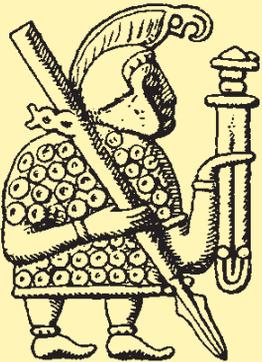


# FORN VANNEN

JOURNAL OF  
SWEDISH ANTIQUARIAN  
RESEARCH

---



2019/3

*Utgiven av*

Kungl. Vitterhets Historie och Antikvitets Akademien i samarbete med Historiska museet.

*Fornvännen* finns på webben i sin helhet från första årgången och publiceras löpande där med ett halvårs fördröjning: [fornvannen.se](http://fornvannen.se)

*Ansvarig utgivare och huvudredaktör*

*Mats Roslund*

Vitterhetsakademien

Box 5622, 114 86 Stockholm

[mats.roslund@ark.lu.se](mailto:mats.roslund@ark.lu.se)

*Redaktionssekreterare och mottagare av manuskript*

*Peter Carelli*

Vitterhetsakademien

Box 5622, 114 86 Stockholm

[fornvannen@vitterhetsakademien.se](mailto:fornvannen@vitterhetsakademien.se)

*Redaktörer*

*Herman Bengtsson*, [herman.bengtsson@upplandsmuseet.se](mailto:herman.bengtsson@upplandsmuseet.se)

*Christina Fredengren*, [christina.fredengren@shm.se](mailto:christina.fredengren@shm.se)

*Åsa M Larsson*, [asa.larsson@raa.se](mailto:asa.larsson@raa.se)

*Teknisk redaktör*

*Kerstin Öström*

Grävlingvägen 50

167 56 Bromma

[kerstin@vinghasten.se](mailto:kerstin@vinghasten.se)

*Prenumeration*

Vitterhetsakademien

Box 5622, 114 86 Stockholm

e-post [fornvannen@vitterhetsakademien.se](mailto:fornvannen@vitterhetsakademien.se)

Bankgiro 535-3552

Årsprenumeration i Sverige (4 häften) 200 kronor, lösnummer 60 kronor

*Journal of Swedish Antiquarian Research*

published by The Royal Academy of Letters, History and Antiquities

Subscription price outside Sweden (four issues) SEK 250:–

Box 5622, SE-114 86 Stockholm, Sweden

FORNVÄNNEN började utges av Kungl. Vitterhets Historie och Antikvitets Akademien år 1906 och ersatte då *Akademiens Månadsblad* samt *Svenska Fornminnesföreningens Tidskrift*, som båda tillkommit under 1870-talets första år. Förutom i Sverige finns *Fornvännen* på drygt 350 bibliotek och vetenskapliga institutioner i mer än 40 länder.

Tidskriften är referentgranskad.

FORNVÄNNEN («The Antiquarian») has been published by the Royal Academy of Letters, History and Antiquities since 1906, when it replaced two older journals which had started in the early years of the 1870s. Outside Sweden *Fornvännen* is held by more than 350 libraries and scientific institutions in over 40 countries.

The journal is peer-reviewed.

ISSN 0015-7813

Printed in Sweden by AMO-tryck AB, Solna, 2019

# A new documentation of “Runohällen” (Gerum, Tanum)

By *Christian Horn and Rich Potter*

Horn, C. & Potter, R., 2019. A new documentation of “Runohällen” (Gerum, Tanum). *Fornvännen* 114. Stockholm.

This paper presents the results of a recent documentation of the rock art panel called “Runohällen” in Gerum, Bohuslän (RAÅ Tanum 311:1). The documentation was conducted using photogrammetry and analysed using a new documentation method. It was possible to identify several new motifs, updating the record from previous documentations. During this work a petroglyph previously identified as an axe stood out through an elongated and as of yet unexplained feature. It is argued that this motif is indeed an axe, but converse to the older interpretation, it is suggested that the motif is turned “upside-down” when compared to the majority of petroglyphs on the panel. Several interpretations are considered, but it is thought most likely that the carving had an antagonistic purpose.

*Christian Horn, Göteborgs universitet, Institutionen för historiska studier, Box 200,  
SE-405 30 Göteborg  
christian.horn@gu.se*

*Rich Potter, Göteborgs universitet, Institutionen för historiska studier, Box 200,  
SE-405 30 Göteborg  
richard.potter@gu.se*

## *Introduction*

In recent years, the depiction of metalwork in rock art has garnered renewed interest as a chronological proxy to date rock art panels (Bertilsson 2015; Bengtsson 2013; Horn & Potter 2017; Ling & Bertilsson 2017; Skoglund 2016). Beyond this, petroglyphs of metalwork recently granted insights into Bronze Age social hierarchies (Kristiansen 2012; 2014), long-distance contacts (Ling & Rowlands 2013; 2015), narratives (Rédei et al. 2018), and beliefs (Horn 2016). This makes the identification of new types of metalwork an important aim for rock art research as it not only allows us to situate engraving actions on the rocks in time, but also enriches the potential to interpret metalwork petroglyphs and thereby investigate the social role of new types of objects. This

requires, and even merits, a detailed (re-)investigation and discussion of petroglyphs that could represent Bronze Age metalwork.

This contribution aims to expand the knowledge of metalwork petroglyphs in the Scandinavian rock art record by discussing the possible interpretations of a specific petroglyph carved into the surface of a rock art panel called “Runohällen” in Gerum (figs. 1–2; RAÅ Tanum 311:1). Following a re-documentation of the panel using photogrammetry, we combined our observations in the field with the results of the new and older documentations. We here present a possible interpretation of the petroglyph as the inverted depiction of a socketed axe.



Fig. 1. Location of the Gerum panel (RAÄ Tanum 311:1) in southern Scandinavia and the local context.

#### *Documentation method*

In the past decade, Image-based Modelling techniques to create 3D models of individual petroglyphs and rock art panels have generated a breakthrough in Scandinavian and European rock art research (Díaz-Guardamino Uribe & Wheatley 2013; Horn et al. 2018; Lerma et al. 2013; Meijer 2016; Mudge et al. 2012).

The method used to document Tanum 311:1 is commonly called Structure from Motion and was developed in the key fields of photogrammetry and Computer Vision (Micheletti et al. 2015; Sevara & Goldhahn 2011). The process is adept at recovering 3D information from 2D photographs (Cobaz & Jagersand 2003). The photographs are termed cameras in the process. The algorithm finds and matches a number of points occurring in multiple cameras to determine both their interior and exterior orientation parameters (Micheletti et al. 2015). Subsequently, the position of the matched points is triangulated to produce a sparse point cloud that represents the geometry of the scene. Based on the geometry of the sparse point cloud, the software package (Agisoft PhotoScan) calculates a dense point cloud using Multi-View Stereo. Finally, algorithms including Poisson surface re-

construction are used to create a surface mesh from the orientation of the points in the dense point cloud (Kazhdan et al. 2006).

