

The Sparlösa Monument and its Three Carvers

A Study of Division of Labour by Surface Structure Analysis

BY LAILA KITZLER ÅHFELDT

Abstract

Kitzler Åhfeldt, Laila. 2000. The Sparlösa Monument and its Three Carvers. A Study of Division of Labour by Surface Structure Analysis. Lund Archaeological Review 6 (2000), pp. 99–121

The Sparlösa stone (Vg 119) in Västergötland, Sweden, has been analysed with surface structure analysis using a laser scanner and statistical data analysis. The main issue is whether the iconography is contemporary with the older inscription, usually dated to c. 800 AD. In addition, there is a younger additional inscription of the 11th century AD, serving as an inherent method study. Another issue is to study the possible division of labour in the cutting, as opinions have been divided on this matter. Results indicate that two carvers in cooperation produced the original inscription and that the iconography can be connected to one of the older carvers. This means that if the iconography can be interpreted as heraldic signs, these must have been in use in Scandinavia as early as about 800 AD.

Laila Kitzler Åhfeldt, Archaeological Research Laboratory, Stockholm University. E-mail: laila.kitzler@arklab.su.se.

Introduction

The Sparlösa monument (Vg 119, Fig. 1, Fig. 2) in Sparlösa Parish, Västergötland, is a monument which has aroused magnificent interpretations – it has been said to represent cult practices associated with Frey, the realm of the Svear and sacral kingship, hunting scene symbolism and heroic legends. Ever recurrent is the presumed relation to the *Ynglingatal* due to the names Alrik and Erik in the inscription. In this study, the inscription and the ornaments have been examined by surface structure analysis by laser scanning and statistical data analysis (Freij 1986, 1990a, 1990b, 1996; Kitzler 1995, 1998, 2001). The aim of this method is to distinguish between individual carvers. Besides the fact that the chronological relation of the iconography to the inscription is not clear, the monument also offers a case for method study. A couple of hundred years later than the original inscription was cut, an addition

was made. Results of the analysis are also compared to earlier views of the division of labour in the cutting.

Dating

The dating of Vg 119 and its original inscription covers the period from the end of the 8th century AD until about 900 AD, with a tendency for early researchers to suggest a younger dating (Läffler 1906, p. 88; Almgren, B. 1940; Lindquist 1940). Holger Arbman dates the iconography to the end of the 8th century AD, with influence of the late Merovingian or early Carolingian style (Lindquist 1940, pp. 16 f.). The highest credibility has been accredited to Bertil Almgren's stylistic dating to about 800 AD ± 50 years (1940, p.127). Several of the motifs have their point of departure during the 8th and 9th centuries AD, but survive

into the late Viking Age (*ibid.*, p. 117). As to the depictions of birds, quadrupeds and snakes, the naturalistic trait that Almgren notices comprises two periods; the time around 800 AD and the Jellinge-Mammen style period from the 10th century AD to c. 1000 AD. What restricts the dating to the earlier of these alternatives is mainly the depiction of the house (Almgren, B. 1940, pp. 15 f.). Direct parallels to the “owl” on side III can be found, for example, on the Gandersheim casket, an English work dated to c. 770–800 AD. While Almgren finds the closest parallels to the composition of house, ship and horseman on the Gotlandic picture-stones, the “owl” and the lion cut in relief technique have their parallels in Western Europe (Almgren, B. 1940, pp. 124 f.). The ship has been compared to the ship finds of Kvalsund and Oseberg (Almgren, B. 1940, p. 115).

The original inscription of Vg 119 contains a mixture of rune-forms from both the older 24-type and the younger 16-type futharks. Von Friesen understood the monument to represent a certain stage of development of the futhark, i.e. the “common Scandinavian” (*Sw. sammnordisk*, von Friesen 1940, pp. 95 f.). However, it has been remarked that the mixture of rune-forms is not necessarily conditioned by chronology, but may mirror different schools or individual variation (Wessén 1969, pp. 23 f.; Antonsen 1998, p. 155).

Readings and interpretations

Opinions are divided as to how the inscription should be interpreted regarding the names, the kinship between the persons and what the gift might have been, which is so self-evident that it is not specified. Also unknown is what is given at *kialti* (transliteration Svärdström 1958, p. 227), in return. A frequent question is whether the names *Alrik* and *Erik* refer to kings in *Ynglingatal* and as a consequence (according to earlier research) to the *Svear*. In turn scholars have sought what this may tell us about the relationship of Västergötland to Svealand (Jungner 1938; Lindquist 1940; von Friesen 1940; Nerman 1960; Hyenstrand 1989, 1991, 1996; Westerdahl 1996; Norr 1998). Bren-

ner made the first known reading in 1669, followed by Säve in 1863 (Svärdström 1958, p. 196). George Stephens presented the first printed version in 1884, based on Torin’s drawings. In Stephens’ reading, the “Sword-wolf” gave something to his “brother in arms” (Stephens 1884 (reprint 1993, p. 252), Torin 1888). In a dialogue with Bugge, Löffler suggests that the stone had been placed on a heathen altar, later that the monument is a judicial document. Since Bugge maintains that the object is a river, their discussion also dealt with the question whether there existed a right of water ownership in the Viking Age (Bugge 1894, 1908, pp. 104 f.; Löffler 1906, pp. 85 ff.; 1908, pp. 107 ff.).

Until 1937, the rune stone had been built into three subsequent churches without anyone suspecting there was more to see than side I (Jungner 1938; Svärdström 1958, p. 213). New studies were induced on the discovery of three sides more of inscriptions and iconography. Jungner sees a sacral kingdom reflected in the verb *give* and finds in the personal names *Erik* and *Alrik* a connection to *Ynglingatal* (Jungner 1938, pp. 211 ff., p. 28). Von Friesen (1933, 1940) prefers to interpret the monument as a title deed. Von Friesen, Lindquist and Svärdström all find shortcomings in Jungner’s work (von Friesen 1940, pp. 91 ff.; Lindquist 1940, pp. 196 f.; Svärdström 1958, p. 216). Lindquist’s view seems to be that Jungner lacks a profound knowledge of Old Norse, that he is methodologically inconsistent and even violates the runic inscription (Lindquist 1940, pp. 196 f.). Jungner has come to be regarded as a not very credible interpreter of the Sparlösa inscription, but Lindquist, who worked out his own interpretation in the framework of comparative religion, shared his view that the monument reflects a sacral kingdom. According to Lindquist’s reading, *Alrik* describes himself as victorious, rich in years (*Sw. årsäll*), skilled in rune magic and the art of poetry, all manifest signs of kingship (Lindquist 1940, p. 7).

The notion that a king through the gods may give good harvests ultimately goes back to Frazer’s *The Golden Bough* (1890, abbreviated edition



Side I



Side II



Side III



Side IV

Fig. 1. The Sparlösa Monument, Vg 119. Photo 1938 by H. Faith-Ell. ATA.

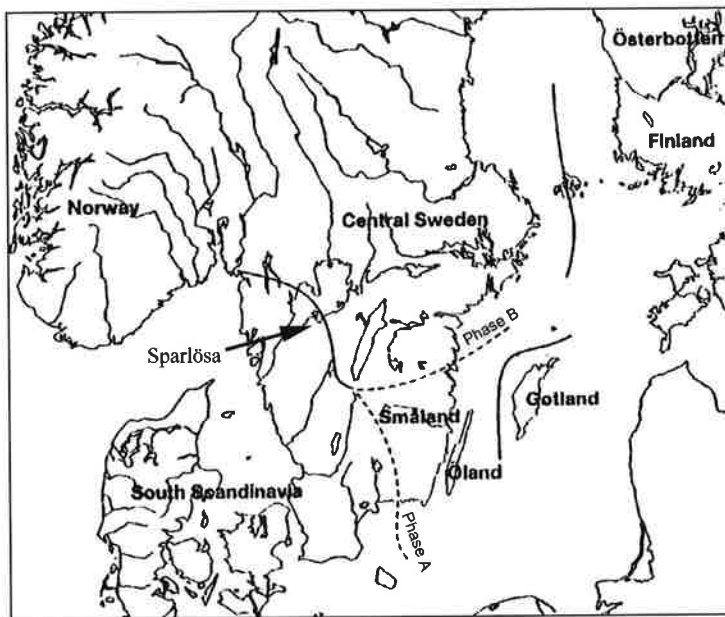


Fig. 2. Map modified after Høilund Nielsen 1997, Figure 1.

in 1922) (Lindquist 1940, p. 178; cf. Sundqvist 1997, p. 137). Lindquist's interpretation of Alrik as a king in a sacral kingdom had contemporary support in Dumézil's *Myths et Dieux des Germains* (Dumézil 1939; Lindquist 1940, pp. 180 f.). The sources on the sacral kingdom in pre-Christian Scandinavia were scrutinized in the 1960s by Baetke, who thought that the overtone of sacrality in kingship was first introduced in the Middle Ages (Baetke 1964, p. 171). However, during the 1990s, the idea of the sacral kingdom has enjoyed a renaissance (cf. Schjødt 1991; Steinsland 1991).

Alrik is understood by Nordén to be Lumber the Judge, who is mentioned in Västgötalagen (Nordén 1943, pp. 202 ff.; 1961). In Marstrand's opinion, Vg 119 is not only a written document to a still living cult practice in honour of Frey, but also an explanation for Neolithic rock art. Since the fertility cult was general for the whole of Europe, the wide chronological and cultural gap is to Marstrand of minor importance (Marstrand 1954, p. 532).

The reading of Svärdröm together with Jansson resulted in a systematic compilation of what caused the divided opinions in earlier research (Svärdröm 1958, pp. 151 ff.). Obstacles in the

interpretation are that an object of the verb *give* is missing and that one part of the carving might be understood either as an ornament or as a bind-rune for two or three runes (Svärdröm 1958, pp. 214 f.; von Friesen 1940, p. 35). The rune sequence *ubsal* cannot unquestioningly be equated with Uppsala; for example, there is no preposition (Svärdröm 1958, p. 219). The metrical structure advocated by Jungner, Lindquist and Marstrand cannot be found unless the text is violated (Svärdröm 1958, p. 228). Rather, the presupposition of the existence of metrical structure offers the possibility of freely supplying missing runes.

