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Petroglyphs as Paintings

The application of digital image enhancement to the study of Årsand 1, Hordaland, Western Norway

The previous article in this volume has explored one aspect of the exciting new possibilities for rock art documentation offered by advances in technology. The following contribution adopts a different approach, focusing on how the application of image processing software can aid the interpretation of rock art in the case of the Årsand 1 painting site, Hordaland, Western Norway.

Figure 1: General view of Årsand looking East. Painted surfaces at centre of photo (J. Dodd)

Årsand 1 consists of fifty-eight motifs painted on different rock surfaces located under a large sheltered cliff overhang, enjoying wide views over Hardangerfjord as well as glimpses of the Folgefonna glacier in the distance (Figures 1, 6 and 7). Since the plan of paintings at Årsand 1 was drawn and published by Johannes Bøe in 1940 (Figure 5), no new attempts at documentation have appeared in press. Moreover, the main foci of study have been conservation and painting technique. The site is often referenced but rarely discussed in detail.

This article discusses the application of digital image enhancement to the documentation and interpretation of rock art. The potential offered by digital image enhancement to identify figures on the rock surface is outlined by describing the findings of independent fieldwork conducted during site visits to the Årsand 1 painting site, Hordaland, Western Norway, during August 2008 and September 2012. Photographs acquired during the fieldwork have been the subject of desk based survey work during 2012 using two image processing software programs, Adobe Photoshop and Decorrelation Stretch (hereafter referred to as DStretch), following the principles outlined by Mark and Bilio (1999; 2002; 2006). After the results of fieldwork are presented, their implications for the interpretation of Scandinavian rock art are assessed and conclusions contended.

Methodology

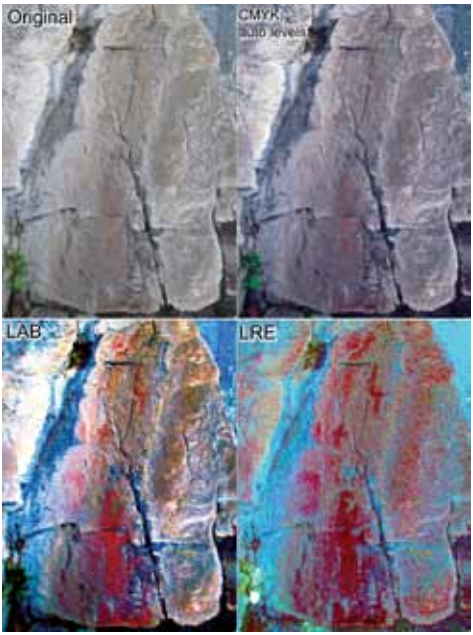
Although digital image enhancement has been known since the 1960's, and employed in rock art since the millennium, improvements in computer processing power and software, as expected from Turing's Law, allow transformations of ever increasing complexity to be performed. The spectrum of visible light contains an infinite range of colours which image sensors capture digitally by assigning numerical values to the light collected. In current technology this is within the red, green and blue colour channels. By expressing and computing the colour through the use of different algorithms, it is possible to accentuate specified colours in a multitude of ways. Most image manipulations performed in rock art studies seek to increase the contrast between different groups of colours by increasing the mathematical distance between them.

Some of the major manipulations which can be performed on an image to increase the contrast between user-specified groups of pixels contained within a digital image include filters, colour replacement, (commonly known as re-scaling), hue shift, saturation, brightness and histogram stretching (David et al. 2001). Whilst colour replacement has been applied by Slinning (2002) to the study of rock paintings in Telemark, the use of further transformation techniques in conjunction with each other has not yet been widely integrated within studies of Scandinavian rock art. This independent project by the author has extensively explored the possibilities offered by each of the above listed transformations in the case of one hundred and thirty-one images, obtained using predominantly digital cameras, shooting in JPEG format. A two megapixel camera was used in 2008 and a twelve megapixel camera (incorporating full manual control) in 2012. In addition, a fixed lens 35mm film camera was trialed in 2008. The two applications used to analyze the images obtained for this study, Adobe Photoshop and DStretch, were selected on the basis of software availability and compatibility with Apple Macintosh computers.

