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Plenary lecture

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Documentation of Runic Inscriptions

Abstract

Documentation and examination are the essence of runological fieldwork. As discussed here, the recording aspect concerns the inscriptions, particularly the runes, themselves. The documentation of runic carvings is a multifaceted activity. It ranges from the production of reading protocols during the examination of inscriptions to the utilization of various techniques for registering what is found on the runic object: (a) visually, i.e. with drawings or photographs, (b) physically, e.g. with squeezes or casts, and (c) scientifically, such as by employment of microscopes, 3D scanning, or most recently Reflectance Transformation Imaging. The main requirement for all such documentation is objectivity.

Keywords: Documentation, runic inscriptions, reading protocols, drawings, photography, squeezes, casts, stereo microscope, 3D scanning, Reflectance Transformation Imaging

Introduction

Discovery, documentation, and decipherment are the three broad aspects of the theme “Reading Runic Inscriptions”. The second of these, documentation – together with examination – comprises the core of runological fieldwork.

Documentation also applies to the discovery of runic inscriptions. Their uncovering is recorded in find-histories, in most cases, at least nowadays, by archaeologists. The accounts provide information primarily about the runic object itself, and thus contain important material for, among other things, an evaluation of the context of the inscription and an appraisal of its state of completeness and preservation. The circumstances of discovery can also be crucial for determining authenticity. In general, however, the record of the find-history has little to do with the particulars of the inscription itself.

As presented here, documentation concerns first and foremost the individual runes in the inscription. There are, of course, broader epigraphic features the runologist must record, for instance the placement and layout of the inscription, the order in which lines are to be read, and details of any

ornamentation. The importance of such matters for the interpretation and understanding of the runes must be evaluated in connection with decipherment. Although these are important considerations, they cannot receive a full presentation here and will be mentioned only in passing.

Documentation of runic inscriptions is a multifaceted endeavor. In form it ranges from reading protocols produced during the examination of inscriptions to the results of various techniques for documenting what can be seen on the runic object: (a) visually, i.e. with drawings or photographs, (b) physically, e.g. with rubbings, squeezes, or casts, and (c) scientifically, such as through the employment of technically advanced microscopes, laser or 3D optical scanning, or most recently Reflectance Transformation Imaging (abbreviated to RTI). The main requirement for all such documentation is that it be as objective as possible.

Reading protocols

Structured reading protocols are not the earliest form of documentation, but – as a scholarly genre – a necessary and welcome result of improved scientific recording methods in the 1800s. They have not changed much over the years, and still consist basically of sketches (more or less exact), a general description of the object and the inscription, and a rune-by-rune specification of what is observed. The rough drawing need not be a work of art but should delineate important traits of the object, the inscription, its runes and any other marks. The written presentation should include all aspects of interest for the inscription and for the individual runes or other signs, symbols or art-work. It usually begins with a general description, including identification and size of object, placement of inscription, layout and size of inscription and so on, especially if the inscription is a new find. There follows a line-by-line, rune-by-rune account, as a rule entailing the identification of rune forms with comments about any deviation from standard forms, any damage, and the like. The information should be detailed, especially when the reading is in doubt.

Good reading protocols can be presented verbatim in corpus editions, as was the case in vols. 3–5 of *Norges innskrifter med de yngre runer* (hereafter NIyR) after Aslak Liestøl had been employed by Oldsaksamlingen to supervise the Runic Archives and had started examining and documenting inscriptions prior to their publication by Magnus Olsen. An example can be seen in the article for N 226 Klepp 2 (NIyR 3: 152; cf. the first half of the typed transcript of Liestøl's handwritten protocol in Fig. 1).

Klepp 2, i Bergens Museum

Line A. Steinen har her nokre slepper som ligg i sylinderflater med aksen i ca 15 grader med overflata. Langs sleppene er så ein del avskalingar som før ein ser etter kan virke som deler av runene.

1. Berre hovudstav. Han ser ut til saman med r.2 å skulle lesat u, men det er eit resultat av avskal- ingane ved sleppa.
 2. Det er ein søkk til høgre for toppen, men det er usikkert om det er ein kvist.
 3. Tydeleg p.
 4. Tydeleg hovudstav, men avskaling langs ei sleppe til venstre for toppen og foten.
 5. Tydeleg hovudstav, men ein søkk til ~~venstre~~ høgre for midten. Usikkert om det er kvist.
- Tydeleg punkt, sansynlegvis nedre punkt i eit skilje- teikn.

Fig. 1. Typed transcription of the first part of Aslak Liestøl's reading protocol for N 226 Klepp 2, with a sketch. In the Runic Archives, Museum of Cultural History, University of Oslo.

The arrangement in NIyR corresponds fairly well with that in Sveriges runinskrifter (hereafter SRI), Danmarks runeindskrifter and in Krause and Jankuhn's *Die Runeninschriften im älteren Futhark* (1966). In conjunction with the transliteration, any runes of interest are presented and discussed. The Danish publication, however, provides very limited information from reading protocols, most likely due to the fact that the publication was conceived as a supplement to Wimmer's edition some forty years prior where such information could be found.

Complete reading protocols are essential for and integral to the field documentation of runic inscriptions, and a field runologist should always codify his or her findings during an investigation in this way. Some reading protocols have a special purpose, for example to check the possibility of a new reading of a single rune or word, and will be correspondingly simplified and less complete.

It is of the utmost importance to keep the observations in a reading protocol as neutral, objective, and descriptive as possible. Here, as elsewhere, the scholar must differentiate between what is recorded or documented, and how these observations can be interpreted (cf. Page 2005).

Visual documentation: drawings

Visual documentation has traditionally entailed the production of either drawings or photographs, with drawings the earliest form of documentation. One of the first to use drawings was the Swedish “father of runology”, Johannes Bureus, who drew runic inscriptions in the late 1500s and first half of the 1600s not only in manuscripts as the basis for his research but also for presentation in various publications for which he personally prepared both etchings and woodcuts. He was a proficient if not professional draftsman, as is demonstrated by his woodcut of U 439 Steninge (SRI 7: 233), for example, an Ingvarr stone that was lost soon after Bureus recorded it.