Hyenstrand points to the location of the rune stone in the border zone of two districts (Hyenstrand 1989, p. 38; 1996, pp. 158 f.). The situation of Vg 119 also roughly seems to coincide with the border between south Scandinavia and Central Sweden sketched by the diffusion of artefacts of Salin's Style II (Fig. 2., Høilund Nielsen 1997, p. 153, fig. 1). In Norr's dissertation (1998) on early Scandinavian kingship, early medieval ideals of kingship are extracted from written sources. The Sparlösa inscription is supposed to reflect these ideals, by telling us that a new king has seized the throne and that the preconditions for his



Fig. 3. Coin from Dorestad, Type 1, III (after Malmer 1966, Pl. 19).

legitimacy have been fulfilled (Norr 1998, p. 191). Several of the earlier researchers have connected Vg 119 to Frey via *Ynglingatal*. In Norr's view, this poem could just as well refer to Odin (Norr 1998, pp. 86 f.). It might be mentioned that in the Rök inscription, which is the closest parallel to Vg 119, Niels Åge Nielsen finds an invocation of Odin (Nielsen 1969, pp. 33 f.). Norr's version of the original inscription is:

Øjuls, Erik's son, gave, (also) gave Alrik ... gave ... in return ... Then(?) sat the father in Uppsala(?), the father who ... Nights and days ... Alrik lu[bi]R feared(?) not(?) Øjuls ... that Sigmar (or "victory-renowned") is the name of (or: "is called, may be called") Erik's son ... mighty battle(?) ... After Øjuls (this memorial is erected). And read the runes there, those that came from the gods, that Alrik lubu inscribed. (Norr 1998, p. 191)

Svärdström reads the additional inscription as:

Gisli gærði æftiR Gunnar, brodur, kumbl pessi. (Svärdström 1958, p. 229)

Gisli made this memorial(?) after Gunnar, his brother. (free translation after Svärdström 1958, p. 229)

Iconography

It has proved difficult to find close parallels to the composition of Vg 119 as a whole. The closest, but far from satisfying, parallels are the Gotlandic picture-stones. Usually, the iconographies of these are interpreted as Valhalla motifs (e.g. Almgren, O. 1940, p. 32; Ellmers 1995). The anthropomorph on side I has been interpreted as Thor (Stephens 1884, reprint 1993, p. 252), Christ (Läffler 1906, pp. 92 f.), an adorant (Jungner

1938, p. 210) or one of the parties in a land transaction (von Friesen 1940). The cross-ribbon is problematic; it has been suggested that it has been added later (Arrhenius, pers. com. 2000). The mask on side II has been interpreted by Norr as a man with a helmet, a pictorial rendering of *hilmir* as a heiti for king (Norr 1998, p. 208). On other rune stones, masks have alternately been interpreted as Odin or Christ (e.g. Carlsson & Ohlsson 1983, p. 21; Snaedal-Brink 1984, pp. 43, 73; Knudsen 1991, p. 11; Rask 1996, p. 88). Jungner explains side III as a nocturnal scene with an attacking owl (Jungner 1938, p. 227). To Åkerström-Hougen, the scene depicts a hunting bird in action, attacking a crane or a heron (Åkerström-Hougen 1981, p. 274). Although the ornamentation of side III is quite unique among rune stones, the vertical composition of side IV is the most discussed part of the iconography. Jungner understood the composition of Vg 119 side IV as a bright world in three stages with a hunting scene, a ship of the gods and a heavenly abode (Jungner 1938, p. 227). The house is probably seen from the gable, built of vertical timber and with an arched roof. The ring could be a holy ring on an altar (von Friesen 1940, p. 27). Offering a multitude of examples, e.g. from *Rigsthula* and the *Saga of Olaf Trygvason*, Karlsson interprets the ring as a door handle (Karlsson 1988, pp. 355 ff.). The house has a striking resemblance to motifs on coins from Dorestad of Type 1 III in Malmer 1966 (Pl. 19). On these coins, the stylization has been taken so far that the original word "Dorestad" in relief rather looks like an emblem whose form of the "roof" arouses associations with Vg 119 (Fig. 3). As for the ship, Westerdahl's opinion is that it connects the stone to the gods Njord and Frey (Westerdahl 1996, p. 19).

The squat quadruped is usually interpreted as a lion. In Scandinavian art, the lion mainly appears in and is incorporated into the Mammen style, but neither iconography nor style can determine the immediate European source of the motif. Vg 119 may be an early prototype (Fuglesang 1980, p. 93). It could be regarded as an early Christian symbol (Hyenstrand 1991, p. 208), but the sym-

bolic meaning of the lion is as vague as it is wide (Fuglesang 1980, pp. 92 f.; Karlsson 1988, p. 103). It looks such as the lion has been squeezed in between the ship and the horseman, as if it had been added later. However, since it has been cut in relief, this seems unlikely. It could have been of value to know whether the same carver who cut the other pictures also cut the lion, but unfortunately it was not possible to make good samples. The figure is composed of lines that are too bent and too short.

In front of the lion there runs a smaller back-looking animal. Similar motifs can be found on the Heggen vane and on a picture stone from St. Paul's in London (Fuglesang 1980). The horseman surrounded by animals has been interpreted as a hunting scene (Fuglesang 1980, p. 87; Åkerström-Hougen 1981). My opinion is that the lion and its smaller companion are parts of this hunting scene. Considering the vertical composition in combination with hunting scenes, the Pictish monuments are the closest parallels outside Scandinavia, but they are also to be found on the Isle of Man and in England (Christiansen 1997, pp. 173 f.). Besides the fact that the hunting motif represents an upper-class entertainment, Vg 119 may have a Christian iconography originating in Western Europe (Holmqvist 1952; Arrhenius & Holmqvist 1960; Kennerstedt 1985, pp. 65 f.; Hyenstrand 1989, 1991, 1996).

The intention of the hunting scene may have been to depict the legend of Didrik of Bern, whose origin is the Gothic king Theoderic (Oxenstierna 1954; Hyenstrand 1991, pp. 208 f.; 1996, p. 157). Theoderic, either as a legendary hero or as a statue, is mentioned in the Rök inscription, which is roughly contemporary with Vg 119 (e.g. Schück 1908, p. 16; Brate 1911, Ög 136, 1915; Lönnroth 1977, p. 27; Brunius 1988, p. 16; Nilsson 1995). Poetry on the subject of Didrik appears in Germany in the 7th century AD (Nielsen 1969, p. 30). In the 9th century AD, Theoderic was a personage of current interest due to the efforts of Charlemagne to revive Theoderic's ideology (Brate 1911). A common interpretation of motifs including horsemen is the Sigurd cycle (e.g.

Jacobsen 1933, p. 31), but the two legends about Sigurd and Didrik have quite likely been mixed up in the Eddic poetry (cf. Tuulse 1975). Support for the hypothesis that the hunting scene is actually meant to refer to the legend of Didrik of Bern comes from the swarm of animals together with the vegetative elements surrounding the horseman, which are associated with the scene of "The Wild Hunt". A sword might seem an unsuitable weapon for hunting, but other riders with swords that have been interpreted as pictorial renderings of Didrik have been found in the churches in Karmel on the island of Saaremaa and in Rydaholm (Tuulse 1975, pp. 65 ff.). The associations with Western Europe and the Franks further support the opinion that the legend in the 9th century AD is to be found in Scandinavian pictorial art.

Birgit Arrhenius' comment on the emblematic quality of the picture on side IV is that the presence of (royal) heraldry may imply very early state formation, and she has therefore expressed doubt as to whether the iconography really is contemporary with the original inscription (Arrhenius, pers. com. 1999). From a comparison between the pictures on Vg 119 and those of the Nordic coins before the 11th century AD (Malmer 1966), it seems likely that it is the same set of images that recurs; birds, ships, deer, houses and masks (cf. Hyenstrand 1996, p. 8). Birds in combination with a ship, as in the Sparlösa iconography, also appear on Frankish coins circulating in the same period (Malmer 1966; Åkerström-Hougen 1981, p. 274). When B. Almgren looks for models for the intertwined birds on side III, he calls the dominating bird an "owl", but the close parallel in the animals in *en face* perspective on the Gandersheim casket, he calls 'lion-heads' (Almgren, B. 1940, p. 124). Strangely enough, he does not himself draw the conclusion that the "owl" could be a fabulous animal. Fabulous animals like the griffin are common in medieval heraldry. I find it reasonable to interpret this fabulous animal, a bird with a lion-head, as a heraldic sign. Besides a hunting scene referring to Theoderic/Didrik, it seems likely that the Sparlösa monument represents early heraldic signs.

Problem

One of the problems that influence the interpretation of Vg 119 is whether the iconography can be held to be contemporary with the original inscription, and thus have an explanatory value to the text content. As pointed out by Andrén, inscriptions and ornamentation of rune stones in general have often been interpreted in isolation from one another (Andrén 2000, p. 9). Iconographically, Vg 119 is unique, and whether it should be interpreted as a result of a separate influence or in the light of the Gotlandic picture stones is not clear (Fuglesang 1980, p. 86). The stylistic dating is complicated due to the fact that from the early Mammen style to the late Ringerike style, there is a general stylistic trend with similarities between the art of the Vendel period and that of the late Viking Age (Fuglesang 1980, pp. 86 ff.). Judging by the adaptation of the runes to the ornament on side III, at least that part was cut before the inscription, while on the other hand the mask on side II seems to be adapted to the inscription. No such internal chronology can be settled for either side I or side IV, in the latter case due to the lack of an inscription. Theoretically, the iconographies of sides I and IV may have been added on a later occasion. Connected to this chronological problem is the possible division of labour in the cutting of the inscription and the ornament.

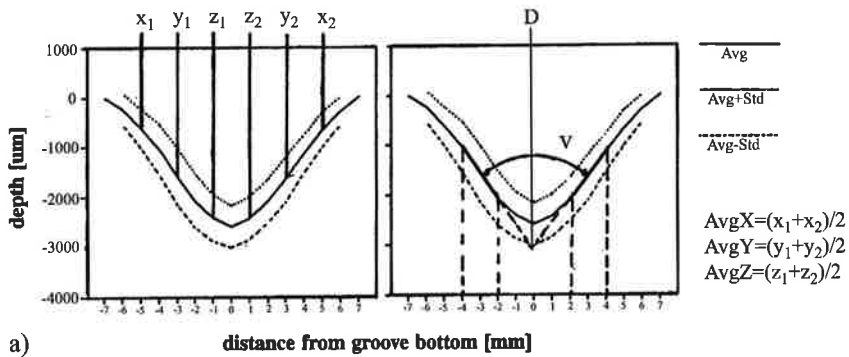
Jungner distinguishes three carvers, besides the one who made the addition with the younger *futhark*; *the artist*, *the helper* and *the vi's guardian* (Norr's translation, Norr 1998, p. 194, Sw. *vevårdaren*; Jungner 1938, p. 225). After his visual inspection he tells about the carvers' special techniques without stating on what basis he draws these conclusions. The artist made the iconography and the inscriptions on side I, side II and the rows to the left of the ornament on side III. The helper cut the inscription rows to the right of the ornament on side III. The vi's guardian is said to have carved the top inscription of side III, the "plate of the priest" (Sw. *prästtavlan*, Jungner 1938, pp. 225 ff., see Fig. 13). According to my own experience from method studies, the reason for the unevenness of the runes on the shelf may

be that it offered an uncomfortable working posture (Kitzler 1995, p.8). Lindquist held the view that two carvers had co-operated, one who wrote the "royal letter" and another who made the inscription on the shelf (Lindquist 1940). According to von Friesen, in spite of some differences there is nothing that justifies the presumption of different carvers having produced the runes and the ornament (von Friesen 1940, p. 18). Neither does Svärdström find any reason to assume more than one single carver, though she and others notice that the rune 17u differs in design from 3u (see Fig. 13; Svärdström 1958, p. 201), a fact which could possibly be suspected to reflect different individuals.

