A symmetry analysis off early mediaeval ormameimtation

Ebeling, Bianca-Sophie

A Symmetry Analysis of Early Mediaeval Ornamentation

by
Bianca-Sophie Ebeling

Abstract

The aim of this thesis is to test the appropriateness of symmetry analysis as a method for the systematic classification of Early Mediaeval ornamentation. This method is different from the traditional Montelian concept of formal classification in archaeology, in that the stylistic entities are not chosen according to the formal similarity of individual motifs and motif-elements, but according to the formal similarity of their symmetrical organisation within an ornamental pattern. It is suggested that symmetry analysis is a more objective method of classifying and analysing ornamentation, as it avoids the subjective selection of typological elements, and therefore also avoids one of the pitfalls of typological classification caused by the ambiguity of the concept of style. Washburn, the originator of this method has suggested that in this way hypotheses can be tested regarding the identity as well as the interaction or information exchange of individuals belonging to a certain cultural, ethnic or social group. In order to test the usefulness of symmetry analysis in relation to these proposals for archaeological research, garnet jewellery from the Merovingian period as well as two manuscript paintings from the Gospel-books of Lindisfarne and Kells have been analysed and compared. It was concluded that the structure of the design-fields of the different types of artefact is one of the main factors for the appearance of certain symmetries within the ornamental context of the artefacts. However, the analysis could also indicate that the method has the potential to classify decorated artefacts according to different regions and workshops of production, and even according to their different social milieu of production. It is concluded that a larger quantity of material has to be analysed in order to get conclusive results from the symmetrical analysis in relation to the latter aspects of investigation, and with regard to the other original proposals made by Washburn.

Acknowledgements

First and foremost I want to thank Dr. Dorothy Washburn in her role as an authority in the subject of symmetry analysis of ornamentation (in both anthropological and archaeological contexts), as well as a woman with great compassion, for the personal support she gave me in my efforts to prove the value of this thesis to 'academia'. I, naturally, thank both Prof. Rosemary Cramp (Dept. of Archaeology) and Dr. Robert Layton (Dept. of Anthropology) for their supervision of my research for this thesis. I was happy to receive both their help and encouragement in setting up the analysis and in applying the method of symmetry analysis to Anglo-Saxon art and I am much indebted to Dr. Layton who set me on the path towards this interesting way of seeing and analysing art. I am also very grateful to many of my friends, who study at various Departments at the University of Durham and who have helped me in various ways ensuring the successful submission of this thesis. Thus, I am especially grateful to Caroline Stockmann for her proof reading and also thank Dr. Susanne Schech (Dept. of Geography), N.L.A. Karunaratne (Dept. of Geography), Dr. Paulo Salucci (Dept. of Physics), and Beate Renner M.A. (Seminar for Ur-und Frühgeschichte, University of Götingen). I am greatful also to my collegues, the postgraduate students of physical anthropology Tracy Elliott, Jenifer Thomson and Cyndy Winter for providing a pleasant working atmosphere in room no.4, 45 Old Elvet where most of this work has been arranged, written and completed.

Contents

Chapter three

Chapter four

Chapter five

List of Plates

List of Figures

Chapter one

The concept of style

Style is a beautiful
ship drifting on the
deep blue sea of art

1. *Introduction to the aim of the thesis*

The aim of this thesis is to test the appropriateness of symmetry analysis as a method for the systematic classification of Early Mediaeval ornamentation. The method, which has been developed by the American anthropologist Washburn, in cooperation with the mathematician Crowe, has recently been publicised in the book *Symmetries of Culture* (1988) to a wider academic audience as a more objective system of analysing patterns than those already existing. It is based on the evidence that symmetry plays a key role in perception allowing human individuals and groups to organize and exchange information. Thus Washburn suggests that by using the method of symmetry analysis in archaeological research, hypotheses can be tested regarding the identity as well as the interaction of individuals belonging to a specific cultural, ethnic or social group. Symmetry analysis is also proposed here as the first method which enables a) the systematic stylistic comparison of ornamentation executed within different media and b) the systematic stylistic comparison of ornamentation found on different types of artefacts with different design-fields. A test has been designed in order to evaluate the two propositions made above for the purpose of stylistic classification in archaeology using examples of Merovingian garnet jewellery as test material. In order to test Washburn's propositions further garnet jewellery from the Sutton Hoo ship-burial and the Chi-Rho illuminated pages from the Lindisfarne Gospels and the Book of Kells have been analysed and compared.