In Denmark, Ole Worm (Olaus Wormius) requested in the early 1600s that drawings be made of runic monuments in the Dano-Norwegian kingdom. Three bishops in Norway and one canon sent manuscripts to him containing drawings of fifty Norwegian runic inscriptions. The manuscripts (three of which still exist) were the basis for the illustrations in Book 6 of his *Monumenta Danica* (1643), the first publication of the Norwegian corpus. The only illustrator whose name is now definitely known was Worm’s own proficient draftsman, the Norwegian Jon Andersen Skonvig/Skånevik (cf. Moltke 1956–58, for half of the rune-stones in the Bergen bishopric). Although canon Peder Alfssøn, a teacher at the Cathedral School in Oslo/Christiania, has traditionally been considered to be the illustrator of manuscript AM 371 fol. with inscriptions in the Oslo bishopric (cf. Moltke 1956–58, 1: 217–233), Worm in a letter dated 1638 (1751, 1: 383 [no. 383]; cf. 1965–68, 2: 55 [no. 700]) relates only that Peder Alfssøn had sent him the manuscript, which contained illustrations ‘drawn by a painter in vivid colors’. At any rate, this person was no professional draftsman, as his inferior illustration of the N 68 Dynna stone demonstrates: the long single line of runes along one narrow edge of an elegant and tall stone is represented as four parallel lines on a squat block (Fig. 2).

Although in the mid-1600s a small cadre of professional draftsmen in Sweden produced the fine copper etchings and woodcuts published much later in Bautil (1750), in the 1700s and 1800s it was most often interested but not necessarily gifted amateurs who sketched runic inscriptions, sometimes out-

Fig. 2. Drawing of the N 68 Dynna rune-stone in the manuscript Peder Alfssøn sent to Ole Worm in 1627 (AM 371 fol., fol. 7r), from Moltke (1956–58, 1: 218).

lining only the runes themselves with no indication of the object. The main problem with most drawings from this early period is their tendency to generalize and idealize: the form of a rune-stone and the forms of the runes are more or less standardized. Later in the 1800s, more scholarly demands led to professional draftsmen again being engaged and to representations in which individualization and differentiation became the norm. The stellar runic illustrator from the mid-1800s and early 1900s was the Dane Magnus Petersen, who drew Danish runic inscriptions for Ludvig Wimmer's *De danske Runemindesmærker* (1893–1908), and also Norwegian ones for Sophus Bugge (*Norges Indskrifter med de ældre Runer* [hereafter *NIæR*], vol. 1, 1891–1903). His drawings were excellent, both those that he made based solely on his own observations during investigation of runic monuments and those made under the guidance of a runologist.

Photography made its entry into the documentation of runic inscriptions in the late 1800s (see below), and during the first decades of the 1900s photographs replaced drawings to a great extent, particularly in corpus editions. Drawings – even good drawings – were more subjective than photographs which, in general, were far more objective.

Of course, older drawings of lost or subsequently damaged inscriptions can provide primary documentary evidence (cf. Bureus's woodcut of U 439 Steninge mentioned above). In most other cases, however, drawings cannot now be considered as primary evidence. Still, they do have a place in the presentation of documentation (see below). This is particularly the case when the inscription is difficult to reproduce clearly with photography; then a drawing, accompanying a photograph or photographs, can be quite informative.

The drawings produced in the Runic Archives in the latter half of the 1900s, i.e. by Aslak Liestøl, James Knirk, and Jonas Nordby, were made by hand with a fine-point permanent marker on tracing paper. The semi-transparent paper was placed over an enlarged Xerox reproduction of a photograph on a light table or lightbox. When the final product was then reduced to publication size, minor irregularities arising from a shaky hand generally disappeared. Nowadays such drawings can be made as layers in a photo-editing program on the computer, as was Jonas Nordby's coloring-in of the lines on the Hogganvik stone (see Knirk 2011: 29 and the cover illustration for that issue of the periodical). If the photo is kept in place, the illustration represents a photograph with the lines traced; when the underlying picture is removed and only the top layer remains, the illustration becomes simply a drawing.

The main reason for filling in the runes with color is to make the inscribed lines clearer and more obvious. But whatever the scholar is not sure about should be handled with care; that is, any lack of certainty should be signaled. In the case of a probable but uncertain *b*-rune on the Hogganvik illustration referred to above, the strokes that were certain were drawn in, whereas dotted lines were used for those that were not entirely sure and of course nothing was sketched where nothing could with certainty be seen. This is in general the same procedure as is followed when the Runic Unit (Runverket), Swedish National Heritage Board, paints the hewn or carved lines on Swedish rune-stones.

Drawings can be good pedagogical tools in the popular or popular-scientific dissemination of information about inscriptions. Drawings of all the inscriptions in the "Kiss me!" runic exhibition in Oslo in 2010, presented in conjunction with the Seventh International Symposium on Runes and Runic

Inscriptions there that year, were part of the exhibition itself and are still available on the Internet.

A drawing can be illustrative and can even come close to constituting primary documentation in a corpus edition, even of an inscription that still exists and is in the same state as it was when it was first photographically documented. An example is found in the corpus publication of the merchant's tag N 722 from Søndre Gullskoen, Bryggen (the 'Wharf', or the 'German Wharf' [Tyskebryggen]) in Bergen, reading 'Ragnarr owns this yarn' (NIyR 6: 186–188). The photograph published there (p. 186), even when enlarged to over 150%, did not document the runes well enough, and therefore a drawing, on the same scale, was reproduced immediately below. On the facing page, close-up photographs, enlarged to almost 300% in relation to the object itself, provide more help, but there the inscription had to be presented in pieces, with overlap.