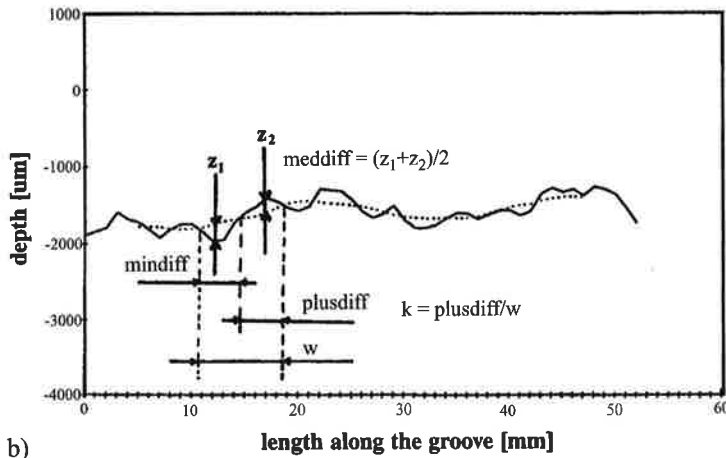
In the following, Vg 119 will be analysed in order to see whether the ornament can be connected to the original inscription by variables referring to the cutting technique. If the analysis should indicate that the same person cut the inscription and the ornament, there is still a possibility that the older inscription has been 'improved'. It might have been re-cut at the same time as the ornament was added, i.e. the ornament could still be younger than the original inscription. It is not very probable, but it is a hypothetical possibility and a critical point that could be made to the analysis.

Analysis

The method of surface structure analysis with the explicit aim of distinguishing between individual rune carvers has been developed at the Archaeological Research Laboratory at Stockholm University (Freij 1986, 1990, 1991; Kitzler 1995, 1998, 2001). Basically, the procedure is that casts in plasticine of runes and ornament are measured with a 1 mm interval by a non-touch laser scanner. The measuring accuracy of the laser probe is 0.002 mm. The measurement results in a "topographical map" of the cut mark consisting of a data matrix of height values, which can be treated by mathematical and statistical analysis. The variables used in further analysis refer to the groove shape in the cross-section of the cut mark and to



a)



b)

Fig. 4. Variables.

a) Cross-section of the cut mark. The value for each sample is the mean value of the cross-sections within the sample with 1 mm interval; e.g. for a 150 mm long sample, the value of v is based on 150 observations.

b) Longitudinal direction. The value for each sample is the mean value within the sample; e.g. for a 150 mm long sample the value of w may be based on roughly 20 observations of periods.

cutting rhythm and stroke interval in the longitudinal direction (Fig. 4.). In order to understand which variables are the most relevant to obtain certain information, method studies have been made on recently cut rune stones. These have been produced under various circumstances regarding skill, tools and cooperation. It has been found that the individual carver is best reflected by multivariate statistical analysis on a choice of variables, each representing an aspect of the cutting technique. For technical details of the equipment and sampling, readers are kindly asked to consult the above-mentioned works. I have not made any attempt at a more secure reading, as has been done by Swantesson on other rune stones with very similar equipment to that used here (Swantesson

1998). Basic concepts of statistics such as t-tests, F-values, p-levels, variance etc. are explained, for example, in Cohen & Holiday 1982.

Anyone will understand that there are abundant sources of error when one looks for individual characteristics when the participants in the cutting change tools, develop in skill and learn from one another. The ancient rune stones have also been subjected to weathering, lichens and painting. A positive factor is that method studies have shown that development and change of tools are not so fatal for the task of distinguishing individuals as there may be reason to believe (Kitzler 1998, p. 93). In addition, skilled artisans of the Viking Age may even be easier to identify than modern ones who are not rooted in tradition (cf. Hill 1978).

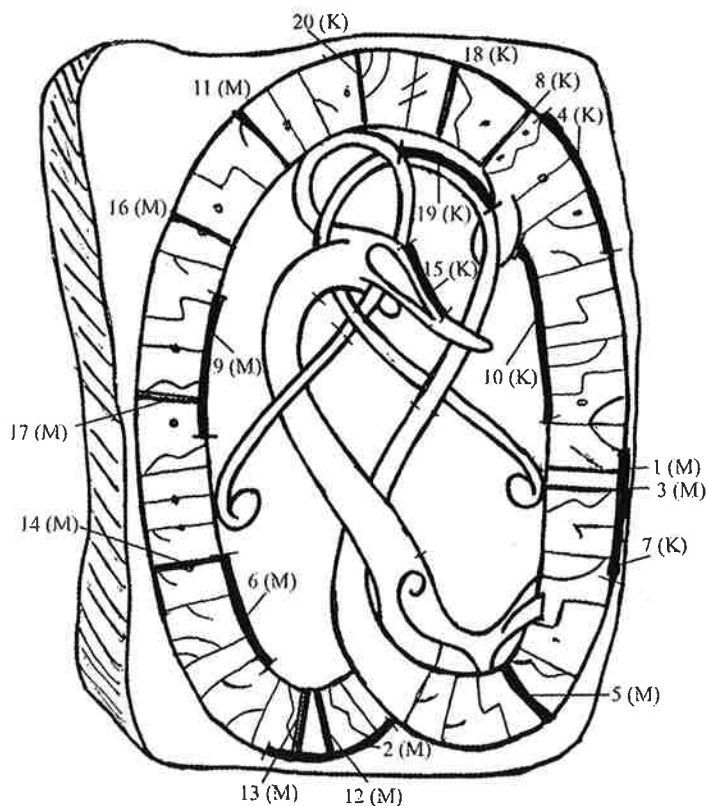


Fig. 5. K2, a rune stone cut by Kalle Dahlberg and Markus Lindberg in 1997. Samples have been marked. K= Kalle, M= Markus.

A method for measuring the degree of weathering of rock is the Schmidt Testhammer method. The principle of the method is to make an impact on the rock and measure the rebound. A higher degree of weathering gives a shorter rebound (Meurman 2000, p. 11). The results of this method are rather coarse and a great number of impacts is needed. The method has been used, for example, on silver mines in Västmanland and on rock carvings in Bohuslän (Meurman 2000, p. 22). However, a series of impacts damages the rock, so it is doubtful whether this method in its present design is recommendable for rune stones.

Method study on a recently cut rune stone

In the analysis of Vg 119, I have followed a procedure that has been formed in concordance with a recently cut rune stone, Pegasus (here named K2, Fig. 5.), cut by Kalle Dahlberg and his helper

Markus Hobring. This stone has previously been introduced in a study of how an experienced carver differ from a beginner (Kitzler 1998, pp. 91 ff.). Twenty samples have been used in the method study.

1) In the first step, only the groove shapes in the cross-section of the cut mark are considered. The groove shapes are expressed by the variables $AvgX$, $AvgY$ and $AvgZ$ (Fig. 4). Runes and ornament are separated. The aim is to find out whether more than one carver could be suspected to have worked on the carving, i.e. if there is more than one cluster (=group of near-lying samples) in the diagram. This clustering is preliminary and is suitable only for comparisons between samples from the same carving. There may be differences in the groove shapes which do not necessarily imply that there are different carvers. Therefore, the clusters should be regarded as *hypothetical* individuals, which will be checked by other variables. The

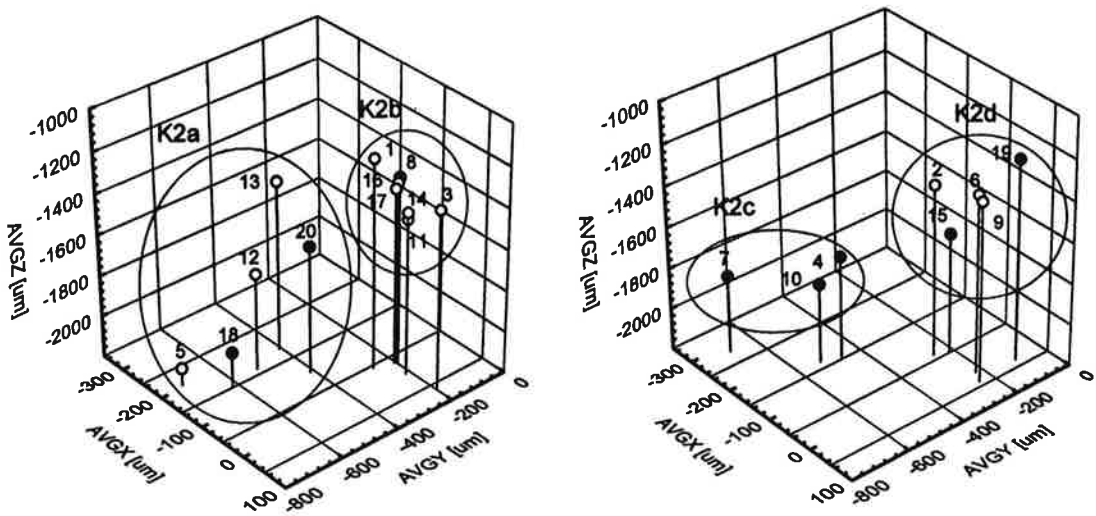


Fig. 6. Groove shape diagrams for the recently cut rune stone Pegasus, K2. Black dots=Kalle, experienced carver, white dots=Markus, beginner. a) runes b) ornament

Sample no.	Carver identity	Clustering in Groove Shape diagram var: AvgX, AvgY, AvgZ			Classification in Discriminant Analysis var: v, AvgZ, k, w		
		Cluster	Interpretation ¹⁾	Correct?	Classification ²⁾	Interpretation ¹⁾	Correct?
K2n1	Markus	K2b	M	yes	K2b	M	yes
*K2n2	Markus	K2d	M	yes	K2b	M	yes
K2n3	Markus	K2b	M	yes	K2b	M	yes
K2n4	Kalle	K2c	K	yes	K2c	K	yes
*K2n5	Markus	K2a	K	no	K2c	K	no
*K2n6	Markus	K2d	M	yes	K2b	M	yes
K2n7	Kalle	K2c	K	yes	K2c	K	yes
K2n8	Kalle	K2b	M	no	K2b	M	no
*K2n9	Markus	K2d	M	yes	K2b	M	yes
*K2n10	Kalle	K2c	K	yes	K2a	K	yes
K2n11	Markus	K2b	M	yes	K2b	M	yes
K2n12	Markus	K2a	K	no	K2a	K	no
*K2n13	Markus	K2a	K	no	K2d	M	yes
*K2n14	Markus	K2b	M	yes	K2d	M	yes
*K2n15	Kalle	K2d	M	no	K2c	K	yes
K2n16	Markus	K2b	M	yes	K2b	M	yes
*K2n17	Markus	K2b	M	yes	K2d	M	yes
K2n18	Kalle	K2a	K	yes	K2a	K	yes
K2n19	Kalle	K2d	M	no	K2d	M	no
K2n20	Kalle	K2a	K	yes	K2a	K	yes
Result		14/20 correct =70%		Result		16/20 correct =80%	

*) The classification in the Discriminant Analysis deviates from the clustering in the Groove shape diagram
¹⁾ K= Kalle, M= Markus
²⁾ The most probable alternative according to the Discriminant Analysis. The other alternatives are not listed here.

