (Eliasson 1999). This kind of journey is thought to be well-structured, repeatable and objective through a limited set of language terms and expression. It is also a proof of presence to be stored in a centre for documents, an archive, ordered from principles, already anticipated, during the journey. What is looked for has to be decided in advance and assumptions must be made on how it will appear. Moreover, the very seeing or observation is a learned quality, guided by the meeting between an archaeological material and a set of scientific questions. Hereby a source material is created. It is made a source material by us, not by itself. Central to this is the source's ability for representation. It is less of a personal memorandum and is principally directed to be usable by others, colleagues, in comparisons with accounts made in the same way by other persons: as models, quotations, copies, but also to be criticised. In the history of archaeology these pioneers are seen as isolated, strong individuals, but probably this is merely a hangover from the romantic view of the lonely researcher. Instead, journeys included more than one person, often a small group of specialists, depending on the qualifications of the antiquarian. It is not standard that the same individual could measure, depict, investigate, take samples and write down observations. If excavations were included, these were conducted but not physically realised by the antiquarian. Help with digging was organised through day-labourers at the farms, service men at nearby military regiments etc. Regarding the depictions, there was a sort of drawing machine available, which could help to gaze-frame the picture, providing the right proportions etc.

Taken and transported away from the visit are the figures of the measurements, the depictions, in different scales, of the sought rock image, the rubbings and casts, the descriptions and observations in text, not least, the condition of the monument, and finally – on top of everything – the travel book describing what was done, where, when and by whom. The discovery visit has come to an end and the rock image and the place is shut. But the produced documents are not an end in themselves. Back at the laboratory, studio or archive, the texts are reorganized not along what was done and written during the visit step by step, but according to the structural logic of the document. Drawings are converted into presentable copies on better paper quality, rearranged, framed and sometimes coloured. The final codification will be the carved and later printed woodcut from a drawing, which in a way – through wide distribution – guarantees the possible stereotype. The original notes from the visits are often reused and erased for other purposes. There is a parallel wearing out both of the rock image surface and the documents produced. Unfortunately both categories are on their way to destruction.

The importance of place

Rock art must be situated somewhere. Most of it is immobile and obviously part of the bedrock. Some rock art, in the form of small stones with engraved or pecked figures and cup marks, is movable and may have been circulated, but how such networks may have been organised is unknown to us. A remarkable use of rock art is the category of standing stones, which have been situated, where there were no stones before. Cist graves with picture stones or so-called hand-stencil stones are important markers in the landscape and help to structure the different forms of rock art.

The chosen place for rock art is not definitely the same place as that occupied by the ancient monument, the rock carving site in antiquarian terms. Place is a historical and social creation and the maintenance of a place demands people. The place fades away if its use is discontinued. What remains of the site is a possible but dissolved historic place, which can be productive in archaeological discourse. On the other hand, a new place is created by the antiquarian activities and is held together by quite different social uses. Rock art as a modern concept collects candidates and forms both formal and spatial circumstances, which stand out from other archaeological phenomena. Reflections on placing supports wider interpretations of rock art beyond pictures and figures and may better relate to other historical remains.

Archives

Antiquarian activities create new material worlds which did not exist in that manner before. There has never been a sort of model chamber or repertoire storehouse from which rock art was chosen and performed. Further, there has never been an office where the quantities and distribution of certain figures have been registered and permission of use was obtained. The modern archives are substitutes of real things, which are not suitable for collecting as they are. New types of order, closeness and neighbouring are given, as a reference system in the antiquarian world. Moreover, the documents, belonging to different field campaign periods, also mark time within the archive. If documents would be not identical but totally congruent with the chosen objects, it is only the research situation, which suddenly is moved indoors in a concentrated way. So, instead of being identical, documents must clearly have contents of interpretation, which become important arguments within the interpretative framework. Archives need translation and the reading and viewing of documents is an art in itself. As different documents are situated in different archives, just like artefacts, new journeys are needed for archive visits. The apodemic travel seems to never cease.