Modern drawings can in particular instances have certain advantages as illustrations. It may be almost impossible for one reason or another to photograph an inscription, as was the case in Norway with the runes on the church bell hanging in Hvaler church, N 11, where beams of the suspension structure largely conceal parts of the text. A drawing of a squeeze then substitutes for a nearly-impossible photograph in the corpus edition. Since the runes run around the circular bell, they would have had to be presented in several photographs. A continuous drawing therefore provides a clearer illustration, as would a photomontage.

Drawings can be executed with different degrees of representational accuracy. Magnus Pedersen's masterpieces were quite naturalistic. A somewhat more schematic sketch can include editorial information, such as line identifications and arrows to indicate reading direction, cf. the drawing from 1991 of the Tune rune-stone, reproduced in the relevant article in *Reallexikon der Germanischen Altertumskunde* (Knirk 2006: 333). The instance mentioned above of the merchant's tag N 722 exemplifies a somewhat schematic drawing consisting of the presentation of: (a) the outline of the object, (b) the incisions of the runes, and (c) indications of cracks or damage, using dots or lighter, darker, or jagged lines that contrast with those of the runic incisions. This is a good alternative for supplementing photographs in editions.

Visual documentation: photography

Historical development

The chemical camera was invented in the 1820s and, in various improved forms, came into common use in the course of that century. In the late 1800s, the film camera with light-sensitive material was developed and subsequently dominated the market for a century. The camera was used before the turn of that century for documentation in a variety of publications including *NIæR* (cf. two phototypes of the Tune stone on p. 40 in vol. 1, 1891), although initially in that work drawings were the preferred form of documentation.

The plates in the first volume of the Swedish corpus edition (SRI), *Ölands runinskrifter* (1900–06), comprise only etchings, which is generally also the case in the second volume, *Östergötlands runinskrifter* (1911–18). Erik Brate used photographs in the first fascicle of volume three, *Södermanlands runinskrifter*, in the mid-1920s, but the quality was poor and the photos amateurish. Great improvements were made by Elias Wessén, who collaborated with a professional photographer, Harald Faith-Ell, during his field trips in Södermanland between 1928 and 1930.

At about the same time, Erik Moltke was developing techniques for photographic documentation in preparation for the publication of *Danmarks runednskrifter*. His considerations and recommendations are summarized in an article in *Fornvænnen* from 1932 concerning ‘technical aids and methods in the service of epigraphy’, where among the techniques he discusses is the magnesium bomb, i.e. in modern terms: the flash. That article is still well worth reading on the subject of photographic documentation of runic inscriptions. The rewarding results of Moltke’s technical and methodological work are evident in the superior photographic material in the Danish corpus edition of 1941–42 (cf. Moltke 1956–58, 2: 251–264). The Danes developed a system of double photographic documentation whereby two illustrations of most rune-stones are provided: one a natural, objective photo of the surface with the runes as they appear with the best possible lighting, and the other with the runes filled in with color.

The Swedes have also at times employed this procedure in their corpus edition, SRI, but have most often provided only photographic documentation consisting of pictures taken after the runes and ornamentation have been painted on the stone, and not “objective” ones of the unpainted carving. Magnus Olsen, unfortunately, did not obtain good photographs for the first volume of *NIyR*, but for subsequent volumes, as a result of Liestøl’s work,

he did. Krause and Jankuhn (1966) did not always use good photographs; for example, as the only documentation of the KJ 71 By stone, they published a photograph where the runes were colored in with white chalk.

Bengt A. Lundberg, the expert Swedish runic photographer, must also be applauded for his excellent documentary and artistic work. He published an article on 'photographing rune-stones' in *Fornvännen* in 1988 in which he discussed many aspects of runic photography, including the use of polarization filters and the like.

Although almost all photography now employs digital cameras rather than analogue (film) cameras, most procedures are basically the same and need not be discussed separately.

Examination and photography

Examination is almost always a prerequisite for good photographic documentation. If the runologist-photographer does not know what he or she is trying to document, the light may be placed in the wrong position and important details of rune forms concealed rather than revealed. In short: it is easier to make a decent photographer out of a professional runologist than it is to make a decent runologist out of a professional photographer. Probably the best solution is a combination: a professional runologist working together with a professional photographer, as with Wessén (first in Södermanland in 1928–30), and similarly Michael Barnes with Lundberg in preparation for the Maeshowe publication (Barnes 1994).

Although documentation is the topic here, a few comments are in order about the examination of runic inscriptions. The field runologist must understand the nature of the material on which the runes were carved as well as the way in which they were carved. He or she should register tell-tale signs of anything that affected the surface both before and after the inscribing took place. For rune-stones a magnifying glass can be used, perhaps preferably a small round one of the type used by film photographers to examine slides and negatives. For the examination of small objects, a stereo microscope with a fiber-optic light source is essential. Fiber-optic lighting ensures that the object being lit does not suffer as it is not heated up. Note, however, that sometimes the naked eye can see things that are not obvious under the stereo microscope. In order to achieve the most reliable results, the scholar must examine runic objects and incisions in as many ways as possible. That applies also to lighting; it is simply not true that light coming in obliquely from the side always produces the optimal effect. During an examination, the

scholar should try to distinguish between recent damage and old, between lines or holes made by the knife or chisel and cracks or other natural damage. Any marks must be examined to determine whether they are man-made and apparently intentionally cut, or perhaps represent a natural defect, or simply constitute prior or subsequent damage.

The key factor for visual examination is light, and the best source of light for rune-stones is often the sun. The sun, however, does not always cooperate on days set aside for inspection, and may be in the wrong position when it does. In the case of a bright day with the sun in the wrong position, a mirror can be useful. The scholar might even need to have a large piece of black cloth to produce shade so that the mirror can be employed to control the source of the light. Otherwise, it is important to have a good, strong electric light source, for example a 1000 watt halogen video lamp, and long electric leads or even a generator available, not only for photography, but also for inspection. Sometimes an artificial light source is even better than the sun for inspecting and photographing rune-stones.

Practical tips for photography

Erik Moltke in his article from 1932 has a number of useful methodological observations concerning the photographing of runic inscriptions. Some practical recommendations are repeated below, with new ones added. They concern two main areas: lighting and focus, with ancillary information about circumstances affecting the two.