2. *Previous attitudes towards the comparison of art forms in archaeology and Early Mediaeval art*

In his work *The Insular Gospel Books 650-800* Henderson attempts to discover where in the monastic confederation (familia) of St Columba the *Book of Durrow* was made. The answer for Henderson lies geographically in favour of England, and more specifically Northumbria and he proceeds to support his hypothesis with the following observations about style: "The objects in the pagan royal burial at Sutton Hoo in East Anglia and the style of the decorations in the Book of Durrow resemble each other. [Thus] the rectangular mounts and pyramidal mounts from the Sutton Hoo sword-belt are like the objects laid on a bed of interlace in the Durrow carpet-page (f.125r). The painted objects or ornaments are deliberately decorated like the interior of the irregular hexagon ornament on the purse-cover. The square blocks of the eight-centered cross on f.IV have minute panels of chequers, like the millefiore glass settings in the conical studs" (1987:32). Henderson goes on to compare the scabbard bosses from Sutton Hoo with the ornaments in the centre of the St. John's Gospel carpet-page, and states that "the symmetrically placed short and long ribbon-beasts on the St. John's Gospel carpet-page are closely paralleled by the two varieties of creatures on the Sutton Hoo purse-cover, [and that] the idea of a carpet-page has a reasonable parallel in the rectangular framed, over-all treatment of the Sutton Hoo shoulder-clasp" (ibid). Precious metalwork is not all that Henderson invokes in characterising the style of the *Book of Durrow* and in order to establish the similarity of motifs and patterns. He also refers to the possibility that the mechanical aspect of the production of chains may have inspired certain forms of interlace ornamentation in manuscripts. He writes: "The designs in the manuscript are dominated by interlaces, of varying, contrasting weights and widths. The most striking ornamental analogy to this feature of the Book of Durrow is in the reconstructed wrought-iron suspension gear associated with the largest cauldron, of which the chains show varied textures and patterns "(ibid). Finally, he claims that "when hanging-bowls are invoked as analogies for the spiral patterns in Durrow, we also invoke by association suspension devices, perhaps chains or ropes "(ibid).

Henderson establishes here stylistic similarities, or analogies, between motifs, patterns and their formal quality of shape and outline in different material and from different social provenance, and draws conclusions suggesting their connection in art-historical terms. He supports these comparisons and analogies, citing different examples of internal stylistic evidence drawn from each of the different ornamentations. Nevertheless, this drawing of analogies is not based primarily on formal stylistic evidence, but is dependent on social historical reasoning. Thus Henderson justifies the relevance of similarity in patterns from different material provenances, e.g. precious metalwork from *Sutton Hoo*, and the paintings in the *Book of Durrow* on the grounds of the importance of the smith and his role in early Christian society: "such people were socially important, and their technology, which was ubiquitous, was probably influential visually when it came

to the ornament in other crafts and arts" (1987:34). When he comes to explain the similarities of the ornamentation within the context of the different social circumstances in which the *Sutton Hoo* artefacts and the ornamentation of the *Book of Durrow* have been produced, Henderson proceeds again on purely historical grounds. This time he regards the social function of a royal institution as a determining factor: "... the function of institutions like Lastingham in respect of the patron must be one of the reasons why secular decoration intruded into church use" (1987:pp.36). Another example of the establishing of stylistic similarity through historical reasoning is provided by Dodwell who quotes a variety of literary sources to support the hypothesis that secular craftsmen had an influence on monastic art styles and that there were commonly shared ideas and tastes prevalent in both of these socially different sectors (1982:12f). Again the socially important role played by the goldsmith in Anglo-Saxon society is stressed as well as the importance of work comission for "monasteries and churches by lay patrons who made use of lay artists" (1982:23). Evidence of the stylistic relationship between the ornamental layout of different media may come, according to Dodwell, from other historical sources which confirm that goldsmiths were often also painters: "We know indeed that in the Late Saxon period goldsmiths could be painters: the only two goldsmiths of whom we have extended accounts, Spearhafoc and Manning, are also described as painters: painters of manuscripts...In all this there is an encouraging element since, if goldsmiths did turn their hands to painting, then we can get some idea of the engravings on the lost shrines, reliquaries, altars, vessels and so on, from the manuscript-paintings and drawings that survive. Indeed the dynamic lion on the *Echternach Gospels* has itself all the appearance of a vigorous brooch, and many gilded illuminations have obvious associations with goldsmith work" (Dodwell 1982:82).