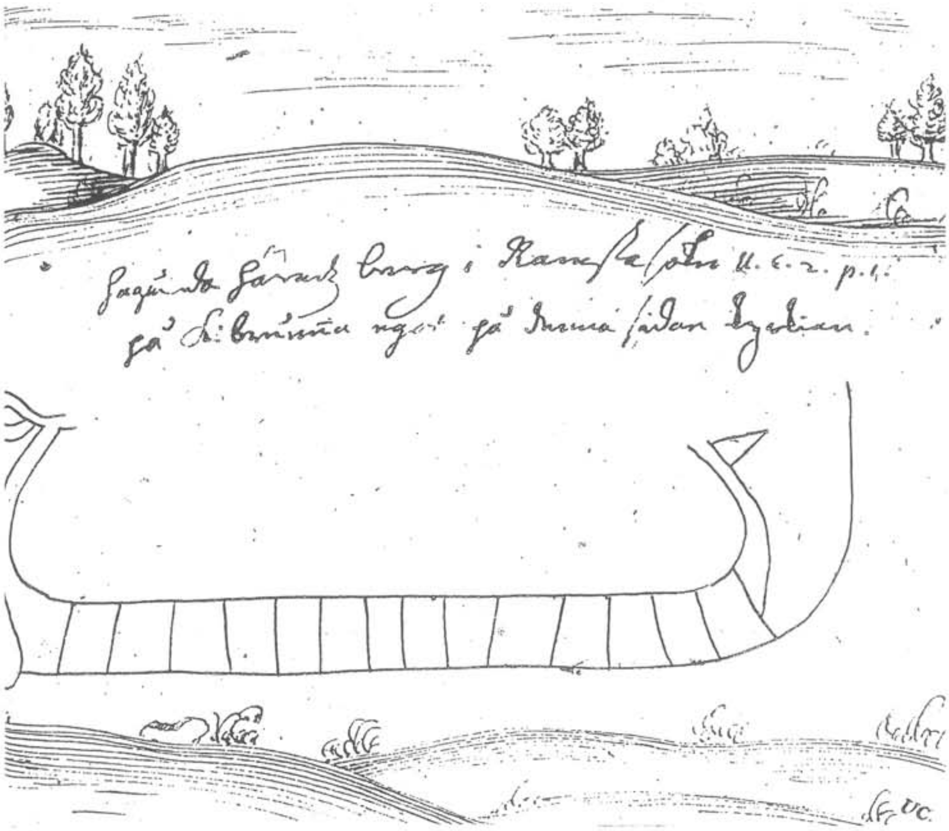


Fig. 1. The rock carving site of Librunna, Parish of Ramsta, County of Uppland. (Ramsta sn (parish) no. 3). Woodcut by Ulf Christofersson, with handwritten comments regarding the geographical situation. Date uncertain – c. 1693. Original in the Peringskiöld collection, The Royal Library, Stockholm. Note the setting with the sloping bedrock and the focused ship figure. The topography is indicated but rather stereotypical. No scale, no indication of North.