As with examination, lighting is a key factor in good runic photography. Usually it is preferable to have one major light source, positioned at the left side of the inscription (if it is in a line) or of the object. However, as Moltke discovered while using his flash, many times the best results came with natural light and the magnesium bomb, or with natural light and a strong source of artificial light. Background lighting may add to the photograph in various ways, as long as the main source is strong enough to produce the desired contrast. Instead of simply showing very dark shading for the runes, the bottom of the grooves can be seen, for example. As already mentioned, a mirror can be used to control and direct the light of the sun onto an inscription, and it can also prove useful if an inscription is awkwardly placed, for example at a very short distance from a wall, so that the photographer cannot get far enough away to take a picture. The mirror can then be placed against the wall and a shot taken of the object in the mirror, which is, of course, a mirror image and must be reversed when the photograph is studied and used.

As regards artificial light sources, it must be remembered that the strength of the light diminishes quadratically in proportion to the distance from the source: if the source is twice as far away, the light is only one quarter as strong. Thus, if the light source is too close to the object being photographed, there may be a great difference in lighting between the extremities of the inscription. This difference is not particularly obvious to the naked eye while focusing the camera, because the mind adjusts for the differences, but it becomes obvious on the resulting photograph. An object 50 centimeters in length with a light source held over an arm's length, i.e. one meter, away, will have more than twice as much light on the end closest to the light source.

Although the best results are frequently obtained by arranging the light at an oblique angle to the surface with runes, a rough surface might produce too many shadows to have the light placed very sharply. A mirror can perhaps be used at the opposite end of the inscription from the light source; this would then neutralize the shadows of the uneven surface and increase the contrast with the shading in the grooves. Dark shading should not necessarily be avoided, unless the edge of the runic object is not well enough illuminated and therefore cannot be seen due to lack of light. In that case, a white Styrofoam block can be placed near the dark end and will reflect enough light to illuminate the edge but not so much as to decrease the contrast. If the grooves on a rune-stone are lighter in color than the rest of the surface, which is quite often the case (sometimes approaching white), taking a picture with direct lighting on the surface from right beside the camera may give good, complementary results. If the incisions themselves are dark, as they often are on rune-sticks or bones, direct light from right beside the camera may produce a good contrast and clear photographs. The object will appear flat, however, and the photo will usually be less aesthetically pleasing. Night photography of rune-stones with artificial light can be rewarding. The photographer then has complete control of the light and can usually obtain the greatest contrast between the runes and the stone surface. The same attainment of contrast pertains to photographing small objects in a dark room.

The number one rule is that the camera must be in focus, and it is quite often not enough simply to use autofocus, which might not function well enough; manual focusing is to be preferred. A tripod is usually necessary to ensure that the camera is held still and thus that the focus is clear. For photographing small objects, a copy stand is recommended. Although not as aesthetically pleasing, a neutral (grey) background is usually to be preferred for small objects. This also helps with automatic light measurement by the

camera since a white background would most likely lead to underexposure of the runic object and a dark background to overexposure. The problem can of course be reduced by selecting “center-weighted” metering.

For objects that are not flat, and particularly for rounded objects, depth of focus (i.e. the depth of the area that is acceptably in focus) is important. The entire inscription, not just part of it, should be in focus. A narrow aperture opening (a higher f-stop number, e.g. f 22–32) renders greater depth of focus, but will increase the time needed for the exposure. With non-flat objects, it is best to focus on the median distance rather than the shortest distance, which might be the distance to the object in the center of the field of view and thus the point autofocus would give most weight. Although it is good to get as close to the runic object as possible so that it covers almost the entire field of view, there may be some distortion (and less focus) if the object continues all the way to the very edge. As far as possible, runes should be photographed at a right angle (90 degrees) to the surface; taking a picture from the side will result in a lack of proportion. For high-quality documentation of small runes, a macro lens that allows 1:1 photography is recommended as this provides excellent possibilities for enlargement. With analogue (i.e. film) cameras, the film speed (ASA or DIN rating) or sensitivity to light was important because lower speed corresponded to finer grain but this is not the case for digital cameras, where pixels per inch rating (also indicated by file size) is important for higher resolution. There is, however, some loss of image quality by significant “noise” with exposures taken at high ISO levels. Digital cameras continue to improve, and the standard noise threshold of ISO 1600 (= ASA 1600) that was valid in 2010 was already a tremendous improvement on the analogue level.

Digital photographs can be manipulated easily using Photoshop or the like. Documentation can be improved by sharpening focus, increasing contrast and adjusting brightness. Scholars should, however, beware of over-adjusting, since that can produce somewhat unnatural effects, and they should always keep the file with the original photograph.

Examples of photographic documentation

In the following, documentation by photography of various problematic aspects of runic readings will be discussed and illustrated with close-ups taken with a macro lens. The problems include: damage to characters, runes at breaks in objects, pressure marks versus cuts, dubious dotting of runes, and intersection of carved lines. The examples are taken from inscriptions on

Fig. 3. Close-up (5:1) of the middle section of runes 6–11 on side A of the fragmentary bone with inscription N 831 Trondheim showing surface damage in the vicinity of rune 9 **ḷ** **a**. © Museum of Cultural History, University of Oslo.

wood and bone from Bryggen in Bergen and from Trondheim; in addition, there is a close-up of the KJ 16 Bratsberg silver bow clasp inscription.