Henderson and Dodwell are cited here as examples of recent authorities but earlier writers also, such as Bruce-Mitford (1978) and Kendrick (1938) who base their conclusions about stylistic similarity partly on historical explanations, but also compare motifs and patterns which are executed in a different medium, with different methods of production within different design-fields as well as within different social circumstances of production and creation. Art-historically and historically these comparisons may be justified, and the hypotheses concerning stylistic relationships based on these may be valid judgements. There is at present, however, no way of testing these art-historical hypotheses empirically. Symmetry analysis, which will be used in this thesis seems to be a method of analysis suitable for such an empirical task. With such a method hypotheses could be established on the basis of empirical stylistic evidence regarding the possible reasons for the stylistic relationship between different media. Before the method is introduced here, however, it is necessary to deal with previous methods of archaeological classification, concepts of analysis and the methodological problems which developed therefrom.

3. *General problems in the formal analysis of art in archaeology and the history of art*

The basic concepts of artifact classification are those of *similarity* and *dissimilarity*. Müller was one of those who at an early stage clearly emphasized the importance of the concept of similarity within archaeological material research: "Where there is similarity, there must be relationship, a connection of some kind or other. This is an assumption as necessary to Man as that we live in an orderly world" (1884:194). In the context of archaeological material research the delineation and grouping of 'types' is considered as the most important phase in the process of comparing artefacts and establishing their degree of similarity. 'Similarity' combined with 'typology' is used as a concept in order to compare the formal properties of artefacts so that hypotheses may be made as regards their relationship to other forms of similarity such as in time, use, terminology and environment. In his revision of the foundation of material research in archaeology, Malmer specifies three different kinds of typological similarity. Thus 'physical similarity' of artefacts permits the distinction of artifact types (object types). On the basis of 'similarity of find combinations' the distinction of types of find combinations (e.g. razor, pair of tweezers and awl; wine dipper and strainer) and also grave types and habitation site types are established. 'Chorological similarity' then allows the distinguishing of local types (1963:251). The theory of types and their relation, i.e. typology, had a direct influence on the stylistic analysis and interpretation of prehistoric and Early Mediaeval art, the latter especially in relation to the definition of the 'physical similarity' of types (see sect. 2c.). In the realm of the history of art, tracing relationships in time and space depends on formal stylistic aspects. The concept of style can be seen as a common concept used both in archaeology and the history of art in order to analyse visual art. It is therefore used here in order to investigate the common problem of typological and stylistic analysis and the classification of visual art in archaeology and the history of art.

In the study of the history of art there are at least three formal properties which have been considered in the analysis of style: 'form-element', 'form-relationship' and 'form-quality' (which also includes the overall quality, i.e. expression). According to Schapiro, these three aspects provide the broadest, most stable, and therefore most reliable criteria in correlating works of art with an individual or culture (Schapiro 1953:287ff). In stating this, Schapiro is here actually refering to the concept of style, i.e. its definition, in the history of art in particular. He defines 'style' as "the constant form in all its related aspects in the art of an individual or a group"(ibid.)(1). There is, however, no general agreement

(1) A more general but equally ambiguous definition of style is given by the same author: "Style can be defined as the conventions, qualities and expressions of an individual or a group, which make up the art of any particular time or place" (1953:287ff)