In the field we take photographs in accordance with the best-practice recommendation. That means the photos have a 60–70% overlap (Reu et al. 2013; Meijer 2016). This guarantees a high precision of the 3D models enabling measurements as precise as 1 mm in a 10 m scene. To increase this precision even further, target points aided the calculation of the model (Sapirstein 2016). The placement of the target points was guided by a visible and a tactile investigation of the panel surface, as well as referencing older documentations of the panel in Gerum to ensure that no engraved part of the rock's surface was covered. A total of 1115 photos were taken to build a model of the full uncovered extents of the rock art panel.

The open source software Meshlab, which allows us to view and light the scene from all possible angles, was used for analysis. Other possibilities to visualize details on the model available in Meshlab include the enhancement of the surface (ambient occlusion), rendering (radiance scaling), and curvature colorization. As a further

step, we used a technique we have termed “digital frottage”. A Digital Elevation Model produced in PhotoScan and processed in ArcGIS 10. This helps to ameliorate visualization problems by making the petroglyphs visible, regardless of any lighting in the scene.

For each newly introduced rock art panel, the Riksantikvarieämbetet identification will be listed upon its first mention in the text.

#### *Site description and previous research*

“Runohällén” in Gerum (RAÄ Tanum 311:1) is located on the edge of a plane between 16–14 m above sea level facing SSE. It slopes down at a 50–60 angle to the stream Gerum at the bottom of a crevice ca. 27 m away. Johan Ling (2014, pp. 87–91) studied the canoe petroglyphs, the effects of the land uplift on the panel, and its chronology extensively. According to Ling, the panel was part of a fjord during the Bronze Age. Water still

Fig. 2. a) Drawing of the Gerum panel after Bengtsson & Olsson 2000 (after a tracing by T. Högsberg), b) Still-image of the 3D model.

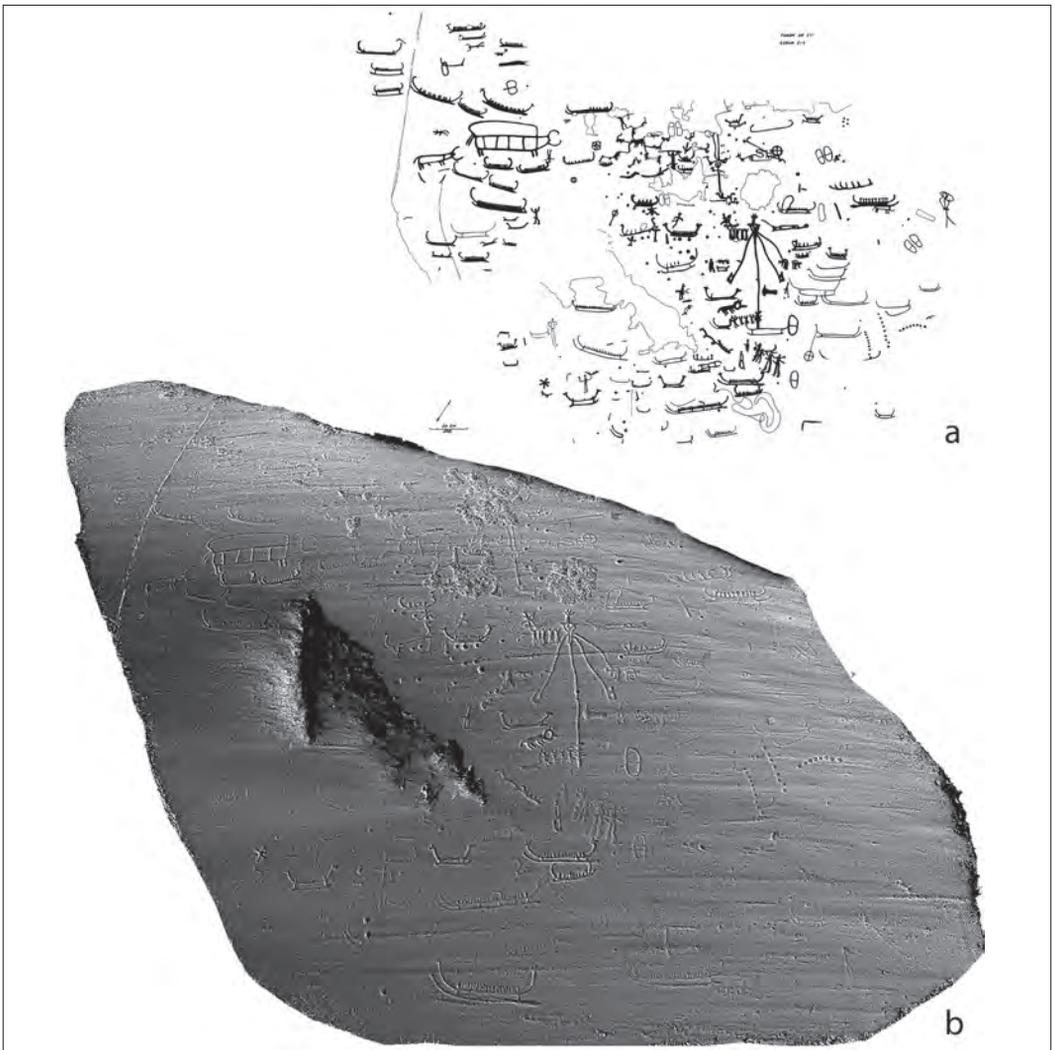




Fig. 3. Digital frottage prepared from the photogrammetry documentation of the Gerum panel.

covered the entire panel during the Late Neolithic and it potentially emerged during period IB of the Bronze Age. In the subsequent period II, the water retreated further allowing images to be carved into the upper half of the panel. The entire

panel became dry over the course of period III.