A recording sheet was created to document the transformations performed to create each image file. Alongside the name of each image file were listed the manipulations performed, the aims behind the manipulations, and a brief description of results. The nomenculture of the image files was structured according to a series of abbreviations devised by the author, to describe the different processes performed to create the image. Readers seeking further detail of the methodology and in-depth results are encouraged to contact the author using the email address at the end of this article. A brief summary of the results is presented below.

Certain transformations applied in Photoshop and DStretch provide more insight than others. Within Photoshop, all images benefited from conversion to CMYK colour and a histogram stretch via the 'Auto Levels' command. Manual colour adjustment of the red colour space and selective replacement of colour was useful to tease

Figure 2: Sequence of images demonstrating transformation processes (photos: J. Dodd)

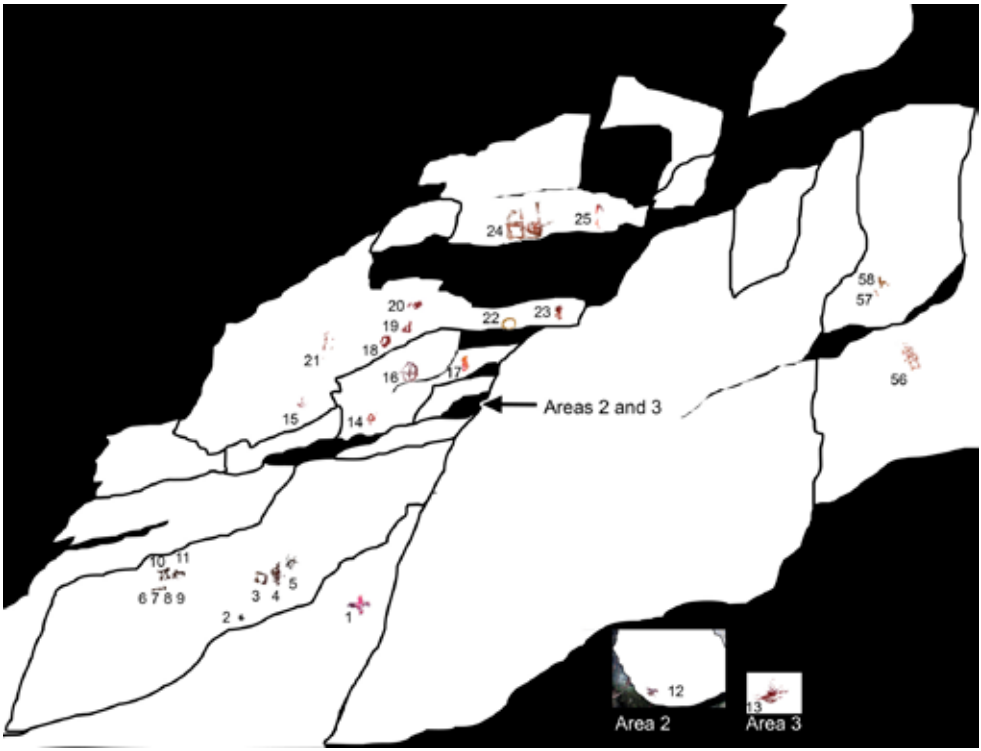


out details of the painted figures whilst preserving the appearance of the rock surface. Converting the results of the two aforementioned commands to black and white, with the red drained from the image, also produced clear results in a number of instances. Following adjustments in Photoshop, images were then converted back to RGB colour for processing in DStretch. The most frequently used DStretch transformations were: LAB, LRE, YBR, YXX-YRE and LXX-LYE. The 'flattening' of images containing high light / shadow contrast prior to rendering the aforementioned transformations occasionally proved fruitful. Overall, transformations accentuating red pigments were the most effective, whilst black paint, such as found within figure #33 proved more challenging to enhance. Whilst the use of higher resolution cameras is preferable for highlighting the detail of figures, lower resolution alternatives, including those contained within mobile phones, can nevertheless be successfully manipulated to provide useful information.