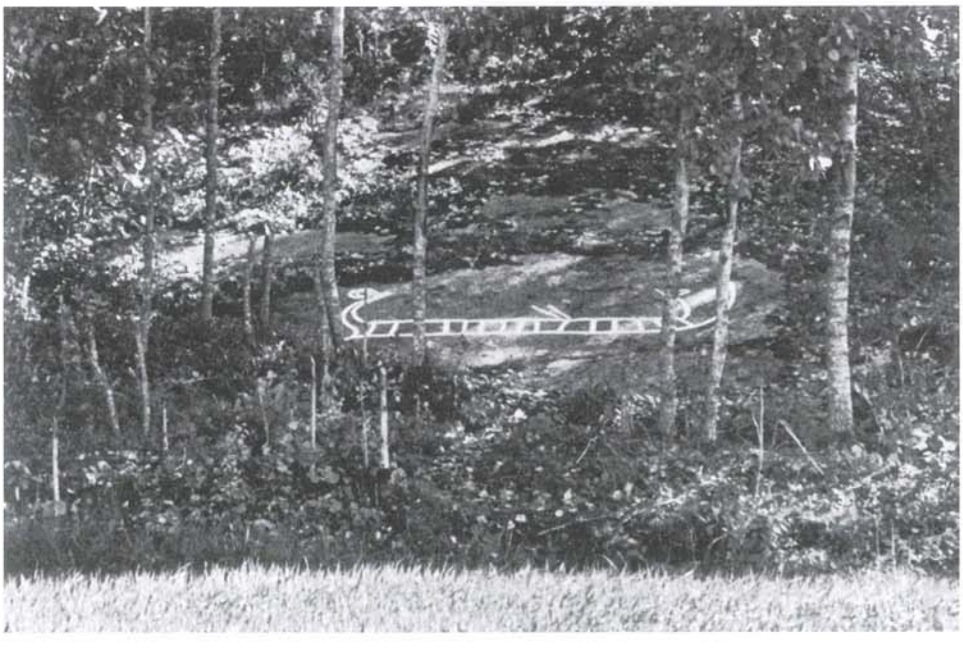
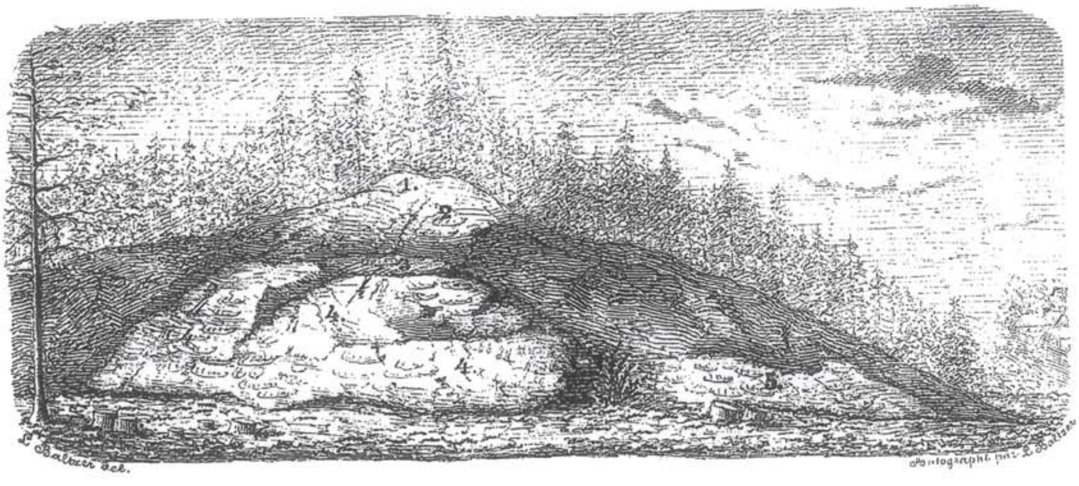


Fig. 2. Rock art ship at the site of Ramsta no 3, Librunna 2:1, County of Uppland (same as Fig. 1). Photo: Sören Hallgren 1971. The ship is 280 cm long and painted in white, for photographic contrast. Compared with Fig. 1 it is amazing that the antiquarian has so successfully managed to establish a pictorial language to express the observation. It is evident that the almost three hundred year old woodcut image guided how the photograph was taken.