Table I. Results of method study on recently cut rune stone. The clusters in the Groove Shape diagram have an accuracy of 70% as compared to the true carver identity. These preliminary clusters are used in a Discriminant Analysis. The Discriminant Analysis reclassifies some of the samples, with a higher accuracy as a result (80%).

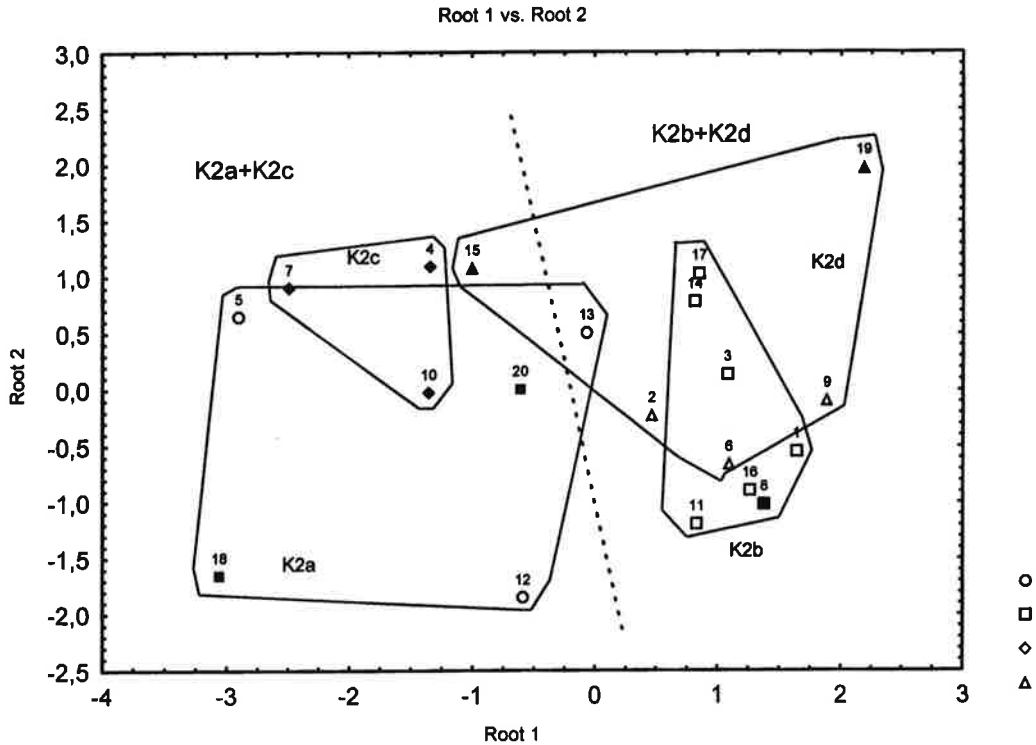


Fig. 7. Results of Discriminant Analysis of K2.

a) Graph of Canonical Scores. The dotted lines indicate the groove shape clusters. The diagram illustrates the relative distances between the clusters. Black points = samples cut by Kalle.

b) Distances between groups expressed in p-levels calculated from F-values with the relevant degrees of freedom.

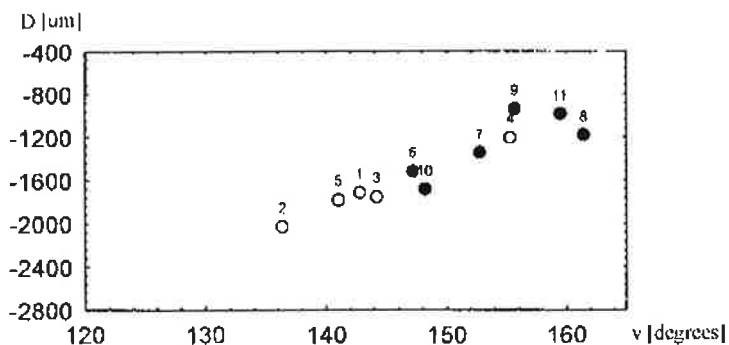
p-levels calculated from F-values; df=4,13				
	K2a	K2b	K2c	K2d
K2a		0,023	0,749	0,046
K2b	0,023		0,041	0,846
K2c	0,749	0,041		0,099
K2d	0,046	0,846	0,099	

advantage of these preliminary clusters is that the difference between the carvers is dichotomized, which will make comparisons between different rune stones easier.

Example: On the rune stone K2, four clusters may be distinguished, two in the diagram for the rune samples (K2a and K2b) and two in that for the ornament samples (K2c and K2d) (Fig. 6.). The more skilled of the carvers probably produced the deeper cut marks (i.e. to the left in the diagram). Whence, the rune cluster K2a and the ornament cluster K2c are attributed to Kalle, while K2b and K2d are attributed to Markus. This clustering in the groove shape diagrams yields for K2 an accuracy of 70% (Table I). This reflects the

fact that in reality the samples of the two carvers overlap.

2) In comparing samples from different rune stones, or runes with ornament on the same rune stone, it is necessary to take longitudinal variables into consideration as well (Fig. 4b). The preliminary clusters created above are tested by other variables. These are *v*, *AvgZ*, *k* and *w*, each representing one aspect of the cutting technique (Fig. 4.). The runes and the ornament are not separated. The clusters are entered into a *Discriminant Function Analysis* (DIS). Briefly, this method could be said to attempt to distinguish the groups of samples that have been introduced and it calculates to



a)

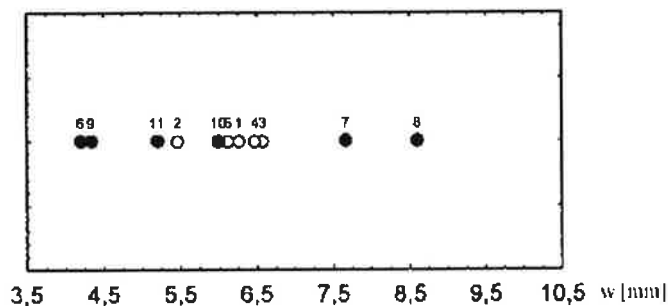


Fig. 8. Samples from the Sparlösa monument, side I. White dots = original inscription, black dots = younger inscription.

a) Groove-angle (v) vs. hypothetical depth (D).

b) Point-diagram for stroke interval (w).

what degree each variable adds to the distinguishing of one group from the rest of the data. Finally a function is created that may be used for classifying data of unknown origin. This means that DIS is a method for classification, not for clustering. The DIS analyses in this study have been performed by Standard Method, tolerance 0.01 (in Kitzler 1998, Forward Stepwise Method was used). The DIS classifies the samples according to the defined functions. This classification may differ from the preliminary clusters above. The reason is that three more aspects of the cutting technique have been included in the analysis. The classification in DIS gives an accuracy of 80% for K2, which is an improvement (Table I).

There is no straightforward way of telling whether multivariate clusters are valid. Although t-tests may tell whether there are significant differences between populations, they can only do so for each variable separately. We want to take into account the gathered argument of four aspects of the cut mark. The DIS can give an idea of the relative distances between the clusters, but it should be remembered that p-levels in a DIS cannot be regarded as just as reliable as in a t-test. It is not

correct to make regular hypothesis tests with DIS (Aldenderfer & Blashfield 1984, p. 64). The results of the DIS can be expressed in a variety of ways. The ones used here are *Graph of Canonical Scores* (Fig. 7a), *Distances between Groups* expressed in p-levels (Fig. 7b) and *Classification of Samples* (Table I). The p-levels are recalculations of the F-values. Metaphorically, the F-value expresses the relation between 'signal' (=the difference between groups) and 'noise' (=the variation within groups). A low value of p reflects a large difference between the groups. A significance level of $p < 0.1$ has been chosen, which is higher than the conventional scientific level ($p < 0.05$) (cf. Hair *et al.* 1992, p. 100). This reflects that higher accuracy cannot be expected at present due to factors such as fatigue or wear of tools influencing the result. Since this method is still being modified, it is hoped that the accuracy will be improved in future research. If p for the relation between two groups is higher than the chosen significance level, the discrimination between them will not be maintained, i.e. they will be interpreted as samples of the same population. The results have been interpreted according to how the procedure works in empirical studies of

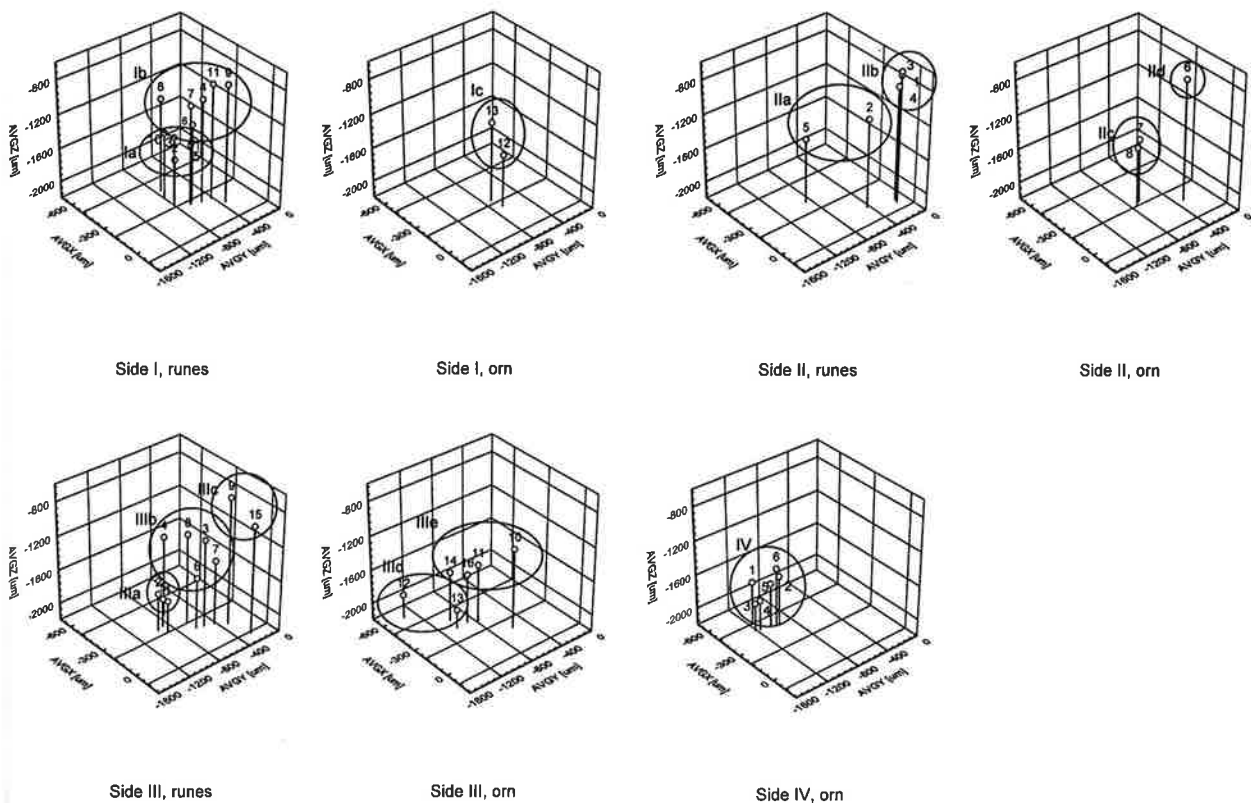


Fig. 9. Groove shape diagrams for the Sparlösa stone. a) Side I. b) Side II. c) Side III. d) Side IV.