New insights into Årsand 1

The application of image processing software at Årsand 1 has advanced knowledge of the paintings in a number of directions. Approximately fifteen currently undocumented figures have been identified and revisions proposed to the detail of twenty-eight figures documented by Bøe. The manipulated files have been used to document the figures using the 'magic wand' and 'quick select' tools contained within Photoshop. This work has been particularly fruitful as exactly what is represented at Årsand 1 is debated, and scholars have suggested that numbering of Årsand 1 should

Figure 3: Plan of paintings on South facing elevations, Årsand 1.



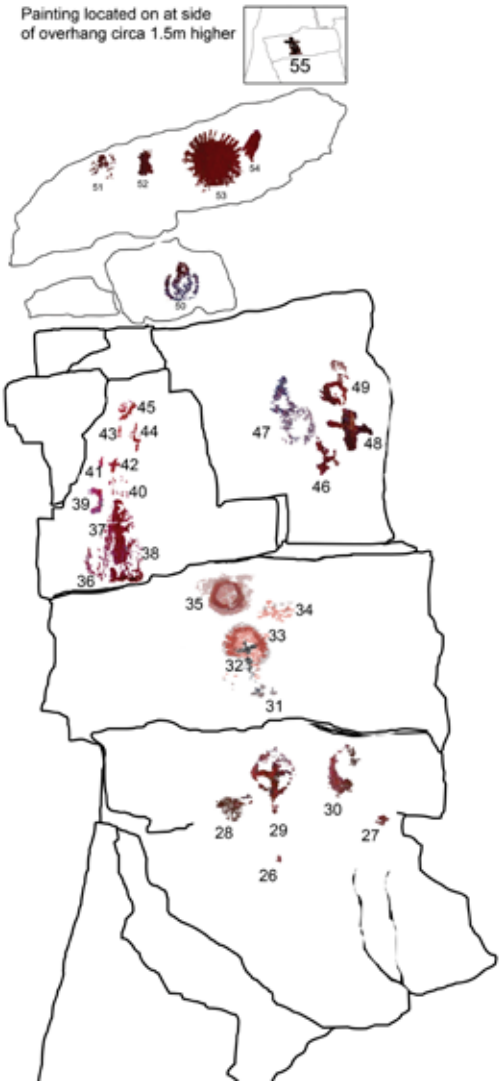


Figure 4: Plan of paintings on West facing elevations, Årsand 1.

be revised (Wrigglesworth 2011: 935). The scheme presented in Figures 3 and 4 combines tracings made in Photoshop from the manipulated images with a revised numbering system constructed by the author, presented in Figure 5. The rock faces at Årsand have been divided between the South and West facing elevations, as these are the major aspects of the paintings at Årsand 1. Figures 3 and 4 are not drawn to scale and the aspect of painting #13, located on a loose stone near the entrance, has been altered as it naturally faces skyward. As a consequence of parallax and perspective, the relative proportions of the figures (derived from photographs taken directly overhead) in relation to outline of the rock faces in the plan will have been subject to degrees of distortion. In future, it would be interesting to drape documentation over laser scans, or polynominal textual maps of the rock surfaces which could be viewed on computer.

The increased sensitivity lent by digital image processing has been key in identifying new representations and proposing revisions to those already known. Bøe missed few figures during documentation in 1940. Image processing software proposes that many of the most perplexing figures within Bøe's documentation appear less complex today than suggested in 1940. Instead, there appear to be many more dots, lines and cross in circle figures, crosses, differing anthropomorphic figures, and a number of rings and circle figures. Two of the cross in circles are painted using a combination of red, black and yellow paint. Two are painted solely in red and one is painted black. Certain figures seem to occur in pairs including two possible anthropomorphic figures and two sets of circular figures. There is also the prominent sun figure #53.