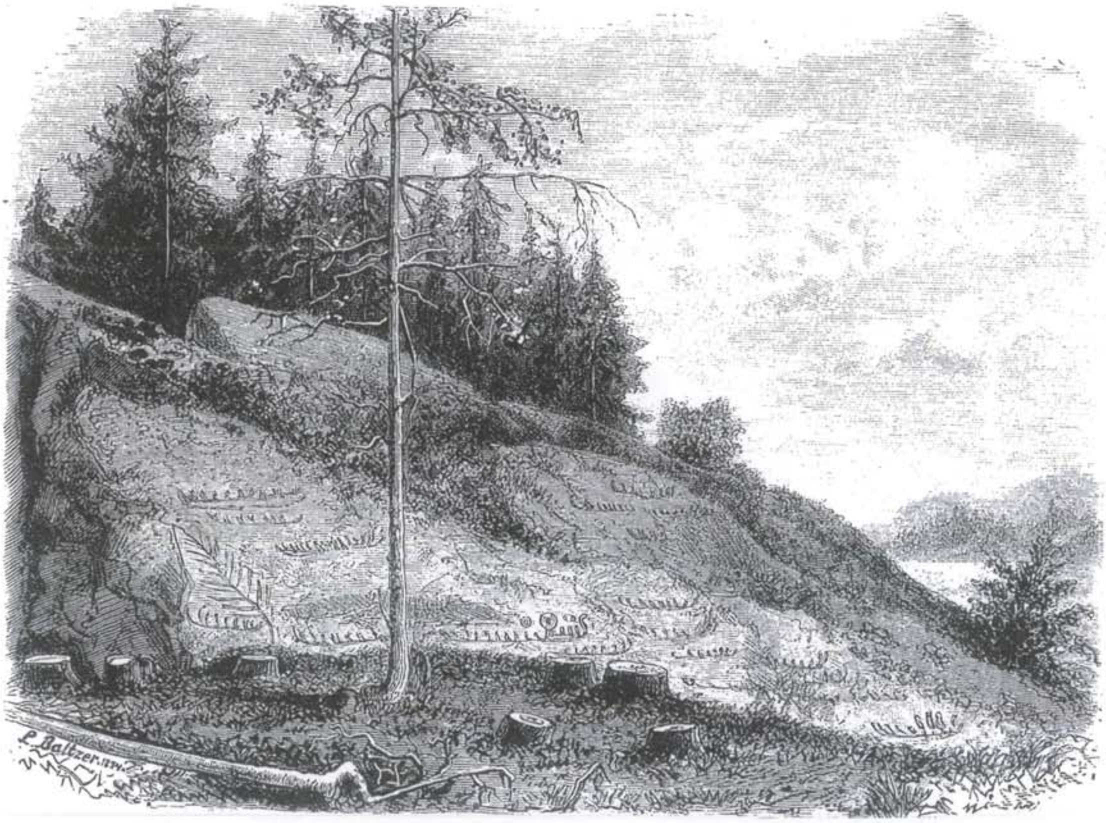


Fig. 3. Two overviews of the rock carving site of Lökeberget, County of Bohuslän. Lithography by Laurits Baltzer, 1881. Note the ambition to account for both the setting, the form of the bedrock, with cracks, weathering and vegetation, and rock art.