The panel in Gerum is a large site with a currently known extent of 9 x 6 m. The last published overview of the region puts the number and identification of petroglyphs as follows (Bengtsson &

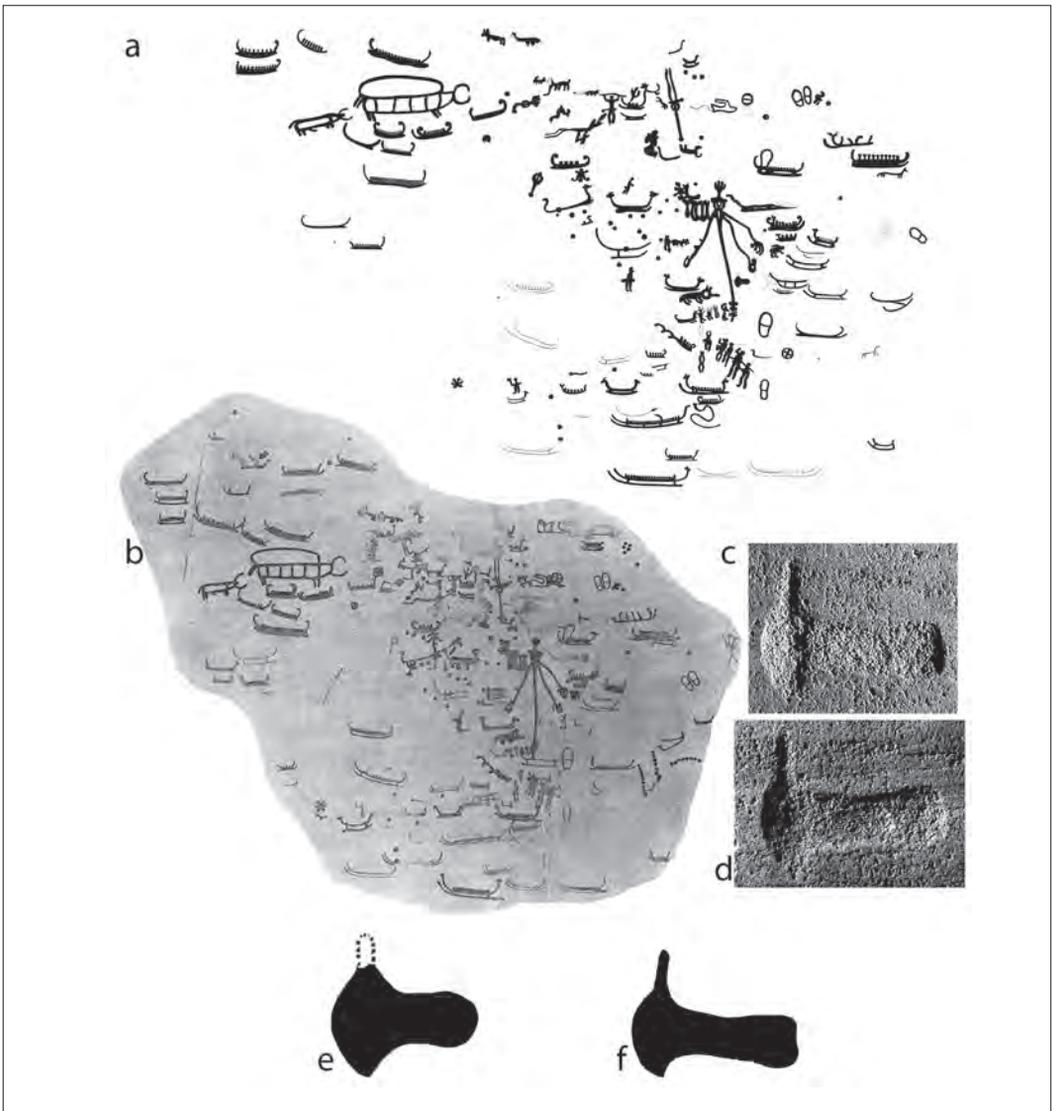


Fig. 4. a) Graphic of the Gerum panel by Axel Emanuel Holmberg in 1848, b) Graphic by Lauritz Baltzer in 1886, c) Night photography by Bertil Almgren in 1955, d) Night photography by Ellen Meijer in 2014, e) Enlarged drawing of the axe after Holmberg, and f) after Högsberg.

Olsson 2000, p. 36): 82 boats, 36 anthropomorphic figures, 23 animals, 14 foot soles, 3 ring crosses, 2 circles, 1 cross, 1 mast-like figure, 3 obscure figures, 119 cup-marks, and several lines (fig. 2).

The new documentation has been fully analysed to account for the number of the major motifs (figs. 3 and 4 a–b). According to this count,

there are 95 boats, 43 anthropomorphic figures, 28 animals, 16 foot- or shoe-soles, and 187 cup-marks. In addition, there are 13 potential boats, one potential animal, and one potential foot- or shoe-sole. The cup-mark count includes cup-marks that have been used as heads of anthropomorphic figures (Horn 2016) which may explain

some of the discrepancy. Another explanation for the difference is that the latest publication did not record the lowest section of the panel (Bengtsson & Olsson 2000, p. 36). Two older graphics by Axel Emanuel Holmberg (in 1848) and Lauritz Baltzer (in 1886) of the panel are, in many respects, more precise (fig. 4 a–b). However, even here not all engravings on the panel have been recognized. The most likely explanation is that some of them are so faint that they escape visual and tactile detection, and could only be visualised with the aid of sensitive and visually enhancing digital methods (Horn et al. 2018).

The petroglyph discussed here is situated to the right of the mast-like figure, viewed from the lower edge of the panel at the spot visitors are directed to view the panel from today (figs. 3 and 4 a–b). It was engraved only 4 cm away from the lower third of the mast, which has traditionally been interpreted as a “maypole”, a carousel, or a similar object (Almgren, O. 1927; Almgren, B. 1987; Bertilsson 1987; Hygen et al. 1999; Fredell 2003; Kaul 2004). Baltzer indicated it as a very faint petroglyph which is confirmed by rubbings made by Dietrich Evers and Torsten Högberg in 1970 and 1983, respectively.

All older documentations notice a line going up from the left side. None of the previous documentations based on rubbing and drawing record a detailed internal structure of the petroglyph. However, some internal features are visible in raking light night photographs taken by Bertil Almgren (1955) and Ellen Meijer (2014), which we will discuss in the next section (fig. 4 c–d). The motif’s interpretation seems to have been an axe, with Holmberg and Högberg tweaking the appearance to resemble such an object by making the lower edge of the left side more pointed and sharper than the rubbings reveal it to be (fig. 4 e–f). Conversely, the right-hand side is presented as more rounded.

The shape of the axe as represented by Holmberg is rather stout with a length-width ratio of almost 1:1 (fig. 4 e). The blade is rounded and swings widely outward with sharp breaks at each end of the cutting edge. The body is waisted and the butt end rounded in a semi-circular fashion. Högberg’s depiction is roughly similar with a few important differences (fig. 4 f). The upper end of

the cutting edge is obscured because he fully acknowledges the line going upwards. The axe body is more elongated, and the butt end is flat with a slight inward curve.