Additionally, investigation of several surfaces supposed to evidence rock paintings according to Bøe returned negative results. Twenty-three figures recorded by Bøe were not located during field visits in 2008 and 2012. Processing of some images indicates Bøe may have mistaken natural stains as figures. In other cases, precipitates may have leached from the rock surface covering images, or some representations may have weathered away. However, the presence of natural stains could have significance for our understanding of Årsand 1. Similarity

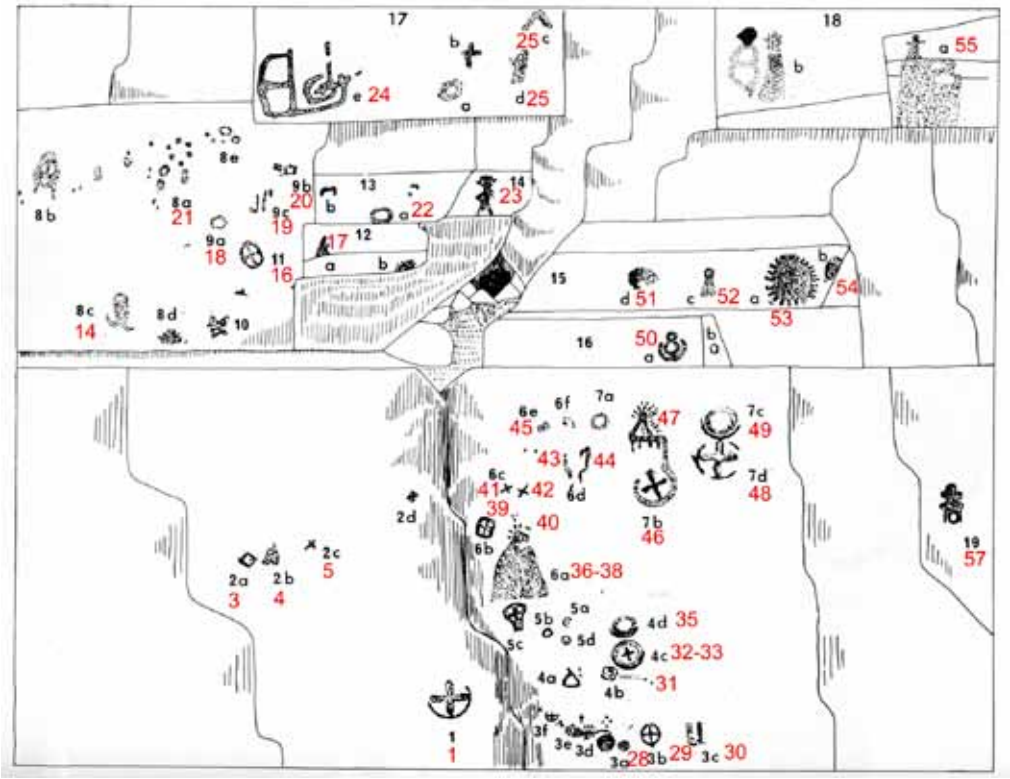


Figure 5: Bøe's 1940 documentation with revised numbering of this study indicated.

between natural stains and faded images might have been interpreted as a connection with an ancestral or mythological past. Alternatively, or in addition to associations with the past, colour symbolism may have played an important part in the perception of Årsand. The rock faces under the large cliff overhang, where all the images are found, present striking colour contrasts of red, white, black and grey, from which a visitor has to distinguish the work of nature from that of humanity. The blur of the division between natural staining and paint may have been a significant factor in site selection. Perhaps the site and its pigments already possessed innate potency or animate agency to the prehistoric populace, who negotiated with this potency during the mixing of pigments and the painting process.