Clusters in groove shape diagrams			Clusters after modification by DIS		
Cluster	Samples*	Runes/Ornament	Cluster	Samples*	Runes/Ornament
Ia	1.2.3.5.10	runes	Ia	1,2,3,5,10	runes
Ib	4.6.7.8.9.11	runes	Ib	4,6,7,8,9,11	runes
Ic	12.13	ornament	Ic	12,13	ornament
IIa	2,5	runes	IIab ¹⁾	1,2,3,4,5	runes
IIb	1,3,4	runes	-	-	-
IIc	7,8	ornament	IIcd ²⁾	6,7,8	ornament
IId	6	ornament	-	-	-
IIIa	1,2,5	runes	IIIab ³⁾	1,2,4,5,6,7	runes
IIIb	3,4,6,7,8	runes	-	-	-
IIIc	9,15	runes	IIIcb ³⁾	3,8,9,15	runes
IIId	12,13	ornament	IIId	12,13	ornament
IIIe	10,11,14,16	ornament	IIIe	10,11,14,16	ornament
IV	1,2,3,4,5,6	ornament	IV	1,2,3,4,5,6	ornament

*the samples are numbered within each surface of the stone

¹⁾ The distinction between the clusters IIa and IIb cannot be maintained

²⁾ One sample clusters cannot be analysed in DIS. IIc and IId have been combined.

³⁾ The samples in the cluster IIIb have been distributed on IIIa and IIIc

Table II. Clusters of samples on the Sparlösa monument.

p-levels calculated from F-values: df=4.7			
	Ia	Ib	Ic
Ia		0,024	0,968
Ib	0,024		0,262
Ic	0,968	0,262	

a)

p-levels calculated from F-values: df=4.2			
	IIa	IIb	IIcd
IIa		0,088	0,513
IIb	0,088		0,122
IIcd	0,513	0,122	

b)

p-levels calculated from F-values: df=4.4			
	IIIa	IIIb	IIIc
IIIa		0,108	0,037
IIIb	0,108		0,191
IIIc	0,037	0,191	

c)

p-levels calculated from F-values: df=4.1		
	IIId	IIIe
IIId		0,353
IIIe	0,353	

d)

Fig. 10. Results of Discriminant Analysis within each surface of the Sparlösa monument. Relative distances between groups expressed in p-levels. The groups refer to the clusters defined in the groove shape diagrams (see Fig. 7, Table I). a) Side I, runes and ornament. b) Side II, runes and ornament. c) Side III, runes. d) Side III, ornament.

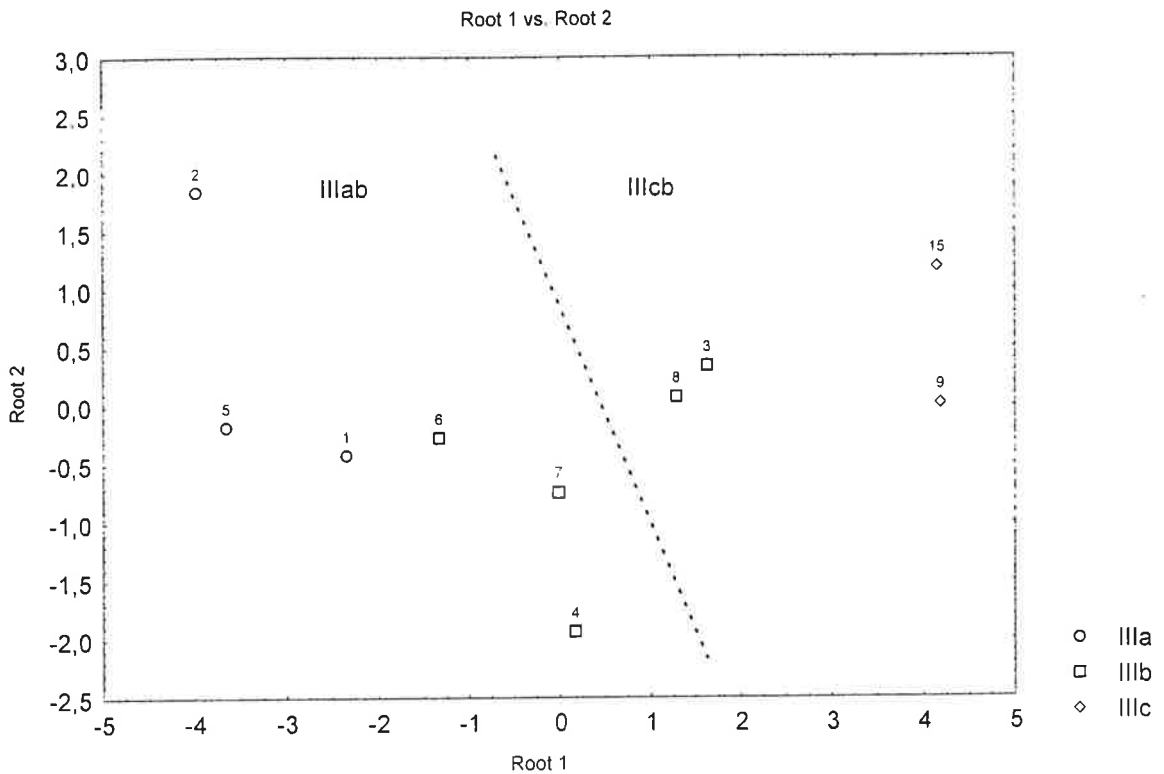


Fig. 11. Result of Discriminant Analysis for the runes on Side III of the Sparlösa monument; graph of canonical scores. The samples divide into two groups. The samples of the cluster IIIb are distributed over the two groups.

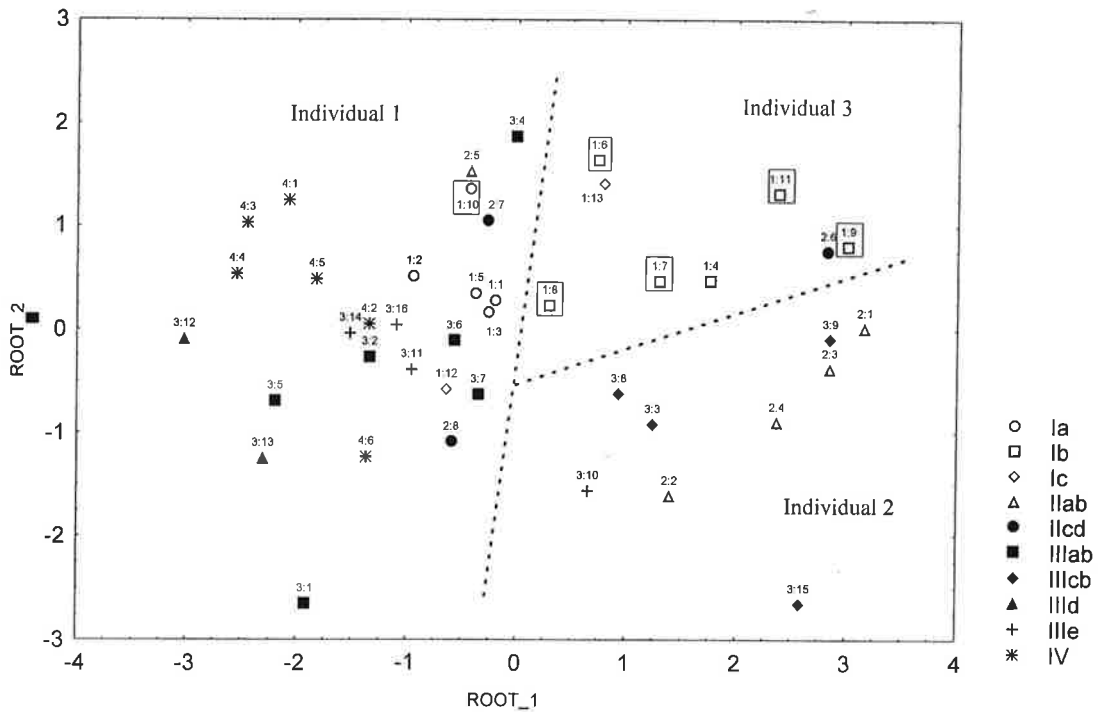


Fig. 12. Result of Discriminant Analysis of the Sparlösa monument, all sides; graph of canonical scores. Samples that diverge from the general pattern are marked by arrows.

a sample with a known division of labour.

Example: In the scatter plot of canonical scores, the four clusters from K2 seem to fall into two groups; K2a and K2c overlap one another, as do K2b and K2d (Fig. 7a). The same is expressed in the table of distances between groups (Fig. 7b), where it is clear that the distinction between clusters K2a and K2c cannot be maintained ($p=0.75$), nor that between K2b and K2d ($p=0.85$). The relative distance between the two rune clusters K2a and K2b is expressed by $p=0.02$ and the distinction is regarded as still valid. This is also the case for the two ornament clusters.

3) We assume that the left of the two groups that appear in the scatter plot of canonical scores can be attributed to Kalle (since K2a and K2c already have been attributed to him) and that the right group can be attributed to Markus. It may be noticed that there are some differences in the distribution of samples as compared to the clusters in the groove shape diagrams. Following the classifi-

cation of the DIS, an accuracy of 80% is achieved in distinguishing between the two carvers (Table I).

I have pointed out elsewhere the difficulties in comparing runes and ornament, because a skilled carver seems to develop specialized techniques for runes and for ornament (Kitzler 1998, p. 93). This example indicates that runes and ornament may be compared in this type of analysis. There is a systematic difference when two carvers cooperate; the one who cuts the deeper runes does so in the ornament as well.

Division of labour on the Sparlösa monument according to surface structure data

Forty-three samples have been collected from Vg 119, 26 of runes and 12 of ornament (Fig. 13). The following analysis is analogous to the procedure described in the method study above:

1) Preliminary clusters are defined in the groove shape diagrams (Fig. 9, Table II). During the first three centuries since its production it can be assumed that the rune stone stood in the open air, before it was put into the first church wall, probably in the 12th century AD. The varying degree of exposure might have resulted in different weathering of the four surfaces. Therefore separate groove shape diagrams have been made for each of the four surfaces. Runes and ornament have also been separated at this stage. A DIS is made for each surface. If the relative distance between the clusters is $p > 0.1$, the clusters have been combined. Rune clusters are only combined with other rune clusters, and the same goes for the ornament.