Inscription N 831 Trondheim, on two conjoining fragments of a cattle rib-bone dated to the first half of the 1000s, has various damaged characters at the breaks and elsewhere. Side A reads: **sq:ristisaatsumarlakantakhru...**, perhaps to be interpreted as *Sá ristí, sá at sumarlangan dag ...* ‘He carved, he who a long summer day ...’, although there are other possibilities. Suggestions were made in the preliminary manuscript for the corpus edition to consider the form of the ninth rune (the first *a*-rune, **ḷ**, of two) to be **ḷ**, and then to read it either as **o**, and interpret **soa** as *svá* ‘thus’, or as a short-twig **b**, then with **sba** as *spá* ‘prophecy’. There are small areas with surface damage in the immediate vicinity of rune 9: below the preceding *s*-rune, before the *i*-rune that precedes this, and near this *a*-rune, the lower portion of whose stave is partly eradicated (Fig. 3). The elongated damage to the *a*-rune, located on the left side below the clear branch, meets the stave slightly higher than the largely obliterated part, and runs in the same general direction as the branch on each of the *a*-runes; this is, however, also the direction of the other nearby surface scrapes. No cut is visible in the branch-like scar, which

Fig. 4. (a) Close-up (1.6:1) of the break in the stick at the end of side A of N 833 Trondheim showing runes 8–12 **riþih**, the left edge of a following stave, a thin strip where the surface has scaled off, and then the jagged break. (b) Close-up of the reverse with the runes **ast** and remains of a following stave, the left edge of which is visible in the lower part of the break. © Museum of Cultural History, University of Oslo.

should thus not be considered to be carved. The reading as **a** appears certain.

On a fragmentary flat stick from Trondheim dated to the period 1175–1275, remnants of runes are visible at the break. Side A of N 833 reads: **spyrastrīþih***..., *Spyr Ástríði h(v-)...* ‘Ask Ástríðr who/what/where/when/why ...’. At the break, the stave of a thirteenth rune is clear (Fig. 4a), and there is a well-founded supposition that it belongs to the *u*-rune of an Old Norse interrogative starting with **hu**, *hv-*. In general: Where runes have been cut or hewn, the object (be it stick or bone, or even stone) is weakened, and breaks in objects therefore frequently follow incisions. Here the break is slightly displaced from the incision, and a thin strip of the surface has scaled off to the right of the clear remnant of the stave. The break has instead followed the stave of the last rune on the reverse side, the left edge of which is somewhat visible in the bottom half of the break (Fig. 4b). The reverse reads thus: **ast***... and is incomplete. In the preliminary manuscript for the corpus publication, however, this inscription was interpreted as complete, with **ast** for *ást* ‘love’, and the entire message was put in the context of a love triangle where the recipient was requested to track the woman (to see whom she met or what she did) rather than to question her about something. In fact, the stave in the break, which indicates that the word continued, probably belongs to an *r*-rune in a repetition of the personal name from side A, thus **ast[riþr]**, *Ástríðr*. Apparently this stick was labeled so that the recipient would know to whom the question was to be posed. The runes on the reverse are spread out and the name was probably the only word there.

Pressure marks can at times be mistaken for cuts, particularly if the

Fig. 5. (a) Close-up (2:1) of the remains of runes before and after a break in the round stick with inscription N 863 Trondheim showing an apparent $\downarrow$ l right after the break. (b) Close-up with greater enlargement (2.3:1) and different lighting revealing that the apparent l-branch is in reality a pressure mark with no cut in the bottom of the groove. © Museum of Cultural History, University of Oslo.

surface cracked under the pressure. Then, however, the apparent “cut” is usually not clean and straight but jagged. On a short and broken round stick, perhaps a walking stick, with a badly damaged inscription, N 863 Trondheim, dated to the period 1050–1200, Aslak Liestøl thought he saw a long-branch (i.e. double-sided) *t*-rune right after the break in the middle of the inscription (Fig. 5a), where the left branch was visible at the edge of the break. In the preliminary manuscript for the corpus publication, an *l*-rune was the preferred reading, and the inscription, which begins with **kui:**, was interpreted as possible fragments of *qui es in coelis* ‘who art in Heaven’. In different lighting, however, it is obvious that the “branch” downward to the right at the top of the stave was in reality caused by pressure rather than being cut (Fig. 5b). There is a stave, but no l-branch. At present a short-twig (one-sided) *t*-rune cannot be confirmed on the object itself, but Liestøl’s photographs indicate that this may be a possible reading.

The dotting of an *i*-rune, which turns it into an **e**, is not always easy to confirm, for example on rune-sticks excavated from Bryggen. These objects lay in a water-logged environment for centuries, and consideration must be given to the fact that wood fibers, if they have been pushed down, rise up again if moistened. Due to the rising of wood fibers, many such dots have now all but disappeared (cf. Knirk 1998). Even obvious dotting can at times be overlooked, as it was by the author Ingrid Sanness Johnsen and the editor (myself) of the corpus publication of the ownership tag N 753 Nordre Engalgården, Bryggen. The inscription reads **þorlakramek**, *Þorlákr á mik* ‘Þorlákr owns me’, not **þorlakramik** as published there (NIyR 6: 209). The

Fig. 6. Close-up (1.6:1) of runes 7–11 in inscription N 753 Nordre Engelgården, Bryggen in Bergen, on an ownership tag illuminated with direct light, showing dotting in the groove of the next-to-last rune, thus ʏtʏ **mek**, not ʏtʏ **mik** as transrunified and transliterated in the corpus edition. © Museum of Cultural History, University of Oslo.

dotting on the stave is difficult to perceive under oblique lighting due to lack of light in the cuts, but is quite clear in the bottom of the groove with light shining directly on the stick (Fig. 6).

The *ek erilaz* inscription on the KJ 16 Bratsberg bow clasp demonstrates how the crossing of lines carved in soft metal such as silver can leave tell-tale signs of the order in which they were made (cf. Peter Pieper’s work discussed below) since slight burs, i.e. rough edges to the cut made by the engraving tool, are produced. It is obvious (Fig. 7) that the first two runes of the bind-rune were not carved as ʁ with the lower branch of ʏ subsequently added. Rather they were conceived and executed as a unit. The staves were cut first, thereafter the long branch from the top of the first all the way to the middle of the second (representing one branch of the **e** and continuing as one of the **k**), and finally the second short **e**-branch (which is also the second **k**-branch) from the top of the second back to mid-way between the two staves. The latter crosses both the second stave and the first branch. While this observation has little to contribute to the reading as such, it may be of interest in a discussion of how runes were actually carved.