Årsand within the wider Scandinavian context

Research has struggled to integrate images at Årsand within the general framework of archaeological understanding of rock paintings elsewhere in Scandinavia. Many studies regard Årsand as an atypical site, outlying more widely evidenced trends. Johannes Bøe (1940: 150) pointed out the similarities between cross in circle paintings at Årsand and stylistically similar motifs frequently found as carvings from Southern Tradition rock art.

The dating of Årsand is subject to debate, and doubt over this issue is problematic in further exploration of the meaning behind the paintings. Stylistically, the motifs appear to evidence similarities with Southern Tradition rock carvings, particularly the

five cross in circle motifs. If the paintings at Årsand are part the Southern Tradition, they are unique. Attempts to date the paint have been made but the paintings appear to have been created by mixing water and iron oxide leaching out of the nearby rock faces (Michelsen 1992). In light of the new insights offered by the documentation prepared during this fieldwork, a fresh appraisal can be made of the chronology and interpretation of Årsand 1, according to stylistic evidence.

The author has contended elsewhere that figures #29, #32 and #33 at Årsand 1 may evidence similarity with an artifact held in the collection of The National Museum of Denmark, Copenhagen, a bronze holder with inlaid amber disc dated to the Bronze Age (Dodd 2011: 176). Alternatively, the paint at the base of #29, and the long axis of black cross #32, conceivably may be the extension of a brush stroke or a paint run. However, if bronze holders with inlaid amber discs are represented at Årsand, placement within the Bronze Age for these representations is strongly indicated. Scholars have argued that the artifact held in the collection of the National Museum, Copenhagen, and others similar to it, may have been used in rituals centred around the sun (Kaul 1998; Kaul 2004; Kaul 2005c).

Paintings #29, #32 and #33 are not the only images at Årsand proposing associations with the sun. The sun with rays incorporating a dot at its centre, #53, Figure 6, resembles Pre-Roman Iron Age carvings found at Leirfall III, Nord-Trøndelag, Central Norway, and the Kyrkje-Eide stone found in 1885 near the town of Eide, at the head of the Nordfjord, within Sogn and Fjordane. There is also some distant similarity between the sun figures with adorants as depicted at Backä-Brästad and Aspeberget, located in Bohuslän, Sweden, dated to the Bronze Age. For the purpose of this article, the author wishes to concentrate on the

Figure 6: Sun with ray painting on West facing elevation. 35mm film negative with CMYK and "Auto Levels" transformations applied in Photoshop (photo: J. Dodd).

Figure 7: South (left) and West (right) facing elevations at Årsand 1. Entrance to cave located at top of photographs. Original image on left. CMYK and "Auto Levels" transformations applied in Photoshop to right hand image (photos: J. Dodd).

evidence from Kyrkje-Eide. Most of the rock art located within inner Nordfjord around Kyrkje-Eide has been placed within the Pre-Roman Iron Age (Mandt 1973b). The Kyrkje-Eide stone may have been carved during the same period. However, carvings of Early Bronze alongside Late Bronze Age ship styles at Krabbestig and Domba (Lødøen & Mandt 2012: 131-132) situated within the outer coastal areas at and around the Nordfjord mean that Early Bronze Age dating can not be totally ruled out.

According to the Norwegian Directorate for Cultural Heritage online GIS and database, "Askeladden", the Kyrkje-Eide stone was found during the course of earthworks associated with farming activity, and according to the informant, there was a lot of bone in the sloping ground together with the stone. If this were human bone, it might suggest the motifs are linked with death. Therefore, there may be a possible association between sun with ray figures and death. The author has proposed elsewhere (Dodd 2010; Figure 7) that clustering of images around the entrance to the small cave at the site may contend that the location was interpreted as an opening to another world, such as the underworld, spirit world or realm of the ancestors as proposed within the work of Lewis-Williams and Dowson (1993: 8; 10).