Side I: Side I has been exposed for the longest time. It is on this surface that we find the younger inscription beside the older one. Figure 8a illustrates that the older and the younger inscription on side I have different means in the groove angle v but that the populations overlap. Figure 8b makes it evident that the mean value of the stroke interval w is rather the same but that there is a difference in variance. The groove shape diagrams (Fig. 9a) indicate two clusters among the rune samples, Ia and Ib. Cluster Ib includes most of the samples of the younger inscription. There are only two samples of the ornament, and they are regarded as belonging to the same cluster, Ic. The DIS (Fig. 10a) suggests that there is a significant difference between the rune clusters. The ornament cluster is not significantly different from any of the rune clusters, which means that either of the two rune carvers of this surface could have cut the ornament.

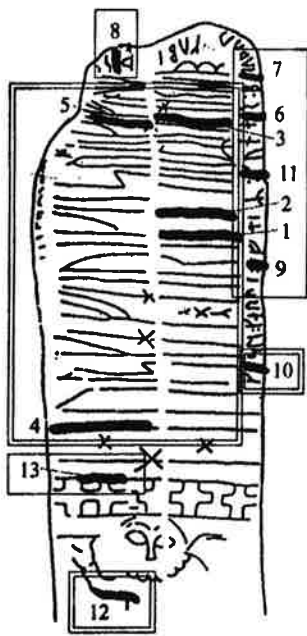
Side II: The groove shape diagrams (Fig. 9c) indicate two rune clusters, IIa and IIb, and two ornament clusters, IIc and IID. In spite of the seemingly clear division in the groove shape diagram, the distinction between the two rune clusters is not evident in the DIS (Fig. 10b). They are combined into IIab. IID includes one sample only. A one-sample cluster cannot be included in the DIS, because this method is dependent on calculating group means. One-sample clusters are also problematic because we do not know whether this sample is an outlier or if it belong to a "poorly sampled sub-group" (Aldenderfer & Blashfield 1984, p. 61; Arabia *et al.* 1996, p. 356). IIc and IID are combined into cluster IIcd, but we should be attentive to what happens to these samples in further analyses.

Side III: The groove shape diagrams (Fig. 9c) indicate three clusters, IIIa, IIIb and IIIc, and two ornament clusters, IIId and IIIE. To enhance lucidity, the DIS is performed for runes and ornament separately (Fig. 10c-d). According to the classification in DIS, the samples of cluster IIIb rather seem to be distributed on IIIa and IIIc (Fig. 11), while between there are significant differences the two latter clusters. The samples in IIIb are redistributed and the result is the clusters IIIab and IIIcb. The distinction between the ornament clusters cannot be maintained ($p=0.35$), so they are combined into IIIde.

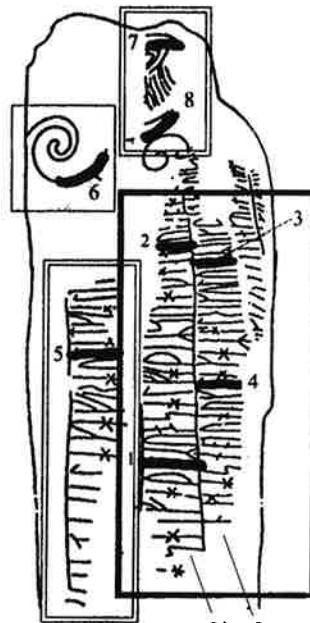
Side IV: The groove shape diagram shows a tight cluster. There is no reason to believe that more than one carver has been working on this surface (Fig. 9d).

Individual	Rune Orn	v [°]	Std	D [µm]	Std	AvgZ [µm]	Std	k	Std	w [mm]	Std	VALID N
Individual 1	runes	141.75	8.3	-1805	328	-1506	244	0.51	0.05	6.58	1.2	13
	ornament	140.03	5.1	-2082	265	-1676	169	0.49	0.06	7.25	1.2	14
Individual 2	runes	152.75	7.4	-1086	346	-921	210	0.51	0.04	7.98	0.8	8
	ornament	144.34	-	-1579	-	-1254	-	0.50	-	8.73	-	1
Individual 3	runes	155.30	5.6	-1190	243	-1013	190	0.49	0.13	6.00	2.0	5
	ornament	152.92	7.2	-1254	464	-1013	336	0.53	0.08	5.29	1.3	2

Table III. The cutting technique of the individual carvers expressed in means and standard deviations for the variables v , D, AvgZ, k and w.

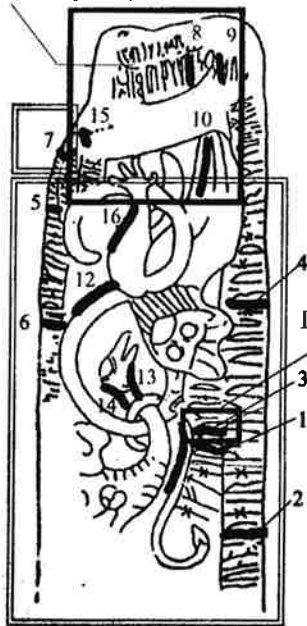


Side I



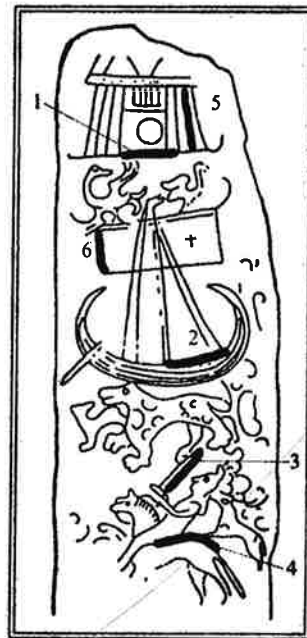
Side II

The shelf
(‘the priest’s plate’)



Side III

Individual 2



Side IV




-  Individual 1
-  Individual 2
-  Individual 3

Fig. 13. The Sparlösa monument. Interpretation of the division of labour on the Sparlösa monument according to surface structure analysis. Samples are marked by numbers. Drawing modified after Björn Himmerman and Ingrid Augustsson.

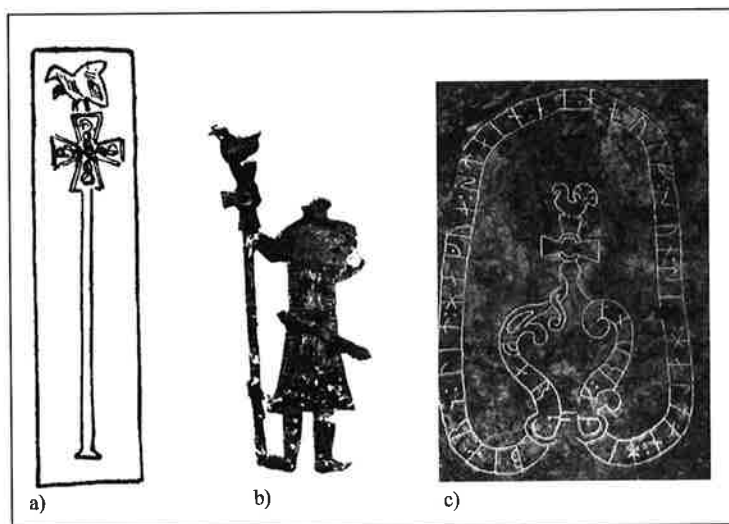


Fig. 14.

a) drawing of pilaster in Milan (after Schramm 1954, p. 241, fig. 2.)

b) 6th-century AD Langobardian bronze shield mount (after Schramm 1954, Tafel 20, Abb. 25.)

c) rune stone in Södermanland, Sö 270 (after Brate & Wessén 1924–1936).

2) At present, the relative distances between all the clusters defined above (Table II) have been investigated with DIS. The result is presented as a graph of canonical scores (Fig. 12). From this diagram, the conclusion can be drawn that the samples fall into three larger groups. On the basis of the method study above, these can be interpreted as representing individual carvers.

Result

A) Division of labour. Individual 1 and Individual 2 together produced the original inscription. The essential features are that Individual 1 cut the original inscription on side I, most of the inscription on side III and ornament on all sides. Individual 2 cut the inscription on side II and possibly some of the inscription on side III. Individual 3 cut the younger inscription on side I (Fig. 13). Four samples (1:13, 2:6, 2:5, 3:10) diverge from this generalized distribution (Figs. 12, 13). In the method study on the recently cut K2, the accuracy of the samples is about 80%. This coincides with the distribution of the samples of the younger inscription on Vg 119. With regard to the character of the material, errors in classification are perfectly normal. For example, two runes on side I (samples 1:4, 1:10) are most probably classified wrongly since the younger inscription is mixed up with the original one. For this reason it

is with reluctance that I attribute particular samples to an individual. But if the consequences of the results were to be taken at face value and the interpretation were consistent with the results, some modifications would be made to the general tendencies. These are that Individual 1 cut parts of the inscription on side II and that Individual 2 cut tail-feathers on the fabulous animal on side III. Individual 3 cut the cross-ribbon on side I and the spiral form on side II, perhaps in an attempt to repair or improve the mask.

B) Characteristics of the carvers. A comparison of the means and the standard deviation of the variables (Table III) may answer the question of how the carvers differ from one another. Individual 1 cuts the deepest and the narrowest grooves. Individual 2 cuts shallow grooves with the largest stroke interval of the two carvers. A large stroke interval may be a sign of a fast and steadily working carver at the task of the flowing lines of ornament. On the other hand, when the large stroke interval appears in combination with shallow grooves in runes, as it does here, it is more likely the sign of a beginner who lacks control over the tool. The deeper pits along the groove bottom appear irregularly and the result is a high mean value in the variable stroke interval (w). This indicates that Individual 2 is a less skilled helper to Individual 1. For the runes on the shelf, these differences may very well be due to the uncomforta-

ble working posture, but there is no reason for these differences in the cutting in the text rows on side II. Individual 3, who made the late addition, cuts with the largest groove angle. The cut marks are as shallow as those of Individual 2 but the stroke interval is short. One reason for the shallow cut marks of the later carver may be that he was forced to cut on the edge of the surface, being given an uncomfortable working posture.

C) *Coherent text blocks.* Nordén and Svärðström are both of the opinion that the carver strove to arrange the inscription so as to place coherent parts of the text on natural spaces on the stone surface (Nordén 1945, p. 57; 1961, p. 258; Svärðström 1958, p. 215). A question close at hand is whether the cooperating carvers divided the work into coherent blocks of text. To know exactly where one carver left off and another continued, the number of samples would have to extend the limitations set for this study. If it is tentatively assumed that the samples of one text row are representative of the whole text row, the results of the analysis may be interpreted as showing that Individual 2 cut rows II:2 and II:3 (Fig. 13). It has also been noticed that Individual 2 probably cut the inscription on the shelf. It might be possible to infer, with due reservation, that the carvers chose to work with coherent text blocks.