This depiction does not conform to other depictions of axes without a shaft, for example, in Simrishamn 16:1 which have been compared to the axes from Lilla Beddinge (Skoglund 2016, fig. 2.28a). The axes have a clear break between the end of the cutting edge and the body. Instead the shape is more reminiscent of shorter waisted axes including (pseudo-) Anglo-Irish axe or Unetice types dating to the Late Neolithic and Early Bronze Age period Ia (2000–1600 BC) (Vandkilde 1996, pp. 78–91; see Oldeberg 1974, no. 94, 152, 349 & 1550). In younger axe types, the rounded butt is rarer and overall they are more slender. For that reason, the elongated shape and flat butt depicted by Högberg could be parallel to the axes from the hoards in Torsted and Virringe (Becker 1964; Vandkilde 1996, pp. 97–103) but also to somewhat later axes, especially those of the Smörumövre type (Vandkilde 1996, pp. 128–129). The Torsted and Virringe axes date to period Ia and Ib respectively (1700–1500 BC). The later palstaves are more slender and/or have less wide blades (Laux 2000; Oldeberg 1976).

While such comparisons are possible, they are problematic since the panel was still largely submerged under water at that time. Engraving them would have been impossible. Therefore, a fresh look at the axe petroglyph from Gerum is necessary.

#### *Result of the documentation of the axe petroglyph*

The new documentation confirms that the depicted object narrows towards the middle, where it is only 5 cm wide (fig. 5 a–b). Towards the sides, the figure widens with the widest point at the extended line measuring 14.4 cm. The widest point on the other side is 6.2 cm. The petroglyph is ca. 18 cm long. While the aforementioned interpretation as an axe is palpable, the problematic aspects remain.

Several other petroglyphs were engraved in an orientation other than the majority of motifs. Two anthropomorphic figures and one boat are depicted at a 90° angle to the other images. One human figure and another boat are seemingly en-

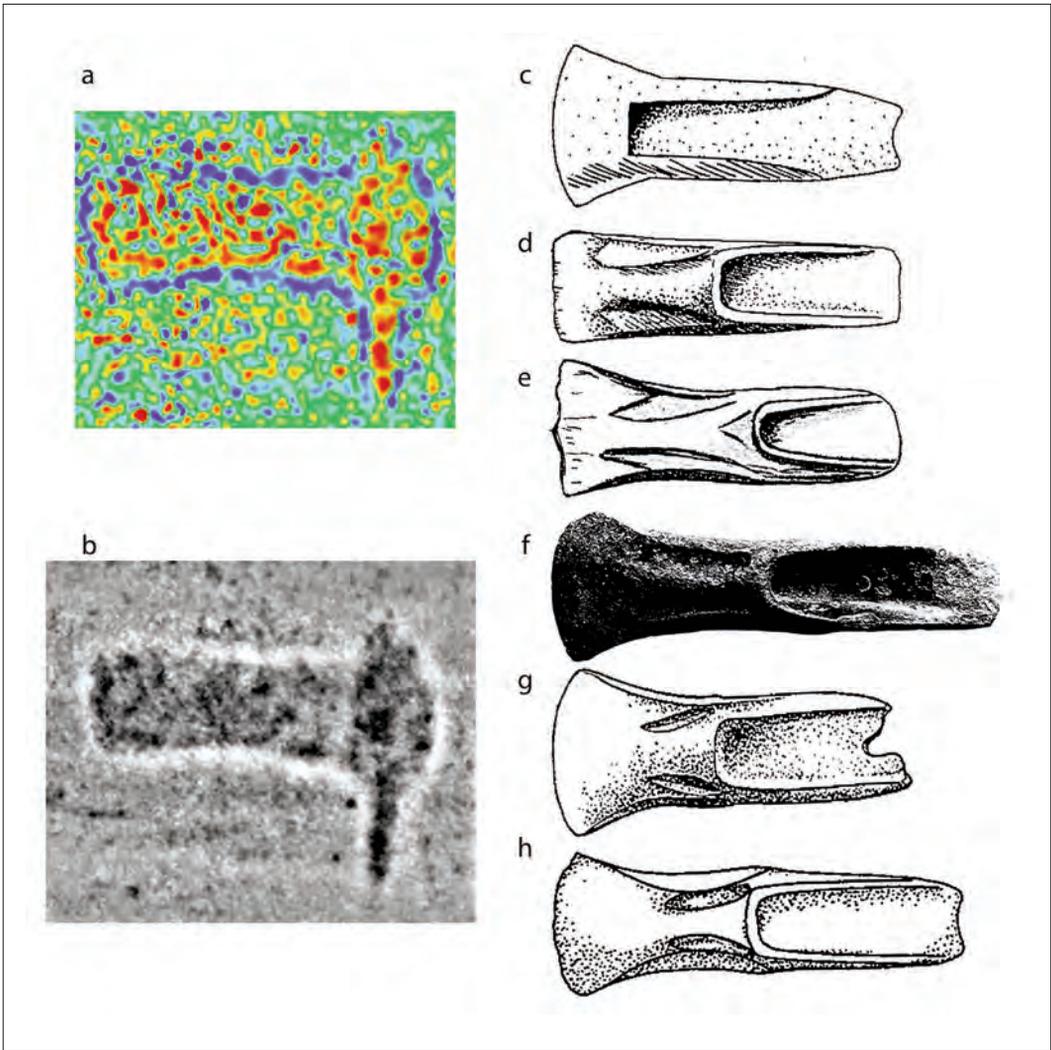


Fig. 5. 3D model of the axe from the Gerum panel: a) with colorized curvature, b) digital frottage. Comparison to a flanged axe and palstaves: c) Fjälkestad, Scania (no. 143); d) Bjännesby, Småland (no. 1829); e) Harplinge (single deposition), Halland (no. 1577); f) Harplinge, Halland (no. 1584); g) Landskrona (surroundings), Scania (no. 445); h) Sjörup, Scania (no. 687). All numbers in Oldeberg 1974.

graved “upside-down”. The term “upside-down” is for now only used in the sense that these carvings have the opposite directionality to most other carvings on the panel (see below). However, it is not intended to make any presumptions of how these images were intended to be viewed. It can be assumed that the carvings were made approaching the panel from the top since they are well

made without any mistakes and have the correct proportions. This leaves the possibility that the axe discussed here may have been made looking down on the panel from a higher part. To explore this possibility, we rotated the petroglyph 180° and continue to discuss it in this orientation (fig. 5 a–b).

The 3D documentation confirms the internal

structure visible in the raking light photography by Almgren and Mejer (figs. 4 c–d and 5 a). In the region with the elongated line, the motif is carved deeper in a roughly oval shape. There is a slight retraction visible below the upper point of the oval. The oval form gives the end of central part of the petroglyph a u-shape with a kind of tail on the upper and lower side. On the lower part of the oval, the elongated line seems to be engraved somewhat deeper. This difference in depth, however, disappears higher up in the oval.

### *Discussion*

When viewed with a 180° rotation, with the elongated line facing down, the oval cutting into the remaining petroglyph, and the widening on the other side, the motif still looks like an axe. However, there are some important differences. Most recognizably, it would be an axe with a depiction of the shaft-head and the upper part of a handle. While the blade would still widen, it is also narrower than presented in the older documentation (figs. 2 and 4 a).