A warning concerning the use of photographic documentation for examination is in order. The size of the original object must always be kept in mind when photographs are studied. For example: Attempts have been made to date medieval inscriptions on Norwegian rune-sticks typologically by rune form. On enlarged photographs scholars have noted, for example, that the form of the *r*-rune was somewhat open, not closed, something that might indicate an early dating, i.e. before the influence of roman letter forms became more pronounced in the High and later Scandinavian Middle Ages.

Fig. 7. Close-up (3:1) of the KJ 16 Bratsberg silver bow clasp inscription demonstrating how burs along cuts in softer metals can be used to determine the order of the incision of lines, particularly in the first half of the complicated bind-rune (M + < ek). © Museum of Cultural History, University of Oslo.

Such reasoning may be entirely off the mark, however, if the real height of the rune is only 1 cm, and the opening between the branch (i.e. bow and tail) and the stave is simply 1–2 mm. The observation may then tell more about the proficiency of the carver in controlling the knife than about the dating of the inscription.

It must be stressed, finally, that even though much more objective than drawings, photographs are not 100% objective. Good photographs are, however, about as close as it is possible to come to the ideal for documentation, namely 100% objectivity. Concerning more modern procedures for visual documentation, such as 3D scanning, see below.

Photographic documentation in archives

It is well known that drawings in archives, often from the 1600s, 1700s and even the 1800s, can preserve information on lost or damaged inscriptions, and archival searches are thus a necessary component of the production of corpus editions.

It is also important to consult archives for photographic documentation since, as is also well known, older photographs can preserve information which has been lost in the time that has elapsed since they were taken. This applies, however, not only to Swedish rune-stones documented photographically in the early 1900s but also to small objects, such as rune-sticks from excavations in Bergen, Trondheim, Oslo, and Tønsberg, which were unearthed during the past fifty years and are at present in storage or on exhibition in archaeological museums; these may have deteriorated, particularly those

that spent decades being preserved wet prior to conservation. Unfortunately, not all editors check archives for relatively recent pictures that may be better sources than the runes in their present state on the object itself. In particular, some runes now lost at breaks of sticks may have been present at discovery and appear on photographs taken before conservation procedures were carried out.

Photographic documentation should therefore preferably be made as soon as possible after discovery. There are simply too many examples of the deterioration of objects after they have been discovered and before they have made their way into museums and undergone the necessary conservation procedures. As conservation technicians know, initial photographic documentation should be carried out before conservation commences. Photographic documentation by conservation technicians is, however, not the same as that performed by a runologist, or by a professional photographer under instruction from a runologist.

Physical documentation

Various techniques for physically documenting runic inscriptions have been used in one form or another for centuries. Rubbings can be made, for example, or squeezes or impressions (negatives) or casts (positives) produced. Less exact and less “physical”, tracings can be made on transparent plastic film, or even on paper by feeling the lines of the runes through the paper. Particularly in the case of lost or damaged inscriptions, older rubbings, impressions and casts can constitute primary documentation.

It can be noted that Lis Jacobsen, in her important contribution to the inscription on the KJ 101 Eggja stone in 1931, extensively employed a plaster cast made of the stone. Most of the close-up photographs presented in her publication (pl. 2–8) were taken of the cast rather than the stone itself. One advantage of such a procedure is that color differences on the original no longer disturb the perception of the carved grooves. In Danmarks runeindskrifter, photographs of casts are also sometimes presented as documentation.

The different techniques and types of material used to make squeezes or impressions will only be exemplified here. Squeezes are basically made by putting a sheet of some sort of material over the inscription and then pressing it into the grooves. One of the easiest materials to use is blotting paper, which is bulky and absorbent. This should first be drenched in water, and then can be beaten into place on a rune-stone by hammering with a brush

on the reverse. After careful removal, the paper dries and becomes stiff. Although a negative of the inscription is produced, the reverse can function as a positive, especially if it was covered with a piece of cloth before the hammering began so that the bristles did not tear it up. For more complete instructions on this method, see a long footnote in Moltke's previously mentioned article (1932: 325f., n. 2). The scholar sometimes has to be inventive when making impressions. If blotting paper is not available, toilet paper can be used, but then in many layers. Even aluminum foil can be employed, but then extreme care must be taken with the brush so that its bristles do not perforate the foil. Liestøl made latex impressions and plastic lacquer casts, and published an article about this procedure in 1956. Nowadays, silicone is the preferred material for making molds, but then a conservation technician should perform the procedure. Modelling clay (or Plasticine) can also be used, especially for coins and the like, and the person doing this need not be a technical specialist.

For the physical documentation of runic inscriptions, examination is not a prerequisite. A rubbing can be made, for instance, without any idea of what the readings are, and the same is true of other forms of physical documentation. Physical documentation is also quite objective, even though it can never replace the original object. The object itself must be examined, and any new findings arrived at by studying physical documentation must be compared with the inscription on the object itself if it still exists.

There are two major problems with physical documentation. Firstly, its production can damage or lead to deterioration of the object itself. For example, silicone molds were made of 140 runic objects from Bryggen to make copies for use by both Bryggens Museum and the Scandinavian Department at the University of Bergen; incidentally, copies were made from only fifty of the forms. When making silicone molds of rune-stones, a thin film of some substance must be applied to the surface so that the silicone does not adhere to it. Unfortunately, this procedure did not work well in Bergen, or was not correctly carried out. The sticks and bones were still being preserved wet and had not yet been conserved, and it was perhaps felt that a film of water was enough to prevent adhesion – which it was not. Almost all the wooden runic objects of which such molds were made have white silicone adhering to some of the grooves, as do many of the bones. (This means that the molds and consequently several of the copies that were made are not particularly good.) Hundreds of hours have been spent cleaning the objects under a stereo microscope with a very sharp needle and pointed tweezers. Much of the rubbery, white remnants of silicon in the grooves has thus been

removed physically. Since making impressions can damage objects, it must be executed with caution.