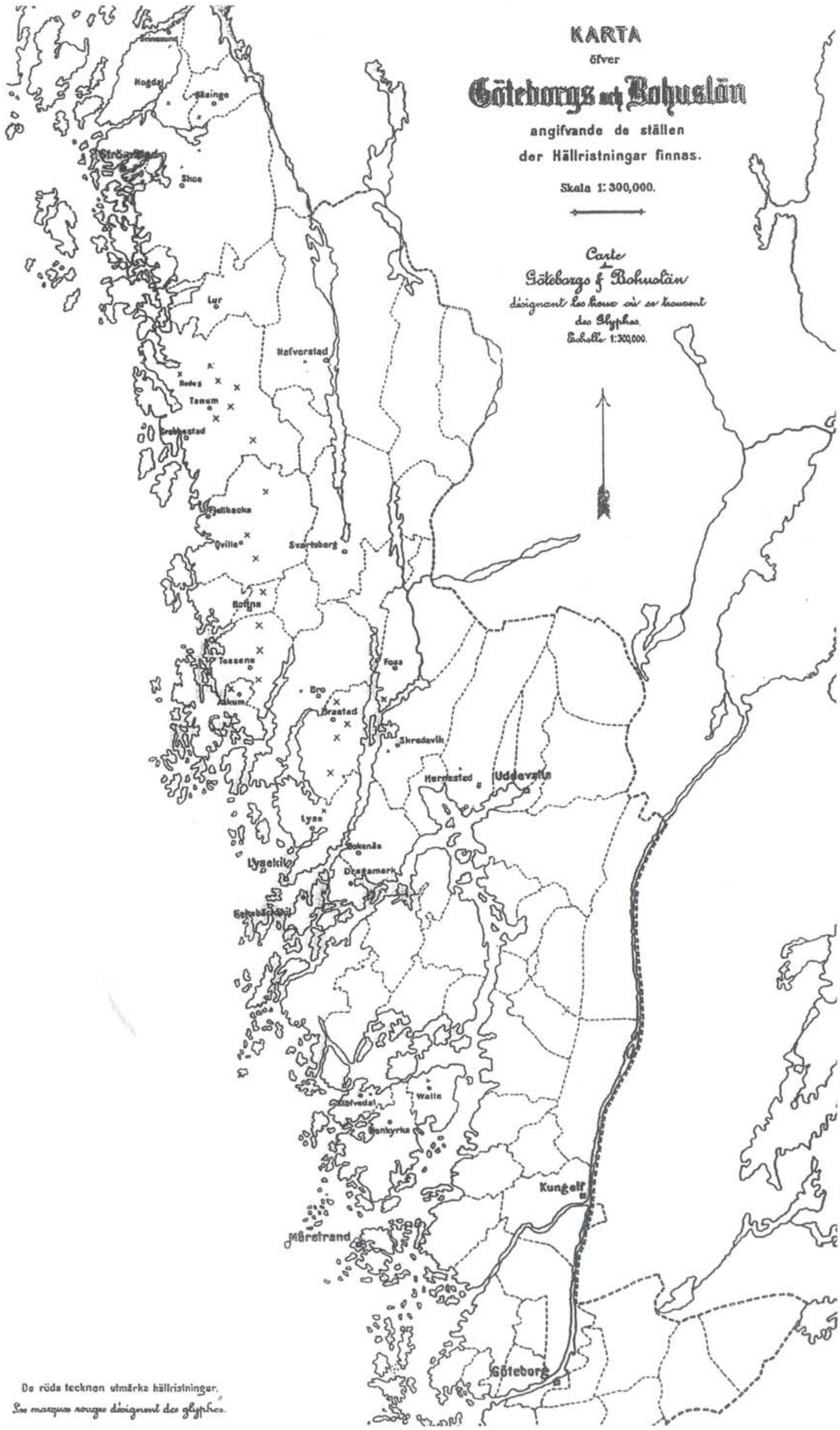


Fig. 4. Map of known rock art sites in the county of Bohuslän, where the locations are given within the parish borders. From Hällristningar från Bohuslän, 1890, by Laurits Baltzer. Another version is published by Baltzer in 1911.

Places make areas, make regions

As Carl Linneus research journeys were influenced by earlier travellers, the antiquarians of his time were influenced by Linneus – the way he planned and structured the apodemic enterprises, and how the results were presented. However, Linneus was more interested in singularities than which species preferred to live together or the geographical distribution of a certain herb or flower. Geography meant to him a possibility only to revisit the place of growing.

It is possible to see, that archaeologists argue in terms of distributions, concentrations and designs in geographical areas (Holmberg 1848:3–4). On the small-scale, very good overviews of cemeteries were presented in advanced graphic form, already in Suecia Antiqua et Hodierna. But map production and use was in the hands of the State and seen as a military secret, so cartographic based archaeology was introduced rather late in Sweden, about a century ago. The earliest map of rock art distribution, known to me, is Laurits Baltzer's presentation in his rock art atlas (Baltzer 1890).