In the following, a range of possible comparisons will be offered, as any of them are far from being a close match. As mentioned earlier, the oval shape in combination with the elongated line may indicate the hafting of the axe. Unfortunately, if that is the case then the butt end cannot be investigated. When the shaft represents a piece of wood clamping over the butt end and body, it could resemble the hafting of flanged axes and palstaves, though their body could not have been particularly long. Excluding axes that date to before period Ib, there are some axes with high flanges and palstaves that could match the petroglyphs shape (fig. 5 c–h), for example, from Fjälkestad, the surroundings of Landskrona, Sjörup (all Scania), Harplinge (Halland), and Norra Sandsjö (Småland) (Oldeberg 1974, no. 143, 445, 687, 1577 & 1829).

While axes of these types may have been depicted, there are still problematic aspects. The blades of flanged axes are too wide and they lack the slight widening before the hafting (fig. 5 c). Many palstaves have such a widening (fig. 5 d–h) and there are some with a narrow blade (fig. 5 d; see Oldeberg 1974, no. 1829). However, the hafting section is too long and would stick out of the

back of any knee shafting which was as narrow as depicted on the rock. For the same reason, winged axes can be excluded. Additionally, their wings would give a more sharply tipped hafting trace, unlike the smooth oval shape represented on the rock surface. Vandkilde (1996) dates axes with high flanges to period Ib, which is also when palstaves may have originated. However, their full development reaches its peak during the developed period II, perhaps until the very early period III (Montelius 1917, pp. 43–46; Laux 2000; Oldeberg 1976, pp. 1–9).

Another possibility is that a socketed axe was depicted in the petroglyph. Since socketed axes receive the shaft in their socket, there is no need for an extended body. That would keep the knee shaft flat like in the depiction. A socketed axe discovered with a similar preserved wooden shaft has been discovered in Lögdö Bruk in Medelpad (Montelius 1917, no. 1053). The widening before the haft could represent a ridge, which many possess, on the socket opening that gives them a waisted appearance (fig. 6). A problematic aspect is that many socketed axes have a loop with which they were additionally secured on the shaft. Such a loop is missing on the petroglyph in Gerum. However, there are a few socketed axes from Scandinavia and elsewhere without such a loop (fig. 6). Some may have a hole instead. Intriguingly, one example without context has been discovered in Västergötland which could fit (Oldeberg 1974, no. 2561), but seems to be somewhat too slender (fig. 6 c). Better fitting parallels have been discovered in Norrvidinge (Scania) and Dingtuna (Västmanland) (fig. 6 d–e; Oldeberg 1974, no. 550 & 2640). Both are only weakly waisted with moderately wide blades and a ridge at the socket. These parallels are single finds. However, they can be identified with the types A and D respectively according to Oldeberg (Oldeberg 1976, pp. 8–9). These socketed axes are traditionally dated to period III of the Nordic Bronze Age (Montelius 1917, pp. 43–46), but were perhaps still in use during period IV (Badou 1953; 1960, pp. 18–19). Period V–VI simple socketed axes without a loop of the west-Nordic type seem to be more waisted and or shorter so that the overall proportions fit the axe petroglyph from Gerum less well (fig. 6 f–g; Badou 1960, p. 24). But, of course, if

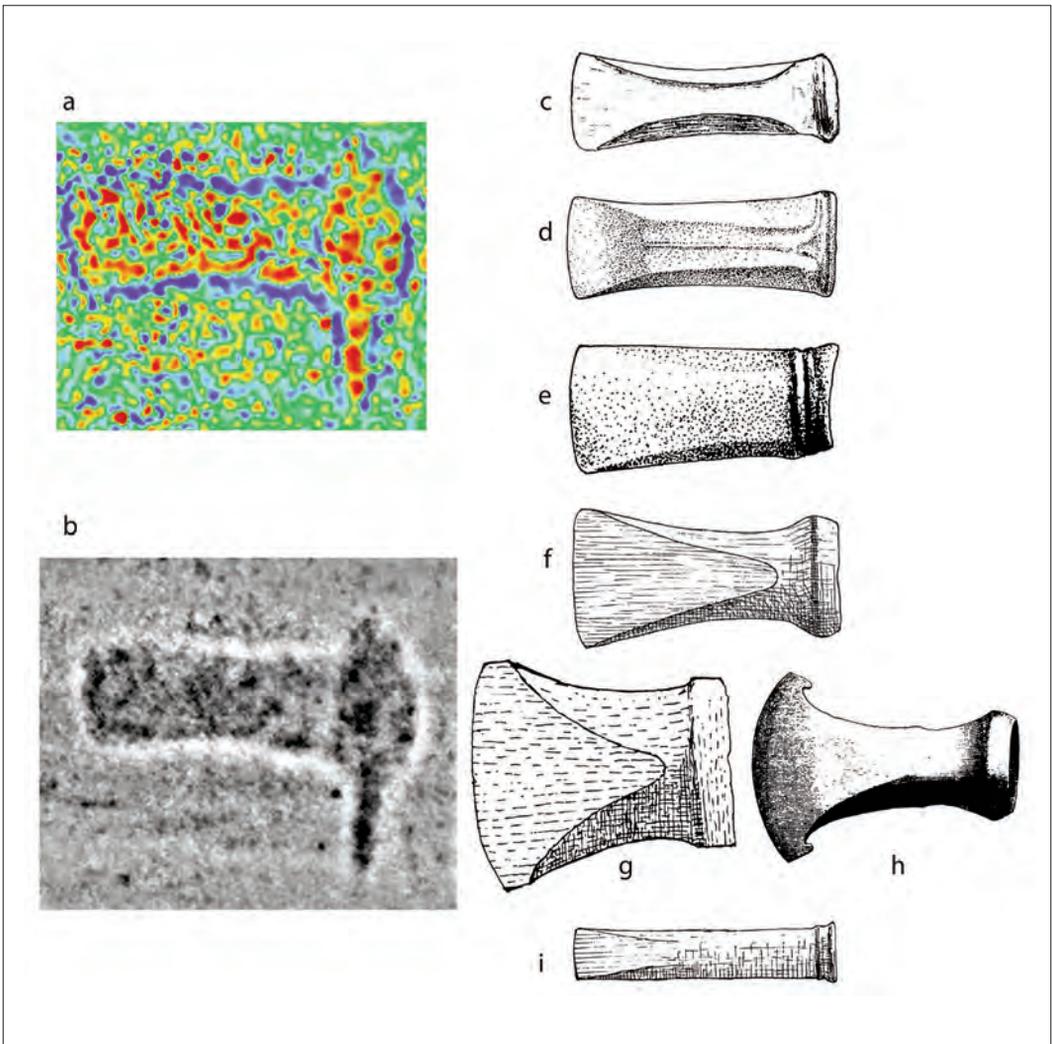


Fig. 6. 3D model of the axe from the Gerum panel: a) with colorized curvature, b) digital frottage. Comparison to socketed axes and a socketed chisel: c) no context, Västergötland (Oldeberg 1974, no. 2561), d) Norrvinge, Scania (Oldeberg 1974, no. 550), e) Dingtuna, Västmanland (Oldeberg 1974, no. 2640), f) Alfshög, Halland (Badou, Pl. VI, VII C 2b: 4), g) surroundings of Gundestrup, Denmark (Badou 1960, Pl. VI, VII C 2b: 1), h) Reflinge, Scania (Minnen 1917, no. 1190), i) Søby, Denmark (Badou 1960, Pl. VII, IX: 12).