about a system of analysis among art-historians. Scholars have emphasized different aspects according to their particular focus of analysis. This applies also to the interpretation of stylistic analysis and the subsequent classification of art-styles in the dimension of time and space. Thus terminology and nomenclature of historical as well as modern two- and three dimensional art refer to a number of different aspects. Wide-ranging style designations of style such as 'Classic', 'Etruscan', 'Romanesque', 'Renaissance', 'Impressionist', 'Post-Impressionist' are tools in establishing a relative chronology of European styles. Each convey the relative time or the place of a style, reactions against or in relation to previous styles, the quality of a style, its author, or other historical and formal aspects. One also finds the terminology of style shifting from the style of a person to the period, from the individual work of art to the works of a school, of a generation, or of a site or race. These examples illustrate the general problem of formal grouping and the classification of style. The concept of style upon which these stylistic classifications are based is ambiguous in that the formal properties of an art form are intimately linked with the cultural historical judgements in time and space. Thus the terms given in order to designate styles vary not only according to the various internal stylistic aspects - one of which may be dominant - but also according to art-historical judgements relating to the cultural level of processes and events. As a result of this variation, styles have hitherto resisted a systematic classification into distinct groups. The way in which art-historians analyse, interpret and classify is in various ways similar to the way archaeologists have approached the problem of typological, i.e. stylistic, classification. In terms of nomenclature, an example is Jacobsthal's division of Early Celtic Art (1944) into 'Early Style', 'Waldalgesheim Style' and 'Plastic Style', which refer respectively to the time, place and quality of a style.

This style nomenclature may be justified by the ambiguity of the concept of style, but the classification of styles becomes a methodological problem when the investigations are focused on chronological developments in art forms. The art-historian is fully aware of this problem. Thus, given an adequate amount of data, he can distinguish the individuality of a particular artist from the general style of the period, can witness the revivals and borrowings of a particular style from the past or present, and can still be aware that the style of an individual or groups of artists may even contrast with the general style of a period. The methodological problem of the classification of styles as it presents itself to the art-historian, in relation to chronological interpretation is perhaps best summarized by Read, an art-historian and philosopher of art: "A chronological sequence must be attempted, with the full realization that it is an arbitrary simplification and involves repetitions, contradictions and ambiguous problems of value" (1964:9). The methodological problem as it presents itself to the archaeologist is in this respect not much different. It is understood here that the only difference between archaeological stylistic analysis and art-history derives from the different material basis of the two subjects. Like the art-historian, the archaeologist uses the

concept of style as a criterion for the establishment of the date and place of origin of objects of art, and as a means of tracing relationships between schools of art. While the art-historian can analyse visual art both from the formal properties of a style, and from what is infered by the historical cultural context, the analysis of the archaeologist is mainly restricted to the study of the formal stylistic properties of an art form. The difference is thus not of kind, but of degree. In relation to the classification of ornamentation in the dimension of time and space this means, however, that the archaeologist has to distinguish between variations in formal aspects of style that are due to the development of ornamentation in time, and variations that are a result of modification according to contemporary local, social and cultural differences. In the following sections, closer attention is paid to the problems of classification of decorative art in earlier and more recent studies in archaeology and Early Mediaeval art.

4. *Examples of problems of stylistic classification in archaeology and Early Mediaeval art*

The Swedish archaeologist Salin laid the foundation for the stylistic analysis and classification of ornamentation in archaeology in his study of Germanic animal ornamentation. In his book, *Die altgermanische Thierornamentik* (1904), Salin develops a relative chronological sequence of types of ornament which he found on Germanic brooches and other metalwork from the fourth to the ninth centuries A.D. In this study of the Scandinavian archaeological material, Salin distinguishes three styles of animal ornament, Style I, Style II and Style III. These terms suggest three distinct stylistic groups of ornamentation which, he surmises, represent ornamentation of genuinely Germanic origin from the end of the 5th century to about 800 A.D. (Salin 1904:214-90).

In his stylistic investigation Salin analyses three organic parts of the animal motif, which he distinguishes as heads, hips and feet. In a series of schematic line drawings he demonstrates the stylistic difference of the animal motif by emphasizing the quality of the outline and shape of these three major organic parts. Salin uses the results of this detailed analysis as evidence to mark out the animal motif as a whole as typical for each of the three stages of stylistic treatment (see fig.1). Salin's stylistic analysis shows that he regards the motif-units, or rather the individual building blocks of a single motif, as an important indicator of stylistic variation and change. This principle of stylistic analysis has been maintained in almost all succeeding systems of classification of Germanic animal ornamentation, and authors who have developed and more recently considered this method, such as, for instance, Malmer (1963), Era-Eskö (1965) and Haseloff (1981) still pay tribute to Salin's critical attention to the formal variation of the constituent parts of the animal motif.