Discussion

The results of the surface structure analysis contradict earlier hypotheses about the division of labour. The results of the analysis indicate that two cooperating carvers made the original inscription as well as the major parts of the iconography. The third carver, who made the younger inscription, may have cut the cross-ribbon and a spiral form in connection to the mask. Actually, the spiral form is the very part of the ornament that suggests a possibility of a later dating. There is also a possibility that the later carver wished to improve the ornament and re-cut parts of it. There may be chronological differences distinguishable by surface structure analysis, but so far no study has been devoted to this issue. The cut marks cannot be

dated by the analysis described in this paper, but it has been concluded that the original inscription and the major part of the iconography are contemporary.

The contemporaneity of the iconography and the original inscription has the consequence that phenomena connected to the iconography can be dated to the 9th century AD, on condition that there is an independent runological dating of the inscription. Because the stylistic dating of Vg 119 has previously been used to date stages in runological development, there is a risk of arguing in circles (von Friesen 1940; cf. Antonsen 1998). If the runological dating cannot be said to be independent, a dating at least has to account for both inscription and iconography. The emblematic signs of side IV cannot be explained away as having been added on a later occasion. It is also evident that an interpretation has to consider text and ornament together (cf. Andrén 2000).

If the condition of independent dating is fulfilled, it might for example imply that heraldic signs were in use in the early Viking Age. Westerdahl and Raneke have suggested other examples of (pre)heraldic signs on rune stones (Westerdahl 1991, pp. 71 ff.; Raneke 1997, pp. 1 ff.). The parallels between pictorial renderings of Langobardian standards and the rune stones with cocks (possibly capercaillies) in Södermanland are intriguing, though they are not contemporary (Fig. 14). The weather vane in the mast of the Sparlösa ship has been proposed to be the standard of a ruler (Törnquist 1993, p. 22). Standards were doubtless used in the Viking Age but, due to their fragile character, none made of textile has been found.

In his investigation of standards of the Iron Age, Percy Schramm has found that early names for standards often coincide with denominations for burial mounds and that standards were often used in connection with burials (Schramm 1954, p. 251; cf. Ebel 1963, pp. 102 f.). The designations discussed are *tufa*, *vexillum*, *kumbl* (Anglo-Saxon *cumbol*) and *merki* (Schramm 1954, pp. 248 ff.). For example, *tufa* is used all through the Iron Age, alternately for standard and for burial

mound. Bede (c. 700 AD) reports that a *vexillum* is carried by King Edwin's retinue when he travels across his realm, and in addition that a *vexillum* was placed on King Oswald's grave. *Kumbl* appears in words such as *kuml-konunga* and *her-cuml*. *Merki* is said to be an exclusively Nordic term for standard (Schramm 1954, pp. 248 ff.). *Merki* is frequent on rune stones, but what this word possibly might imply besides the stone itself has not been investigated here.

Kumbl in runic inscriptions is usually translated as memorial or monument (Svärdström 1958, p. 229). The meaning may also be burial mound. In Västergötland, apart from Gisle's inscription on Vg 119, there are twelve more instances of *kumbl* in runic inscriptions (Peterson 1994). Among a number of other *kumbl* inscriptions in Denmark and Sweden, the word is used in the two Jelling inscriptions mentioning the two kings Gorm and Harald (Norr 1998, p. 218). Two rune stones with *kumbl* have been found on Adelsö in Uppland, where it is most likely that a state demesne was situated (Brunstedt 1996). It is striking that *kumbl* in many cases appears on "royal" rune stones. The reason may be chronological, so that the word appears on early rune stones and kings are the ones who had them erected. But it is also remarkable that in several inscriptions both *kumbl* and *stein* are used, *kumbl* usually with the verb *giardá*. While the stone is erected, cut or carved, the *kumbl* is made. It is possible that *kumbl* does not refer to the rune stones (cf. Palm 1992, p. 177) but to a heraldic sign in the form of a standard or suchlike, near the rune stone or somewhere else. So what did Gisle do, when he says to have *gærdi aftiR Gunnar, brodur, kumbl pessi* on the edge of a monument with a royal proclamation? He might have meant something else than to state that he erected this monument. Gisle need even not have been the one who cut the runes. The statement may refer to the action of placing a standard somewhere – perhaps on a burial just as on King Osmund's grave.

The scene with the horseman has been interpreted as a hunting scene referring to the legend of Didrik of Bern. This can be seen as a bridge bet-

ween the rune stones and the Romanesque art of stonemasonry, where it can be observed how the Church aims at changing pre-Christian ideals by giving a well-known legend a new content (cf. Jorn 1978, p. 13). Hedenstierna-Jonson has shown another example of this phenomenon in connection with a study of the Nordic version of the legend of St. Stephen (Sw. *Staffanskedet*, Hedenstierna-Jonson 1993, pp. 49 f.). During the Middle Age, Didrik is a symbol of pride and the dark forces chase him to Hell. The large animals he hunts show that Didrik has become arrogant (Ohlson 1991, p. 38). My suggestion is that since they could be put in relation to Didrik, at least some of the people in the parish found Didrik's pride congenial, and that the Church wanted to admonish these ideals – so improper for medieval Christianity. Meulengracht (1983, pp. 54 ff., pp. 85 ff.) has pointed out several examples of conflict between traditional self-assertion and Christian morality in the Icelandic saga literature. This conflict may possibly be the reason for the ambivalence of Didrik's characteristics inherent in the legend, noted in art and literature by e.g. Tuulse (1975, p. 65), Jorn (1978, pp. 13 f.) and Kramar-Bein (1993, pp. 114 ff.) – he appears as both good and evil. In Scandinavia, the view of Theoderic as a politically correct Christian sovereign may have survived into the 12th century AD, when the Church became opposed to this (for its own purpose) unsuitable choice of example. The degrading of a once so formidable hero as Didrik may be a result of the same reform on the part of the Nordic Church organization that might have caused the end of the rune stone tradition at the beginning of the 12th century AD (chronological end-point according to Gräslund 1992, p. 198; Fuglesang 1998, pp. 207 f.). Compare this with Zachrisson's suggestion that the pictorial metaphors of the Urnes style were accepted during the missionary period but lost their relevance when the Church was reorganized (Zachrisson 1998, pp. 159 ff.). If there is a parallel between Didrik and the riders we see on the rune stones all through the Viking Age, it may be presumed that neither the (Christian?) carvers of the 9th century AD nor those of

the 11th century had any antipathies against Didrik or the notions he represented. Hypothetically, this might indicate that the rune carvers shared the warrior ideals of the sovereigns and the upper class that the Didrik legend reflects, but at the time when the stone churches were built, an effort was made to reform this ideology in society.

References

- Åkerström-Hougen, G. 1981. Falconry as a motif in early Swedish art. Its historical and art historical significance. *Figura* 19.
- Aldenderfer, M. S. & Blashfield, R. K. 1987. *Cluster Analysis*. Quantitative applications in the social sciences 44. Beverly Hills.
- Almgren, B. 1940. Den arkeologiska dateringen av Sparlösastenen. Tillägg till v Friesen, O. *Sparlösastenen. Runstenen vid Salems kyrka, Sparlösa socken Västergötland*. Stockholm: Wahlström och Widstrand.
- Almgren, O. 1940. Resan till Valhall. *Uppländsk bygd*.
- Andrén, A. 2000. Re-reading embodied texts: an interpretation of rune-stones. *Current Swedish Archaeology* 8.
- Antonsen, E. H. 1998. On Runological and Linguistic Evidence for Dating Runic Inscriptions. In Düwel, K. & Nowak, S. (eds), *Runeninschriften als Quellen interdisziplinärer Forschung. Abhandlungen des Vierten Internationalen Symposiums über Runen und Runeninschriften in Göttingen vom 4.–9. August 1995/Proceedings of the Fourth International Symposium on Runes and Runic Inscriptions in Göttingen 4–9 August 1995*, pp. 150–159.
- Arabie, P., Hubert, L. J., De Soete, G. (eds.). 1996. *Clustering and Classification*. Singapore.
- Arrhenius, B. & Holmqvist, W. 1960. En bildsten revideras. *Fornvännen* 55.
- Baetke, W. 1964. *Yngvi und die Ynglinge. Eine Quellenkritische Untersuchung über das nordische "Sakral-königtum"*. Berlin: Akademie Verlag.
- Brate, E. 1911. *Östergötlands runinskrifter*. Granskade och tolkade av E. Brate. Sveriges runinskrifter 2. Stockholm.
- Brate, E. 1915. Rökstenen och Teoderiksstatyn i Aachen. *Eranos* XV.
- Brunius, T. 1988. Ryttaren på Rökstenen. Ålder och innebörd. *Samlaren* 109.
- Brunstedt, S. 1996. Alsnu Kungsgård. Forskningsprojekt Hovgården. UV Stockholm, Rapport 1996:71/1 (2).
- Bugge, S. 1908. Sparlösa-Indskriften. *Västergötlands fornminnesförenings tidskrift* 2:8 & 9.
- Carlsson, I. & Ohlsson, B. E. 1983. *I vikingarnas spår. En färd till runorna i Eskilstuna kommun*. Eskilstuna.
- Christiansen, I. M. 1997. Alstadstenen – et eksempel på europeisk jagtikonografi. In Fuglesang, S. H. (ed.), *Bilder og bilders bruk i vikingtid og middelalder*. KULTs skriftserie 84. Norges forskningsråd. Oslo.
- Cohen, L. & Holliday, M. 1982. *Statistics for Social Scientists*. London: Harper & Row
- Dumézil, G. 1939. *Myths et Dieux des Germains: essai d'interprétation comparative*. Mythes et Religions 1. Paris.
- Ebel, E. 1963. *Die Terminologie der Runentechnik*. Göttingen.
- Ellmers, D. 1995. Valhalla and the Gotland Stones. In Crumlin-Pedersen, O. & Munch Tye, B. (eds.), *The Ship as Symbol in Prehistoric and Medieval Scandinavia*. Studies in Archaeology & History 1. Copenhagen: Nationalmuseet.
- Frazer, G. 1890. *The Golden Bough. A Study in Comparative Religion*. London.
- Freij, H. 1986. Viking ristade och Grimulv. Studier av runstenarnas spårprofiler och huggmärken. *Laborativ arkeologi 1*. Arkeologiska forskningslaboratoriet. Stockholms universitet.
- Freij, H. 1990a. Dokumentation och analys av arkeologiska ytstrukturer. *Laborativ arkeologi 4*. Arkeologiska forskningslaboratoriet. Stockholms universitet.
- Freij, H. 1990b. Tracing a Rune-Carver by Groove Profile and Cut-Marks. *Norwegian Archaeological Review* 23:1–2.
- Freij, H. 1996. Studier av runstensspårs profiler och huggmärken. Unpublished manuscript.
- von Friesen, O. 1933. *Nordisk kultur* 6. *Runorna*. Stockholm: Bonniers.
- von Friesen, O. 1940. *Sparlösastenen. Runstenen vid Salems kyrka, Sparlösa socken Västergötland*. Stockholm: Wahlström och Widstrand.
- Fuglesang, S. H. 1980. *Some Aspects of the Ringerike Style. A phase of 11th century Scandinavian art*. Odense: Odense University Press.
- Fuglesang, S. H. 1998. Swedish Runestones of the Eleventh Century: Ornament and Dating. In Düwel, K. & Nowak, S. (eds), *Runeninschriften als Quellen interdisziplinärer Forschung. Abhandlungen des Vierten Internationalen Symposiums über Runen und Runeninschriften in Göttingen vom 4.–9. August 1995 Proceedings of the Fourth International Sympo-*