the original engraver was not overly concerned with proportions, one of these examples may well have been depicted. Socketed chisels were compared as well, but can most likely be discarded as a parallel (fig. 6 h).

#### *Interpretation*

Given that most rock art is the outcome of a planned and conscious process, it is likely that the elongated line on the petroglyph next to the mast-like figure in Gerum is not the outcome of an accident, but was meaningful to the engraver. The line and the oval deepening could be the outcome of a later transformation of the depiction of an

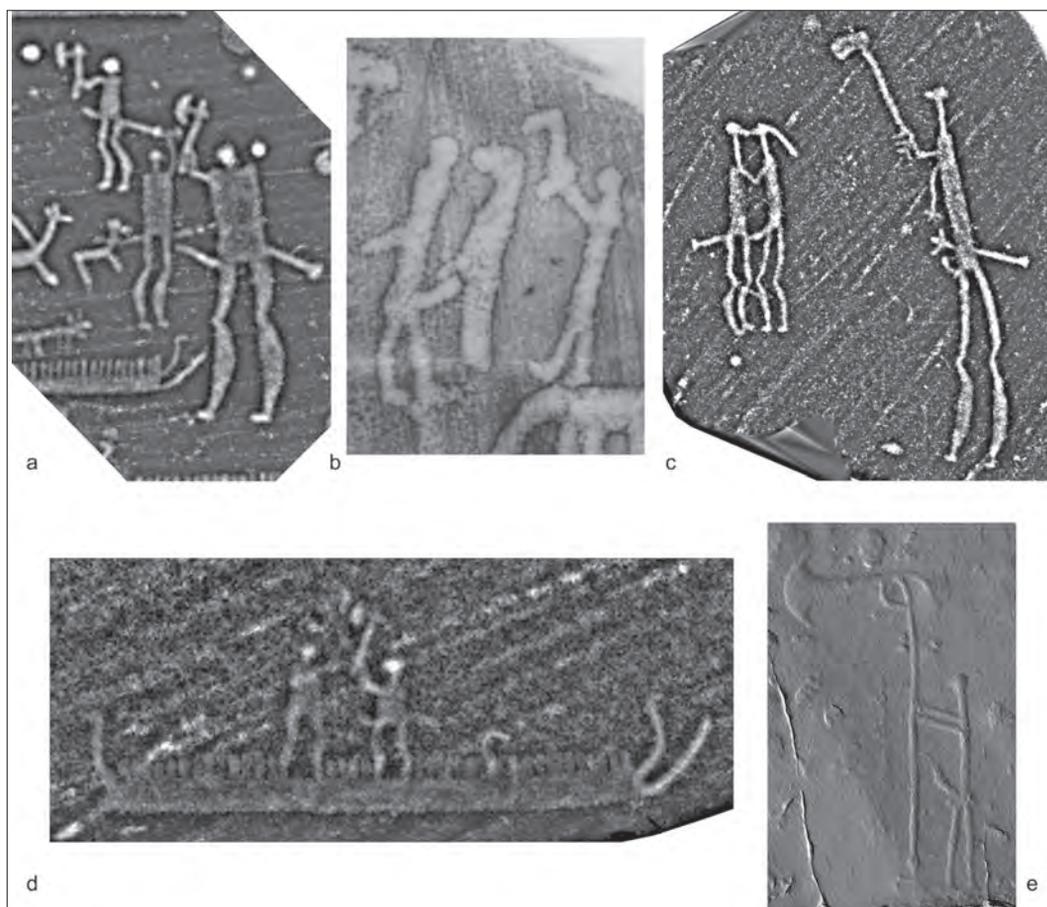


Fig. 7. Rock art representations of axes: a) fight scene between a sword and axe fighter (RAÄ Tanum 255:1), b–c) intercourse scenes with axe wielding figure (b. RAÄ Tanum 160:1, c. RAÄ Tanum 1:1), d) fight scene on a boat (RAÄ Tanum 255:1), oversized axe (RAÄ Simrishamn 23:1).

earlier axe-head. However, since the best-fitting axes date to a time when the panel was still largely submerged, this seems unlikely. At best, it is currently unverifiable in either case.

The presence of “upside-down” figures in Scandinavian rock art in general, and Gerum in particular, provides a strong possibility that the axe petroglyph is another such case. Judging by the best-fitting shape, a socketed axe including its shaft-head and upper handle were engraved on the rocky surface in Gerum sometime during period III–IV (1300–950/920 BC). At present, it is not possible to narrow this time-span any further.

Axes including socketed axes were shown by

experimental studies to be multi-functional tools during the Bronze Age, usable for wood-working and other tasks (Kienlin & Ottaway 1998; Roberts & Ottaway 2003). There are many possible reasons why it was engraved on the Gerum panel. If the “may-pole” is in fact related to the storage of leaf fodder as Skoglund has argued, then the axe could have been a tool related to the production of the “may-pole” or the gathering of the leaf fodder. The close relationship between the two features may be of significance. It might be problematic that the two features are greatly out of proportion and that their position to one another seems odd. Furthermore, while there are many

objects in rock art that require wood-working such as boats, spears, aards, etc., direct depictions of wood-working as an activity itself is virtually absent, or at least exceedingly rare, in the scenes and images.