Therefore, a link between sun symbolism, death and portals between different worlds appears to manifest itself at Årsand 1 during the Bronze, and more probably Pre-Roman Iron Age. However, this construction is based predominantly upon eight out of a total fifty-eight images. It is difficult to find parallels for the paintings of dots, crosses, cross in rectangles, rectangles and anthropomorphic figures, which comprise the majority of representations at Årsand. Although both dots and crosses are represented among the cave paintings of Nordland, radiocarbon dating of finds from

the floor of Solsemhula, on Leka, propose a hunter gatherer society created these paintings, at earliest, around 1500BC, during the Early Bronze Age (Norsted 2011: 14). A cross painting is also found at Vågsenget, Vikna, Nord-Trøndelag at an altitude of between 5 and 12m a.s.l. Although the shore displacement at Vågsenget is not precisely understood, the low elevation of the site may indicate a late dating within the Iron Age or Medieval periods. Kalle Sognnes (pers. comm., 12 May 2012) suggests from the numerous depictions of crosses at Årsand, that perhaps the reason for the difference between Årsand and other Scandinavian prehistoric art traditions arises because Årsand may have been painted post-Christianisation. On the other hand, can we understand Årsand's uniqueness in a different way?

Årsand at face value appears to transgress the expected styles of Southern Tradition rock art. However, examining the wider corpus of rock paintings in Scandinavia, the theme of transgression seems to be a theme exhibited at a number of painting sites within Western Norway. Whilst paintings of Southern Tradition motifs are not evidenced, Southern Tradition style carvings of ships and cup marks are found alongside paintings at the open air painting sites of Honnhammer I and III in Møre og Romsdal, Western Norway. In Nordland, Northern Norway, at the Skåren-Monsen cave painting site, a carving of a ring with rays, similar to those found at Leirfall III, discussed as above, is evidenced on a block which has fallen from the cave roof. However, examination of the sun with ray carving at Skåren-Monsen, during a site visit in August 2013, indicates that although the pecking technique could be prehistoric, it is possible that the figure may be a quarryman's mark from mill stone production at the site between 1600 and 1800.

Within Anthropology, political, religious or moral constraints upon societies can only be transgressed in special circumstances. Årsand's striking colours precipitating out of the rock around the entrance to a small cave may have been perceived as exuding special or supernatural powers, in view of the associations contended earlier with death. This force may have been so great that society felt it must materially engage with the location's potency through painting as opposed to carving. Possibly, the society that produced Årsand 1 was aware of, or had seen painted animals and anthropomorphs in Rogland and Telemark and associated them with a deep time social memory of past ancestors or spirits. Further afield, in Nordland, paintings of crosses within the Skåren-Monsen and Solsem caves contend that cross figures have been symbolically significant over a long period. The technique of painting may have been adopted from the past in order to negotiate with the ancestors lying in darkness behind the rock of the cave, which functioned as an opening to another world.

Conclusion

Digital image enhancement offers new insights into the motifs at Årsand 1 facilitating a fresh appraisal of the site's chronology and interpretation. Comparisons between Årsand's paintings and Southern Tradition carvings found in Western and Central Norway propose creation of Årsand 1 during the Bronze and Pre-Roman Iron Ages. On the basis of both Southern Tradition carvings and Northern Tradition paintings alongside each other at a small number of sites, it could be argued their occurrence provides a precedent for Årsand's paintings within the Southern Tradition style. The transgression exhibited at Årsand may have been a response to the need of Prehistoric societies to negotiate with power arising from the natural characteristics of the site, particularly the potency of colour symbolism and the small cave. Motif analysis supports the importance of the theme of transgression, evoking strong associations with death and social memory.

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Note

The Årsand 2 site, situated around 150m East South East of Årsand 1, consisting of four lines and a circular motif was not visited during the fieldwork. This area may be the subject of a subsequent study.

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