Secondly, and perhaps just as seriously: Private individuals, many scholars, most museums and many other institutions do not consider such physical documentation to be particularly important. Therefore impressions and casts may get lost, broken, or even be thrown away. For example, Liestøl relates that he made a latex impression of the runes on the N 449 Kuli stone in the 1950s (NIyR 4: 281), before the runes were painted red at the museum in Trondheim. His impression, or any resultant plastic lacquer cast, would present a welcome correction for documentation of the inscription. The grooves are now painted, and what is seen and recorded today, also with 3D scanning (see below), is the red paint in the grooves, not the very bottom of the incisions. But at the present time, neither his impression nor any cast can be found in the Runic Archives of the Museum of Cultural History, University of Oslo.

Scientific documentation

Three rather recently developed procedures now employed for the scientific documentation of runic inscriptions are: (a) microscopic investigations, including light-section microscopy (as in Peter Pieper's work with the Weser runic bones, 1989), and other high-precision, digital microscopy, (b) laser or optical 3D scanning, and (c) Reflectance Transformation Imaging (RTI). These topics will here receive short shrift, but some general observations are still in order.

High-precision scientific instruments, in particular technically advanced microscopes, have made it possible to make minute examinations of carvings; for the current state of affairs, see Pieper 2015. For example, Pieper (2010) employed a scanning electron microscope (SEM) to identify the order of incisions in the jumble of cuts on the bow fibula from Hohenstadt (cf. Opitz 1977: 134–138). He was thus able to differentiate between layers of lines in the inscription, finding that an interpretable runic inscription had been crossed out but could be reestablished by discounting the later additions. In a lecture at the Twenty-Seventh Meeting of Field Runologists in Oslo in 2014 and in oral contributions there, Pieper emphasized that it is now possible to take extremely precise automatic measurements of, for instance, the breadth, depth, and profile of runic incisions with an advanced 3D digital microscope allowing magnification of up to 5,000 times (Keyence VHX 2000; with the Keyence VK-X 200 3D laser scanning microscope up to 24,000 times). He

expressed dissatisfaction with the general descriptions used throughout the past century, and even today, to characterize runic carvings. Most recently, for example, Michelle Waldispühl (2013: 62f.) employed the following categories for her epigraphic parameter of depth of incision: ‘very deep’, ‘deep’, ‘moderately deep’, and ‘superficial’, classifications which Pieper (2015: 338) terms arbitrary and capricious. Waldispühl provides no scientific definition of these terms and no quantification of depth.

The examination of runic inscriptions employing microscopes some 100 times stronger than the standard stereo microscope represents an exciting opportunity, but one aspect must be commented on, in particular concerning the precision of measurements. Precise measurements are important for documentation of runic inscriptions and individual runes in inscriptions. However, the simple fact that so much can be measured scientifically does not in most cases mean that such exact measurements will lead to new discoveries. Quantification in itself does not lead to new insight but must be digested and evaluated. Only in some specific instances will important new knowledge emerge from such quantification, and it is difficult to envisage how numerical information like this could facilitate better or more certain readings for any of the hundreds of inscriptions from Bryggen in Bergen. Such information is surely of much more relevance for the inscriptions on metal that Pieper has most often examined. In particular, specific measurements on such objects could, as he argues (2015: 338), lead to more precise descriptions of ductus and clearer quantified distinctions between carvings executed by different hands or with different tools.

Like physical documentation with squeezes and casts, neither laser nor optical 3D scanning nor Reflectance Transformation Imaging is dependent on examination. The two actually lead to similar results, namely a topographical representation or topographical model of the runic surface.

Laser scanning and optical 3D scanning are different but related procedures. The first employs a laser range-finder where distance is as a rule determined by trigonometric triangulation (i.e. calculated by using the angle of reflection of a laser line or point to a sensor at a known distance from the laser’s source). The second uses two technically advanced special cameras, with accompanying laser light source, which register deformation in a structured light pattern from which a computer can then calculate the distance to points in the field of view. In both, the distance from the scanner to a very high number of points on the surface being scanned is measured so that their individual *x*, *y* and *z* coordinates can be determined and a three-dimensional representation of the surface then produced. The micro-mapping of the coor-

ordinates corresponds to a geographical topographic map, and computer programs used for analyzing such maps can be employed on the data. Laser scanning has advanced greatly since the 1990s when Jan Swantesson mapped the surface of the N 449 Kuli rune-stone at the Museum of Natural History and Archaeology (Vitenskapsmuseet) at the university in Trondheim (Swantesson 1998, Hagland 1998). Laila Kitzler Åhfeldt of the Runic Unit, Swedish National Heritage Board, has also used laser scanning for documentation of and research on runic inscriptions (concerning the method see e.g. Kitzler Åhfeldt 2002: 25f.) but now employs optical 3D scanning (on which see Kitzler Åhfeldt 2013: 59f.). Recently she made an optical 3D scan of the Kuli rune-stone, both its inscription and the cross ornamentation, with twenty-five times higher resolution (and in much shorter time) than Swantesson. The results will probably provide more support for the reading of damaged runes. Using computer programs allows the scholar, among other things, to control the lighting, so that he or she sees the surface with the light coming in for instance from the upper right, or lower left, or somewhere else, at 49 degrees above the horizon, or 32 degrees, or some other height. The scholar has complete control over the light and can use dark shading to establish the rune forms, thus achieving on the computer what the runologist attempts in the field with the object itself: an examination with light from different angles and directions.