Conclusions

The structure of gaining knowledge by travelling was not at all original in archaeology. But it affected how landscape was appreciated and how it could be composed and used. Antiquarian travelling followed other travels by the State and the Church. The State wanted its antiquarians to generally observe the conditions of roads and communications as well as economic and farming activities, for example, the presence of useful ores in the countryside: almost like a mission of espionage and economic inventory. Basically all antiquarian apodemic travel was conducted within a hierarchical system, where formal instructions or aide-mémoire were given to the special correspondents. At the end of every trip they had to give accounts of their activities and to persuade the state antiquarian to send them out on new commissions. In a way, the antiquarian travel corresponded to earlier journeys of visitations by the bishops when they inspected parish conditions. Thus, antiquarian activities contributed to the establishment of special antiquarian routes for updating and control which were used for several centuries. Onboard was a special set of observation rules and later on, a cartographic eye. However, no real, extensive antiquarian maps were used until the beginning of the 20th century. Before that, mapping was used for clusters of big monuments and for cemeteries, often with mounds and standing stones.

During the 18th century, with the inspiration of the Enlightenment, local and regional initiatives were taken to produce – for general use – detailed descriptions of parishes in which archaeological observations also found a place. Investigations of monuments by excavation were carried out, accounts were made and artefacts recorded. More thematic investigations became desirable and for the category of rock art, the first major project was started by Carl Georg Brunius c. 1815–15, in the county of Bohuslän. His text and measurements – in French – are still awaiting publication.

References

Arne, T.J. 1931. Antikvitetskollegiets och Antikvitets-arkivets Samlingar. In: *Fornvännen* 1931, pp. 48–93.

Baltzer, L. 1881. *Hällristningar från Bohuslän.* Glyphes de Rochers, Suède. Tecknade och utgifna av L. Baltzer. Med förord av Viktor Rydberg. I. Häftet. Göteborg.

Baltzer, L. 1890. *Hällristningar från Bohuslän.* Glyphes des Rochers du Bohuslän. Tecknade och utgifvna av L. Baltzer. 14 & 15 livraison. Göteborg.

Baltzer, L. 1911. *Några af de viktigaste hällristningarna samt en del af de fasta fornminnena i Bohuslän, med illustrationer och text jämte förord af riksantikvarien m.m. professor Oscar Montelius.* Göteborg.

Eliasson, P. 1999. *Platsens Blick.* Vetenskaps-akademien och den naturalhistoriska resan. Idéhistoriska skrifter 29. Institutionen för idéhistoria, Umeå universitet. Umeå.

Holmberg, A.E. 1848. *Skandinaviens hällristningar.* Arkeologisk afhandling. P.G. Berg, Stockholm.

Jensen, O.W. 2002. *Forntid i Historien. En arkeologihistorisk studie av synen på forntid och forntida lämningar, från medeltiden till och med förupplysningen.* GOTARC. Series B. Gothenburg Archaeological Theses no 19. Göteborg.

Ståhle, C.I. (red.) 1960. *Rannsakningar efter antikviteter.* Band I. Uppland, Västmanland, Dalarna, Norrland, Finland. Häfte I, Text. Kungl. Vitterhets Historie och Antikvitets Akademien. Uppsala, Almquist & Wiksell.

The CAR-ICOMOS charter for the protection and management of rock art and rock art sites

Final draft version

CHRISTIAN ZÜCHNER
INSTITUTE OF PREHISTORY, ERLANGEN, GERMANY

1. Preamble

1.1 – This charter describes the special guidelines that the International Scientific Committee for Rock Art (CAR) recommends to all institutions and persons, public or private, concerned with rock art and rock art sites.

1.2 – The basis of this charter is the ICOMOS Charter for the Protection and Management of Archaeological Heritage (1990) and all subsequent Charters and Declarations of ICOMOS as well as the respective charters and recommendations of ICCROM and ICOM (www.icomos.org, www.unesco.org, www.iccrom.org, www.icom.museum). These are to be adapted to the special demands of managing rock art and rock art sites.

1.3 – Rock art has been an integral part of human culture for more than 40,000 years and can be found in all parts of the world. It is the purpose of the charter to provide guidelines for the conservation, documentation and investigation of this heritage of mankind in order to preserve it for future generations.

2. Definition of rock art and rock art sites

2.1 – Rock art comprises all images, symbols or inscriptions painted on or drawn, carved, pecked or polished into all sorts of suitable stone surfaces. These may be on bedrock, earthfasts and boulders as well as on artificial constructions such as megalithic and other prehistoric or historic monuments.