Depictions of axes in warfare-related imagery, however, are frequent and may point to an important role of axes in warfare during the Nordic Bronze Age. Axe-wielding warriors can be observed in combat with sword-wielders or other axe-fighters even aboard boats, for example, on the Fossum panel (fig. 7 a–b; RAÄ Tanum 255:1). Some graphic intercourse scenes have an additional warrior behind the depicted couple wielding an axe, for example, on the famous Vitlycke panel (fig. 7 c; RAÄ Tanum 1:1) and on a panel in Hoghem (fig. 7 d; RAÄ Tanum 160:1). These scenes have traditionally been interpreted as related to fertility rituals (Almgren, O. 1927; Fari 2003; Mandt 1987) but they may have a darker dimension such as the portrayal of revenge (Horn 2018). In any case, what we see on the Vitlycke panel, as well as on the axes carried by humanoid figures in Simrislund (fig. 7 e; RAÄ Simrishamn 23:1), is that axes are enlarged in the depictions in relation to the associated human figures and the surrounding petroglyphs, emphasizing their role and importance. This is also the case in Gerum. Evidence for a combat role of axes during the Nordic Bronze Age is also beginning to emerge from the study of the use wear on bronze and copper axes (Högberg et al. 2016). Unfortunately, a systematic, quantitative study of use wear on such axes is still missing in Scandinavia.

The “upside-down” depiction of boats has been interpreted as an inversion of meaning, i.e. “upside-down” boats represent the boats of the dead (Fuglestad 1999). However, it has been argued that rock art such as on the panel in Gerum can be approached from different viewing angles, such as in the case of a panel in New Zalavruga (Russia) which may have had many “station points” (Janik 2014). This makes it difficult to determine which aspects were thought of or intentionally depicted as being “upside-down”. Janik defines the station point by looking at the images and determining how they would stand in reality, for example she presupposes that animals would have

been viewed standing on their feet. A similar argument has been made for another panel in Tanum, i.e. Finntorp (RAÄ Tanum 184:1) (Horn & Wollentz 2019). Directly comparing the panels in New Zalavruga and Gerum shows that the directionality in Gerum is much more uniform. In addition, the direction of the large majority of motifs makes them “stand” when the panel is –like today– approached from below coming from the stream that flows next to the panel. Only few depictions deviate, which makes it more likely that this way of applying the motifs in contradiction to the other images was purposeful.

Thus, in the case of the Gerum panel something similar to Fuglestad’s interpretation may have been depicted, and perhaps the closeness to the mast-like petroglyph may have played a role in that regard. Maybe the mast represented a ritual that was supplanted by new beliefs, and the axe represents the cutting down of the old. Should the axe petroglyph date to period III–IV, then it was engraved during a time of upheaval in Europe during the transition from the Early to the Late Bronze Age and the introduction of the urn-field belief system into the north (Vandkilde 2011; Kristiansen & Larsson 2005). The discovery of the Tollense battlefield in northern Germany with perhaps hundreds of victims and potentially thousands of battle participants provides graphic evidence of that (Brinker et al. 2014; Jantzen et al. 2011; Lidke et al. 2018). Perhaps the warrior depictions on the Gerum panel, some with raised spears, point in a similar direction. This interpretation, however, depends on the dating of the mast-like figure and it being older than the axe. The verification or disproval of this future research using the best documentation methods available to investigate rock art, especially anthropomorphic figures, depictions of metalwork, and boats, is necessary.

#### References

- Almgren, B., 1987. *Die Datierung bronzzeitlicher Felszeichnungen in Westschweden*. Uppsala.
- Almgren, O., 1927. *Hällristningar och kultbruk*. Stockholm.
- Badou, E., 1953. De svenska holkylxorna under bronsåldern. *Fornvännen* 48.
- 1960. *Die regionale und chronologische Einteilung der jüngeren Bronzezeit im Nordischen Kreis*. Stockholm.

- Becker, C. J., 1964. Neue Hortfunde aus Dänemark mit frühbronzezeitlichen Lanzen spitzen. *Acta Archaeologica* 35.
- Bengtsson, L., 2013. Rock art ships as a method for dating. Sabatini, S. & Bergerbrant, S. (eds.). *Counterpoint. Essays in archaeology and heritage studies in honour of Professor Kristian Kristiansen*. Oxford.
- Bengtsson, L. & Olsson, C., 2000. *Arkeologisk Rapport 5 från Vitlyckemuseet*. Tanumshede.
- Bertilsson, U., 1987. *The rock carvings of Northern Bohuslän. Spatial structures and social symbols*. Stockholm.
- 2015. Examples of application of modern digital techniques and methods. Structure for motion (SfM) and multi-view stereo (MvS) for three-dimensional documentation of rock carvings in Tanum creating new opportunities for interpretation and dating. Troletti, F. (ed.). *Prospects for prehistoric Rock Art research. XXVI Valcamonica Symposium*. Capo di Ponte.
- Brinker, U., Flohr, S., Hauenstein, K. & Piek, J., 2014. Die menschlichen Skelettreste aus dem Tollenseal. Ein Vorbericht. Jantzen, D., Orschiedt, J. & Terberger, P. T. (Hrsg.). *Tod im Tollenseal. Forschungen zu den Hinterlassenschaften eines bronzezeitlichen Gewaltkonfliktes in Mecklenburg-Vorpommern*. Schwerin.
- Cobaz, D. & Jagersand, M., 2003. Multiple View Geometry and Structure-From-Motion. *IEEE Virtual Reality T1*.
- Díaz-Guardamino Uribe, M. & Wheatley, D. W., 2013. Rock Art and Digital Technologies. The Application of Reflectance Transformation Imaging (RTI) and 3D Laser Scanning to the Study of late Bronze Age Iberian Stelae. *Menga: Revista de prehistoria de Andalucía* 4.
- Fari, C. H., 2003. *Hieros-Gamos. Helleristningstradisjon og myteverdenen i det østlige middelhavsområdet*. Oslo.
- Fredell, Å., 2003. *Bildbroar. Figurativ bildkommunikation av ideologi och kosmologi under sydkandinavisk bronsålder och föromersk järnålder*. Göteborg.
- Fuglestedt, I., 1999. Adorants, voltigeurs and other mortals. An essay on rock art and the human body. Goldhahn, J. (ed.). *Rock art as social representation*. Oxford.
- Horn, C., 2018. Fast like a war canoe. Pragmamorphism in Scandinavian rock art. Dolfini, A., Crellin, R. J., Horn, C. & Uckelmann, M. (eds.). *Prehistoric Warfare and Violence. Quantitative and Qualitative Approaches*. Cham.
- 2016. Cupmarks. *Adoranten* 2015.
- Horn, C., Bertilsson, U., Ling, J. & Potter, R., 2018. By all means necessary. 2.5D and 3D recording of surfaces in the study of southern Scandinavian rock art. *Open Archaeology* 4 (1).
- Horn, C. & Potter, R. 2017. Transforming the Rocks. Time and Rock Art in Bohuslän, Sweden. *European Journal of Archaeology* 63.
- Horn, C. & Wollentz, G., 2019. Who is in charge here?: Material culture, landscapes, and symmetry. Haug, A., Käppel, L. & Müller, J. (eds.). *Past landscapes. The dynamics of interaction between society, landscape, and culture. Human development in landscapes*. Leiden.
- Höberg, A., Brink, K., Grandin, L. & Horn, C. 2016. A silver-coated copper axe from Late Neolithic Scania: Initial analyses. *Fornvännen* 111.
- Hygen, A.-S. & Bengtsson, L., 1999. *Hällristningar i gränsbygd. Bohuslän och Östfold*. Sävedalen.
- Janik, L., 2014. Seeing visual narrative. New methodologies in the study of prehistoric visual depictions. *Archaeological Dialogues* 21.
- Jantzen, D., Brinker, U., Orschiedt, J., Heinemeier, J., Piek, J., Hauenstein, K., Krüger, J., Lidke, G., Lübke, H., Lampe, R., Lorenz, S., Schult, M. & Terberger, T., 2011. A Bronze Age battlefield? Weapons and trauma in the Tollense Valley, north-eastern Germany. *Antiquity* 85 (328).
- Kaul, F., 2004. *Bronzealderens religion. Studier af den nordiske bronzealders ikonografi*. Copenhagen.
- Kazhdan, M., Bolitho, M. & Hoppe, H., 2006. Poisson Surface Reconstruction. Polthier, K. & Sheffer, A. (eds.). *SGP 2006 symposium on geometry processing 2006. Fourth Eurographics symposium on geometry processing*. Switzerland.
- Kienlin, T. L. & Ottaway, B. S., 1998. Flanged axes of the northalpine region: An assessment of the possibilities of use wear analysis on metal artifacts. Mordant, C., Pernot, M., Rychner, V. (éd.). *L'atelier du bronzier en Europe du XXe au VIIIe siècle avant notre ère. Actes du colloque international «Bronze 96», Neuchâtel et Dijon, 1996*. Paris.
- Kristiansen, K., 2012. Rock art and religion. The sun journey in Indo-European mythology and Bronze Age rock art. *Adoranten* 2011.
- 2014. The dialectics of gender. Ritualizing gender relations in Late Bronze Age Southern Scandinavia. Alexandersson, H., Andreeff, A. & Bünz, A. (red.). *Med hjärta och hjärna. En vänbok till professor Elisabeth Arwill-Nordbladh*. Göteborg.
- Kristiansen, K. & Larsson, T. B., 2005. *The rise of Bronze Age society. Travels, transmissions and transformations*. Cambridge.
- Laux, F., 2000. *Die Äxte und Beile in Niedersachsen I: (Flach-, Randleisten- und Absatzbeile)*. Stuttgart.
- Lerma, J. L., Navarro, S., Cabrelles, M., Seguí, A. E. & Hernández, D., 2013. Automatic orientation and 3D modelling from markerless rock art imagery. *ISPRS Journal of Photogrammetry and Remote Sensing* 76.
- Lidke, G., Brinker, U., Jantzen, D., Dombrowsky, A., Dräger, J., Krüger, J. & Terberger, T., 2018. Warfare or sacrifice? Archaeological research on the Bronze Age site in the Tollense valley, northeast Germany. Horn, C. & Kristiansen, K. (eds.). *Warfare in Bronze Age society*. Cambridge.
- Ling, J., 2014. *Elevated rock art. Towards a maritime under-*