- sium on Runes and Runic Inscriptions in Göttingen 4–9 August 1995.*
- Gräslund, A.-S. 1992. Runstenar – om ornamentik och datering II. *Tor* 24.
- Hair, J. F., Anderson, R. E., Tatham, R. L., Black, W. C. 1992. *Multivariate Data Analysis With Readings*. New York.
- Hedenstierna-Jonson, C. 1993. Staffansvisan. C-uppsats. Konstvetenskapliga institutionen. Stockholms universitet.
- Hill, J. N. 1977. Individuality in Motor Performance. In Hill, J. N. & Gunn J. (eds.), *The Individual in Prehistory. Studies of Variability in Style in Prehistoric Technologies*. New York.
- Høilund Nielsen, K. 1997. Retainers of the Scandinavian Kings: An alternative interpretation of Salin's Style II (Sixth-Seventh centuries AD). *Journal of European Archaeology* 5:1.
- Holmqvist, W. 1952. Ryttaren från Möjbro. *Fornvännen* 47, pp. 241–262.
- Hyenstrand, Å. 1989. *Sverige 989. Makt och herravälde*. SAR No. 24. Stockholms universitet.
- Hyenstrand, Å. 1991. Iconography and Rune Stones: The example of Sparlösa. I: Wood, I. & Lund, N. (eds.): *People and Places in Northern Europe 500–1000. Essays in Honour of Peter Hayes Sawyer*.
- Hyenstrand, Å. 1996. *Lejonet, draken och korset. Sverige 500–1000*. Lund: Studentlitteratur.
- Jacobsen, L. 1933. Evje-stenen og Alstad-stenen. In Brøgger, A. W. *Norske Oldfunn. Avhandlingar utgitt av Universitetets Oldsaksamling*. Oslo.
- Jorn, A. 1978. *Folkekunstens Didrek*. Copenhagen: Per-mild & Rosengreen.
- Jungner, H. 1938. Sparlösa-stenen. Västergötlands Rök – ett hövdingamonument från folkvandringstiden. *Fornvännen* 1938:4.
- Karlsson, L. 1988. *Medieval Ironwork in Sweden I*. Kungl. Vitterhets Historie och Antikvitets Akademien. Stockholm: Almqvist & Wiksell International.
- Kennerstedt, L. 1985. Den triumferande ryttaren i Fardhem. *Konsthistorisk tidskrift* LIV 1985:2.
- Kitzler, L. 1995. Ytstrukturanalys av Hillersjö-ättens runstenar samt av runstenar vid Hilleshög kyrka. *C/D-uppsatser i laborativ arkeologi. Läsåret 94/95* vol. I. Arkeologiska Forskningslaboratoriet. Stockholms Universitet.
- Kitzler, L. 1998. Learning to know a rune carver and his cutting technique. A method study and some results. *Laborativ arkeologi. Journal of Nordic Archaeological Science* 10–11. Archaeological Research Laboratory. Stockholm University.
- Kitzler, L. 2000. Surface Structure Analysis of Runic Inscriptions in Rock. A method for distinguishing between individual carvers. *Rock Art Research* 17:2, pp. 85–98.
- Kitzler, L. 2001. Öpir – A Workshop for Rune Stone Production in 11th c. AD Central Sweden. A study of division of labour by surface structure analysis. *Acta Archaeologica*. Copenhagen. In press.
- Knudsen, S. A. 1991. *Runestenen fra Makt*. Særtryck af årbog for kunst- og kulturhistorie. Ribe Amts Museumstråd.
- Kramarz-Bein, S. 1993. Zum Dietrich-Bild der Pidreks-saga. In Glienke, B. et al., *Arbeiten zur Skandinavistik 10. Arbeitstagung der deutschsprachigen Skandinavistik 22.–27.9.1991 am Weißenhäuser Strand*. Frankfurt.
- Läffler, F.L. 1906. Om Sparlösa-stenen, dess två runinskrifter och dess bildfält. *Västergötlands fornminnesförenings tidskrift* 2:6 & 7.
- Läffler, F.L. 1908. Om Sparlösa-stenens äldre runinskrift II. *Västergötlands fornminnesförenings tidskrift* 2:8 & 9.
- Lindquist, I. 1940. *Sparlösa-stenen. Ett svenskt runmonument från Karl den Stores tid upptäckt 1937. Ett tydningförslag*, Religiösa runtexter II. Skrifter utgivna av Vetenskaps-societeten i Lund 24. C.W.K. Gleerup. Lund.
- Lönroth, L. 1977. The Riddles of the Rök-Stone: A Structural Approach. *Arkiv för nordisk filologi* 92.
- Malmer, B. 1966. *Nordiska mynt före år 1000*. Lund.
- Marstrander, C. J. S. 1954. Om innskriftene på Sparlösa-stenen. *Norsk tidskrift for sprogvidenskap* XVII, pp. 503–535.
- Meulengracht, P. 1983. *The Unmanly Man. Concepts of sexual defamation in early Northern society*. Odense.
- Meurman, R. 2000. *Silverberg i järnbävarland*. OPIA 21. Occasional Papers in Archaeology. Uppsala.
- Nerman, B. 1960. Alarik och Erik. *Fornvännen* 55, pp. 34–37.
- Nielsen, N.Å. 1969. *Runerne på Rökstenen*. Studies in Scandinavian Languages 2. Odense University.
- Nilsson, O. 1995. Ryttaren på Rökstenen – Teodorik- versen och dess gåtor. C-uppsats. Institutionen för arkeologi. Stockholms universitet.
- Nordén, A. 1943. 'Vi'-föreståndarens runstenar. Kring Kälvesten-, Sparlösa- och Rökinskrifterna. *Bidrag till svensk runforskning* 2. Antikvariska studier I, KVHAA Handlingar 55, pp. 183–231 + 18 plates. Stockholm.
- Nordén, A. 1945. Rökstensingressen än en gång. *Fornvännen* 40, pp. 57–59.
- Norr, S. 1998. *To Rede and to Rown. Expressions of Early*

- Scandinavian Kingship in Written Sources*. Opia 17. Department of Archaeology and Ancient History, Uppsala University. Uppsala.
- Ohlson, E. 1991. Den vilda jakten. En studie kring fasadrelieferna på Grötlingbo kyrka, Gotland. C-uppsats. Konstvetenskapliga institutionen. Stockholms universitet.
- Oxenstierna, E. 1954. Ryttare och hjortar på nordiska gravstenar. *Fornvännen* 49, pp. 322–330.
- Palm, R. 1992. Runor och regionalitet. Studier av variation i de nordiska minnesinskrifterna. Runrön 7. Institutionen för nordiska språk. Uppsala universitet.
- Peterson, L. 1994. *Svenskt runordsregister*. Andra reviderade upplagan. Runrön 2. Uppsala.
- Raneke, J. 1997. Forntidsdjur och landssymbol – något om djurbilder och heraldiska vapen. *Ale. Historisk tidskrift för Skåne, Halland och Blekinge* 1997:4, 1–5.
- Rask, L. 1996. *Nordisk runläsebok*. Stockholm.
- Schjødt, J.P. 1991. Fyrsteideologi og religion i vikingetiden. In Iversen, M. (ed.), *Mammen. Grav, kunst og samfund i vikingetid*. Jysk Arkæologisk Selskabs Skrifter XXVIII. Moesgård.
- Schramm, P.E. 1954. *Herrschaftszeichen und Staatssymbolik* I. Stuttgart: Hiersemann Verlag.
- Schück, H. 1905. Studier i Ynglingatal. *Uppsala universitets årsskrift*. Program 3.
- Schück, H. 1908. Bidrag till tolkning av Rök-inskriften. *Uppsala universitets årsskrift*. Program 3.
- Snaedal-Brink, T. 1984. *Runstenar i Södermanland. Vägvisare till runristningar i Södermanlands län*. Nyköping: Södermanlands museum.
- Steinsland, G. 1991. *Det hellige bryllup og norrøn kongeideologi. En analyse av hierogami-myten i Skírnismál, Ynglingatal, Háleygjatal og Hyndluljóð*. Oslo: Solum.
- Stephens, G. 1884 (1993). *Old Northern Runic Monuments* 3. Reprint. Felinfach: Llanerch.
- Ström, F. 1954. *Diser, normor och valkyrior: fruktbarhetskult och sakralt kungadöme i Norden*. Stockholm.
- Sundqvist, O. 1997. Runology and history of religions. Some critical implications of the debate on the Stentofte inscription. *Blandade runstudier* 2. Runrön 11. Institutionen för nordiska språk. Uppsala universitet.
- Svärdström, E. 1958. *Västergötlands runinskrifter. Tredje och fjärde häftet. Skaraborgs läns runstenar, Ålvsborgs läns samt Göteborgs och Bohus läns runstenar*. Sveriges runinskrifter, utgivna av Kungl. Vitterhets Historie och Antikvitets Akademien 5. Uppsala.
- Swantesson, J. O. H. 1998. Läsning av inskriptioner med hjälp av mikrokarteringsteknik. In Hagland, J.R. & Dybdahl, A. (eds), *Innskrifter og datering*, pp. 115–128. Senter for middelalderstudier. Skrifter 8. Trondheim.
- Sö + no. *Södermanlands runinskrifter*. Granskade och tolkade av E. Brate och E. Wessén. Sveriges runinskrifter 3. Stockholm 1934–1936.
- Torin, K. 1888. Västergötlands runinskrifter nr 87. *Västergötlands fornminnesförenings tidskrift*.
- Törnquist, L. 1993. Sjökonungens märke och riddarens baner. Nordiska, särskilt svenska fälttecken under forntid och medeltid. C-uppsats. Konstvetenskapliga institutionen. Stockholms universitet.
- Tuulse, A. 1975. Didrik av Bern och Norden. *Konsthistorisk tidskrift* XLIV:3–4.
- Wessén, E. 1969. *Från Rök till Forsa. Om runornas historia under vikingatiden*. Filologiskt arkiv 14.
- Westerdahl, C. 1991. Före heraldiken. *Aktuellt* 1991. Marinmuseum. Karlskrona.
- Westerdahl, C. 1996. Sparlösastenen. Symboler och "politiska" attityder i tidig vikingatid. *Västgötabygden* 5:96.
- Zachrisson, T. 1997. *Gård, gräns, gravfält. Sammanhang kring ädelmetalldepåer och runstenar från vikingatid och tidigmedeltid i Uppland och Gästrikland*. Stockholm Studies in Archaeology 15. Arkeologiska institutionen. Stockholms universitet.