2.2 – Generally, rock art is fixed at its original place and setting. These were chosen intentionally by their creators for specific purposes. Rock art, surfaces and landscape are inseparable elements of its messages. In contrast to many other archaeological remains rock art conveys an illustrated, pictorial insight into the thoughts, desires or beliefs of its creators. Rock art constitutes petrified messages of past and present cultures.

2.3 – Rock art was created at a site or in a landscape of special importance for prehistoric as well as historic peoples. It is embedded in its surroundings. The topography of the site is believed to be part of its message. This means that not only should the rock art and the site be handled with maximum care but also its environment. To remove images from a site, therefore from their meaningful and multiple contexts, to take them into collections or museums, to alter a site or its surroundings means to destroy the messages forever.

2.4 – Rock art and rock art sites comprise a fundamental part of our archaeological heritage, just like all other prehistoric or historic artefacts, sites and monuments.

3. Management, protection and conservation of rock art and rock art sites

3.1 – Each country's laws of antiquities should regulate responsibility and management of all classes of cultural heritage in the most efficient, scientifically and ethically safe way. If necessary, this legislation should be supplemented by specific measures adapted to the particularities of rock art surfaces and sites. If there is not sufficient expertise within this field, the advice of international committees is essential and should be sought by the responsible authorities. CAR will offer suggestions and advise on how to solve concrete problems or arrange contacts with international organisations and communities concerned with cultural heritage in general and rock art in particular.

3.2 – Rock art requires extreme care as it is not normally covered by protective layers or artificial constructions in contrast to many other prehistoric remains. On the contrary it is exposed to all kinds of natural or anthropogenic destructive agents. The influence of acid rain and other polluting factors, climatic variations, plants' roots, lichens and mosses, and trampling visitors may erode and eventually destroy even seemingly solid and compact rocks. Destructive agents and influences should be observed, documented, monitored and redressed systematically to prevent further and irretrievable devastation (www.w-heritage.org/RockCareweb/).

3.3 – Rock art is a shared, universal ancestral tradition, for which modern societies must accept the responsibility of protection for the benefit of everyone. If sites still constitute a part of a living tradition or religion, the responsibility of managing this heritage may pass to the respective community.

3.4 – Outstanding rock art sites should be given world heritage status regardless of prehistoric or historic age. That means that all concerned people and institutions must make the utmost efforts to give these sites special protection. An initial point of contact for gaining World Heritage Status is CAR.

3.5 – Authorities should make all efforts to protect rock art and rock art sites in the most effective and responsible way that the local circumstances will allow. After thoughtful examination and documentation of the specific local circumstances it may be necessary and useful to build discrete fences or enclosures or to restrict visits. Other measures may be to temporarily or permanently cover endangered rock surfaces with protective materials. However, it is of the highest importance that measures should be performed in ways that are as unobtrusive and non-interventional as possible in regard to the rock art and the environment. But in the long term it is more efficient to strengthen the interest, motivation and understanding of present and future generations in our archaeological heritage, instead of keeping the public away altogether. This can be achieved by promoting information, school education, guided visits, regular events and demonstrations etc.

3.6 – Direct measures to delay or prevent the destruction of weathered rock art surfaces may be necessary. Conservation methods should follow international guidelines (www.icomos.org/docs/guidelines_for_education.html). In principle, conservation should be reversible, invisible and non-intrusive. Documentation must be in place ahead of conservation work, and both the process of conservation and the end result must be recorded. Scientific tests and experiments should never be performed on original material.

4. Documentation of rock art

4.1 – An important means for future preservation and understanding of rock art is the use of photographic, pictorial, descriptive and all other methods of documentation and recording. The making of casts may be an option provided that safe, non-intrusive methods are available. All tried and scientifically tested means should be employed to record and document rock art and its environmental contexts without any damage to rock surfaces, images and local settings.

4.2 – Rock art analysis should not cause damage to sites.