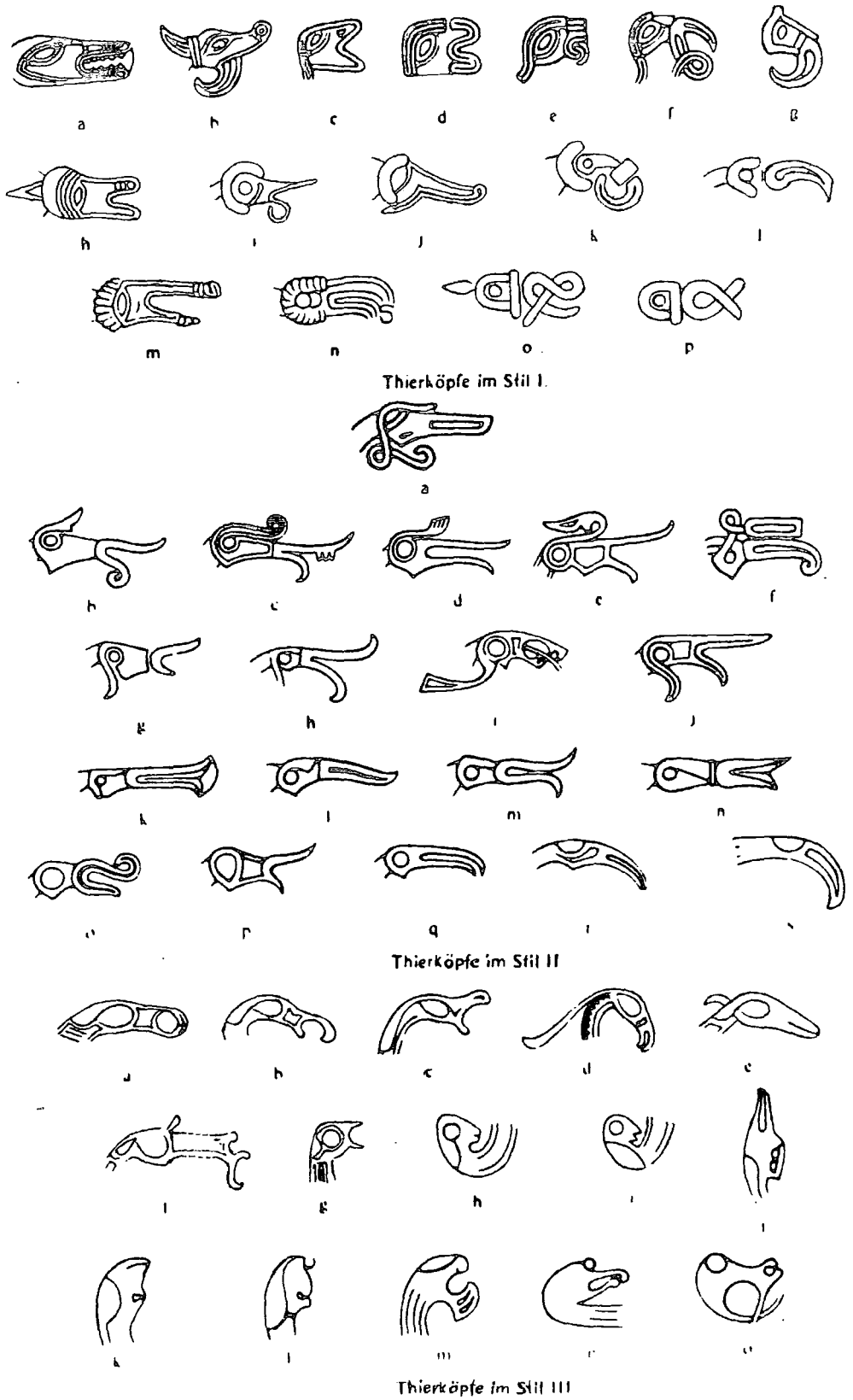


fig.1 Details of animal heads in Salin's Style I, Style II and Style III; from Salin 1904, fig. 515a-p, fig.542a-s and fig. 600a-o