Reflectance Transformation Imaging (RTI) can be defined as “a computational photographic method that captures a subject’s surface shape and color and enables the interactive re-lighting of the subject from any direction” (Cultural Heritage Imaging’s website). The result thus appears similar to that of a 3D scan, although the technology is entirely different. The procedure, which was first developed around the year 2000 and continues to be refined, consists of initially taking a relatively large number of exposures with a digital camera. The stationary camera is mounted on a tripod, and a series of photographs is taken with light, from a flash, coming in from three or four angles (low, medium, and high; or at angles of e.g. 60, 45, 30, and 15 degrees) and from various regular points of the compass all the way round the object, for instance all twelve points on a clock face, which then will produce 36 or 48 images respectively. Each image is a two-dimensional photographic representation with varying highlights and shading due to the variation in lighting. The reflection from the flash is visible in each exposure on two black billiard balls placed near the edges of the field of vision, and the position of the shiny reflections can be used by a computer program (RTI builder) to determine the exact location of the light source for each exposure. The program can use this information, synthesizing the recorded pixel registrations from

each image, to generate a mathematical model of the surface. The reflectance information derived from the three-dimensional shape of the object is encoded in each individual pixel, which in an RTI viewer is then able to “reflect” the software’s interactive “virtual” light from any position selected by the user. Thus images can be produced on a computer screen with re-lighting from anywhere, not simply from the directions and levels that were recorded in the exposures. Recently the KJ 77 Myklebostad rune-stone from Norway was documented in this way, and the results will perhaps support suggestions for readings of extremely worn runes. The Cultural Heritage Imaging website further claims that “RTI also permits the mathematical enhancement of the subject’s surface shape and color attributes”, stating that enhancement functions can “reveal surface information that is not disclosed under direct empirical examination of the physical object”.

The results of all three of the documentary procedures discussed here are quantified and objective. They can provide sober and unbiased evidence but cannot be used on their own as proof of new readings. They must be evaluated before the results are checked against the runic object by personal examination. For example, differences in the weathering of the runic surface of the Kuli stone, where quartz crystals have not deteriorated as much as nearby areas containing softer minerals, have led to registration by 3D scanning of height differences that have nothing to do with the carving; if the real cause of such deviation is not discovered through inspection of the stone itself, study of the measurements alone can lead to incorrect conclusions. The scholar must not be blinded by the hard science represented by these procedures and accept the results as scientific proof of readings. In the humanities, the scholar must still interpret – and check – the results of scientific measurements.

The real advantage of 3D scanning and RTI is not necessarily that more can thereby be seen than on the original object or on good photographs, although this may at times be the case. It is rather that the researcher can perform the “field” examination at leisure in an office on the computer and in addition have complete control over the lighting. The scholar does the same thing as the field runologist: uses the light from all angles to call forth the best results for a reading. It is not yet clear whether these new techniques of scientific examination and documentation will allow scholars to arrive at better readings than those reached by good runological fieldwork with the naked eye and employment of the other techniques discussed in this presentation. It remains to be seen whether the “enhancement functions” of 3D scanning and of RTI will prove to be particularly useful.

Publication of documentation

Documentation is usually provided in conjunction with the publication of runic inscriptions, particularly in corpus editions, and quite often also in other scholarly works. There are various ways this can be accomplished. The following section consists of comments and suggestions concerning the presentation of such documentation.

Presentation of reading protocols has varied in the Norwegian corpus editions. In that of the older runic inscriptions (NIæR), comments were made on every rune, even if it was straightforward and there was nothing to remark on. In that of the younger runic inscriptions (NIyR), only individual runes of any special interest are as a rule commented on, a practice which seems much more reasonable. It is difficult to understand why some scholars feel they must list and discuss every rune in an inscription with such unnecessary statements, or their equivalent, as: “The *l*-rune is an *l*-rune”. This criticism applies similarly to providing individual height measurements for every single rune, even when there is only minimal difference and when the height may be determined by the constraints of the object. The average height of the runes, perhaps supplemented by the height of the tallest and the shortest rune and a specification of which these are, should suffice, at any rate if the height realistically has nothing to add to reading, interpretation, or understanding of the inscriptions.

The presentation of drawings in editions should be encouraged as a supplement to photographic documentation, in particular when the latter does not do justice to the inscription. These then help the reader to understand what he or she should try to see on the photograph. Drawings of runes can in addition substitute for transrunification, providing visual non-standardized information about the form of the runes.

The main reason for publishing photographic documentation is to allow the reader to check the readings arrived at by the editor. Photographs should provide a solid basis for further independent research. Unfortunately, much of what is provided in articles and editions as photographic documentation could better be termed illustration. Excellent photographic records are, however, no substitute for personal examination, and new readings based entirely on photos and not confirmed by personal examination of the runic object are inherently uncertain. In addition, practice in interpreting photographic documentation is necessary since mistakes can be made if expertise has not been developed.

The provision of close-up photographs whenever there is doubt about a

reading is encouraged, in so far as other documentary photographs do not provide optimal evidence. The presentation of a runic inscription, especially in a corpus edition, should be a source of as much information as possible for the reader.

Summary

The following short list is meant to function as a summary of some of the major points of this article.

- Documentation is one of the most important duties of the field runologist. Documentary work (composing reading protocols, taking photographs, etc.) should be performed as soon and as diligently as possible. Good documentation should be provided in editions of runic inscriptions. (The figures published in other presentations are frequently more illustrative than documentary.)
- Photographic documentation is not entirely objective but is the best means of traditional visual recording. Drawings of inscriptions for which there are good photographic records can be important and informative when the inscription is not adequately documented in the photographs. Thus drawings can still have a place in corpus editions. Close-up photographs should as a rule be provided for all areas where there is doubt as to reading.
- Documentation in editions should provide a solid basis for checking and evaluating readings. Documentation can be used to suggest new readings, but such proposals should always be confirmed by examination of the original.
- The employment of microscopes stronger than the stereo microscope is to be welcomed, but in many cases their use may not lead to new or improved readings. 3D scanning and Reflectance Transformation Imaging provide effective computer tools for investigation and documentation, especially if their “enhancement functions” prove to be useful for reading inscriptions. Still, nothing can substitute for personal inspection of original runic objects. All three procedures have gained a foothold in runic documentation, and will no doubt be increasingly employed.

The material in this presentation will be discussed more extensively in the Handbook of Runology which the runic project 2013–14 at the Centre for Advanced Study (= CAS), Norwegian Academy of Science and Letters in Oslo, is still hoping to prepare.

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