4.3 – Excavation of a site may only be undertaken in accordance with the national legislation and in accordance with The European Convention on the protection of archaeological heritage (www.councilofeurope).

4.4 – Laymen travelling even in the remotest areas of the world do much important prospecting work and documentation today. Their work should be governed by agreed international rules so that they do not inadvertently cause damage. They should not fail to report fully on their findings. The best way to enable this might be the creation of documentation centres and networks, to inform people about the importance of their work, to advise them how to deal with rock art and to encourage them to co-operate with these centres. This will prevent the danger of inadvertent destruction. (Existing documentation centers include CCSP (http://www.rockart-ccsp.com/) and RockCare (www.w-heritage.org/RockCareweb/)).

5. Final remarks

5.1 – Rock art, like all other archaeological and historical heritage, is the global heritage of mankind. International co-operation is therefore essential for the development and maintenance of management standards. CAR will assist by instructing authorities and all people doing work in this field.

5.2 – The guidelines for managing rock art and international co-operation are to be found in the present and future Charters and Declarations of CAR as well as of ICOMOS, ICOM, ICCROM which are to be adapted to the special demands of rock art.

Introduction to the CAR-Charter

In 1964, Emmanuel Anati founded the Centro Camuno di Studi Preistorici in Capo Di Ponte, Italy. One of the primary reasons for the foundation of the CCSP was Valcamonica's rock engravings, which were largely unknown at that time. They had to be documented, interpreted and published in order to expose them to the expert world. Through personal contacts, publications and congresses, the CCSP soon became an international centre, where experts and students from all over the world could obtain information and learn how to document and interpret rock art and similar testimony of ancient cultures. In the course of time, a network developed, joining experts and amateurs in their efforts to study and preserve this important heritage of mankind. It was a difficult journey because, apart from monuments like European Palaeolithic art or the paintings and engravings in Africa or Australia, less spectacular rock art was not appreciated as an integral part of prehistoric or archaic cultures by the "official" archaeology of most countries in the world. This attitude continued to predominate through the 70s and 80s of the 20th century. Therefore, systematic survey was largely left to amateurs and a few professional experts. Interest grew with the discovery of ever more rock art sites and in numerous countries, regional and national societies dedicated to documentation, publication and preservation were founded. Concentration of these activities and the involvement of national and international bodies like UNESCO turned out to be necessary. In 1980, ICOMOS, the International Scientific Committee for Rock Art – Comité International pour l'Art Rupestre (CAR-ICOMOS) was founded in Warsaw. For more than 20 years, Prof. Anati and his colleagues at the CCSP were responsible for the co-ordinating CAR activities and its representation toward international bodies. Through his untiring personal commitment as chairman, Anati was able to promote rock art research and its appreciation, and to make CAR the global institution it is today. In accordance with the statutes, the chairman's term in office is limited to a maximum of 9 years, which is why, Jean Clottes took over as chairman in in 1990. He was able to successfully carry on with the work that Anati had begun, in continued co-operation with the CCSP. In 1992, J. Clottes founded INORA, the International Newsletter on Rock Art, which has achieved high levels of circulation and contributes decisively to the speedy publication of new discoveries and methods world-wide. In the past decades, increasing industrialisation, urban sprawl in regions untouched by man, pollution, climatic change, tourism and other factors have led to an alarming rate of destruction affecting rock art which had survived millennia without suffering damage. There is the danger that entire rock art sites may be lost in the near future. In order to better assess this danger and take appropriate countermeasures, the RockCare project was founded by Dr. Bertilsson, the chairman of CAR since 1999, and has seen great success so far. To face the new challenges also at an international and institutional level, the establishment of a Rock Art Charter seemed necessary. In this Charter, rock art and sites are considered to be a special type of monument in respect of archaeology and cultural history. For this reason, the ICOMOS, ICOM and ICCROM guidelines and recommendations also apply to CAR. However, they have been amended to include the specific characteristics and requirements that are crucial for the protection and management of rock paintings and their natural environment. On the basis of this Charter, CAR will formulate recommendations directed at national and international authorities and institutions.