When Salin accomplished this first comprehensive analysis of Germanic animal ornamentation and set up his method of stylistic classification he was influenced by a concept of stylistic development derived from the art-historical approach to stylistic interpretation of the time. According to this conception, forms develop and vary in accordance with the character and the changing spiritual requirements of the time.(2) Salin commits himself to this concept of stylistic interpretation when he writes, "Das Gesetzmässige in der Ornamentik tritt jedoch mehr zu Tage, wo es die Form gilt. Jede Zeit schaut die Dinge auf eine für sie charakteristische Weise an, und damit in Übereinstimmung schafft die Ornamentik ihre Formen " (Salin 1904:159). In terms of the creation of styles, this statement implies that every style is peculiar to the period of a culture, while in a given culture there exist only one or a limited range of stylistic forms characteristic of it. Thus, according to Salin, Style I is the result of the stylisation or abstraction of the more 'naturalistic' rendering of animal motifs found in the art of the Roman provinces, and he explains the formal differences of this Style I as concerning the development of more and more "Stilgefühl" (feeling for style) that has, moreover, spread to different types of artefacts simultaneously, while his Style II and Style III mark evolved phases of Style I ornamentation (1904:222). It is clear from this that Salin interprets stylistic variation as a result of processes in time without considering the fact that style may also vary on a contemporary level in space. He disregards the possibility that animal motifs may also vary according to different individual craftsmen, to different regions or cultures, which seems rather odd considering the vast geographical area from Scandinavia to Hungary to Southern Germany, over which the Germanic animal ornamentation extended amongst the Germanic tribes. However, Salin's concept of a time-dependent cultural and spiritual development *had* to ignore the fact that there exists an independent variation in space because he intended to propose a unilinear development of stylistic forms. His idea of a unilinear development of forms of artefacts over time was probably influenced more directly by the idea of the *typological series*, a model for the classification of artefacts which the Scandinavian archaeologists Hildebrand and Montelius had developed in the process of establishing a methodology for material research. Both authorities were mainly concerned with the 'physical similarity' of artefacts, and they related the degree of similarity of typological forms to the degree to which they are separated in time. Thus, according to this typological concept, close but not complete similarity is considered as a criterion for a short distance in time, while slight similarity is indicative of a larger time gap (Malmer 1963:255). Montelius supported his established system of the typological series with leading examples of typlogical development from the realm of nature, and according to Darwin's theory of evolution. In doing this he no doubt paid tribute

(2) This conception of 'Kunstgeschichte als Geistesgeschichte' was made popular by Vasari, was further developed by Winckelmann and remained influential well into the 19th and early 20th century. Burckhard and Wölfflin are an example of this influence. (Clarke 1956:7ff).

to the current view of his time that a true scientific approach must be analogous with the scientific handling of laws of development found in nature (Müller-Karpe 1975:29).

Salin chooses the smallest units of the animal ornamentation, i.e. the motif-elements hips, heads and feet as indicator of stylistic change. In this case the indicator for stylistic change is the composition of these types of motif-elements and a chronological judgement about stylistic change has therefore to be made on this level of formal variation. In relation to the latter, it is significant that Salin considers his Style II as a kind of 'renaissance' of his Style I; he assumes that the former meets the spiritual requirement of the time to draw the formerly disconnected details of the animal motif together in order to achieve a more consistent image: "...man sammelt die verschiedenen Details zu einem übersichtlichen Bilde zusammen" (1904:245). From a methodological point of view, however, Salin could not account for the juxtaposition of two differently organized and shaped animal motifs which appear on a range of metalwork decorated with Germanic animal ornamentation. This apparent formal anachronism within the material itself is constantly encountered by later authors who took Salin's detailed analysis of the composition of motif-elements as a basis for their classification systems. An example is the 'Mundblech' of Bakka (Sweden), to which Haseloff (1981:247) refers in his investigation of Style I ornamentation, and which illustrates this point (see fig.2 below). The animal ornamentation on the back of this artefact consists of a stylized bird whose body is formed out of a loop of filigree, while its head is well-developed and has a large, curved beak. On the front of the same artefact, however, the animal motif is made up of a pattern of disconnected motif-elements.