- standing of Bronze Age rock art in northern Bohuslan, Sweden. Oxford.
- Ling, J. & Bertilsson, U., 2017. Biography of the Fossum Panel. *Adoranten* 2016.
- Ling, J. & Rowlands, M., 2013. Boundaries, flows and connectivities. Mobility and stasis in the Bronze Age. Sabatini, S. & Bergerbrant, S. (eds.). *Counterpoint. Essays in archaeology and heritage studies in honour of Professor Kristian Kristiansen*. Oxford.
- 2015. The ‘Stranger King’ (bull) and rock art. Ling, J., Skoglund, P. & Bertilsson, U. (eds.). *Picturing the Bronze Age*. Oxford.
- Mandt, G., 1987. Female symbolism in rock art. Bertelsen, R., Lillehammer, A. & Næss, J.-R. (eds.). *Were they all men? An examination of sex roles in prehistoric society*. Stavanger.
- Meijer, E., 2016. Structure from Motion as documentation technique for Rock Art. *Adoranten* 2015.
- Micheletti, N., Chandler, J. H., & Lane, S. N., 2015. Structure from Motion (SfM) Photogrammetry. British Society for Geomorphology (ed.). *Geomorphological Techniques*. London.
- Montelius, O., 1917. *Minnen från vår forntid I*. Stockholm.
- Mudge, M., Schroer, C., Noble, T., Matthews, N., Rusinkiewicz, S. & Toler-Franklin, C., 2012. Robust and Scientifically Reliable Rock Art Documentation from Digital Photographs. McDonald, J. & Veth, P.-M. (eds.). *A companion to rock art*. Malden.
- Oldeberg, A., 1974. *Die ältere Metallzeit in Schweden I*. Stockholm.
- 1976. *Die ältere Metallzeit in Schweden II*. Stockholm.
- Rédei, A. C., Skoglund, P. & Persson, T., 2018. Applying cartosemiotics to rock art: an example from Aspeberget, Sweden. *Social Semiotics* 2015.
- Reu, J. de, Plets, G., Verhoeven, G., De Smedt, P., Bats, M., Cherretté, B., De Mayeyer, W., Deconynck, J., Herremans, D., Laloo, P. Van Meirvenne, M. & De Clerq, W., 2013. Towards a three-dimensional cost-effective registration of the archaeological heritage. *Journal of Archaeological Science* 40 (2).
- Roberts, B. & Ottaway, B. S., 2003. The use and significance of socketed axes during the Late Bronze Age. *European Journal of Archaeology* 6 (2).
- Sapirstein, P., 2016. Accurate measurement with photogrammetry at large sites. *Journal of Archaeological Science* 66.
- Sevara, C. & Goldhahn, J., 2011. Image-Based Modeling of the Present Past. Building 3D Models of Archaeological Environments from Digital Photographs. Jamal, A.-Q. & Alshwabkeh, Y. (eds.). *Digital Media and its Applications in Cultural Heritage. DMACH 2011: the Second International Conference on Digital Media and its Applications in Cultural Heritage*. Amman.
- Skoglund, P., 2012. Culturally modified trees – a discussion based on rock-art images. Jones, A. M., Pollard, J., Allen, M. J. & Gardiner, J. (eds.) *Image, memory and monumentality. Archaeological engagements with the material world. Papers in honour of professor Richard Bradley*. Oxford.
- 2016. *Rock art through time. Scanian rock carvings in the Bronze Age and earliest Iron Age*. Oxford.
- Vandkilde, H., 1996. *From stone to bronze. the metalwork of the late Neolithic and earliest Bronze Age in Denmark*. Aarhus.
- 2011. Bronze Age warfare in temperate Europe. *Archäologie in Eurasien* 24.