Because of his rigorous conception of a time-bound development of style, Salin could happily ignore or at the best 'explain away' such overlappings of different 'styles' in his own time. An example is his confrontation with a similar contrast of stylistic renderings of animal motifs as described above on a squareheaded brooch from Norway (1904:fig.534), which he takes as an example to describe the group of animal-motifs with a typically backwards biting head. He considers the animals decorating the border sections of the brooch as the earlier of the two styles because of the more 'naturalistic' rendering of the animal-motifs and their close formal resemblance to models of Roman art (1904:237). In his final chronological assessment of the style of the animal decoration Salin, however, interprets the other more abstract renderings of animal motifs on the same brooch as "a search at the beginning of a stylistic development for a more homogeneous expression of form whereby a lot of bizarre forms emerge, but quickly disappear again" (1904:237).

Haseloff's interpretation of the 'Mundblech' from Bakka conveys a different conceptual attitude towards the classification of the two contrasting styles on the same artefact, although it still holds to Salin's original distinction of styles. "Das

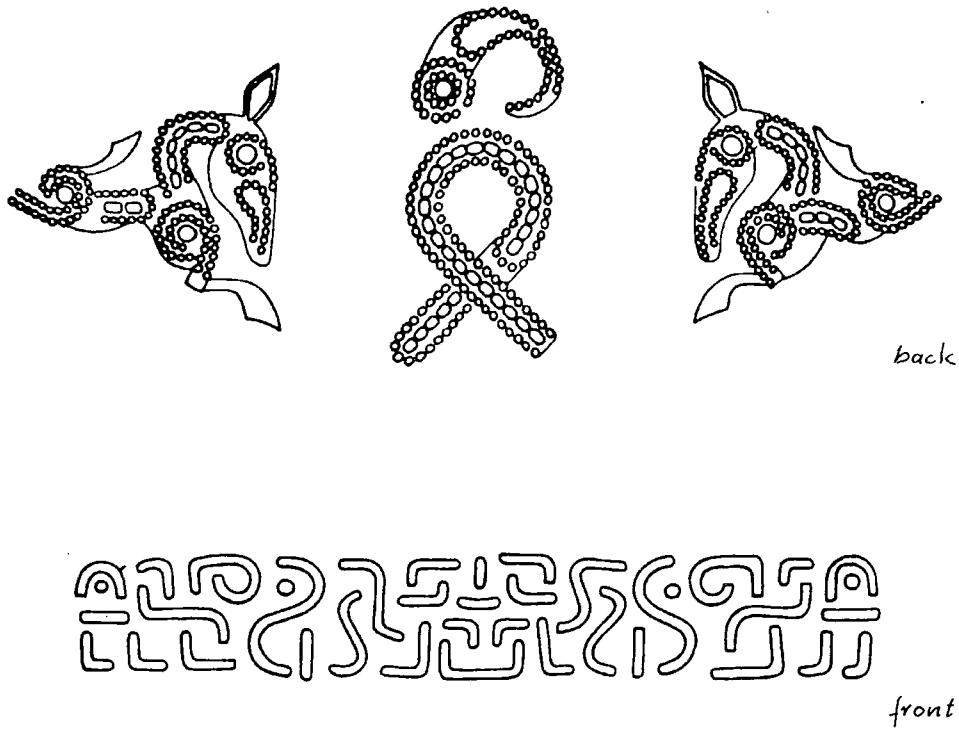


fig.2
The Mundblech of Bakka, Sweden.
Animal ornamentation in filigree on the back (Scale 4:1)
and on the front (Scale 2:1); from Haseloff 1981 (figs. 153,154).

erkennen wie vorsichtig man mit der Verwendung von Ausdrücken wie 'früh' oder 'spät' bzw. 'degeneriert' zu sein hat, wenn ein Stück, wie das Mundblech von Bakka uns vor Augen führt, dass die verschiedenen Stilarten gleichzeitig und nebeneinander vorkommen können " (1981:247). In contrast to Salin, Haseloff here acknowledges the fact that different 'styles' may appear side by side on a contemporaneous level, and he thus expresses caution towards relative chronological categorizations such as 'early', 'late' or 'degenerate'. This caution Haseloff expresses towards the classification of 'styles' may be explained by the different general concept of formal stylistic development which has changed over time to a broader concept, but which also acknowledges stylistic variation in space independent of the time-factor. This change of attitude is already apparent in Era-Eskö's earlier independent reassessment of Style I ornamentation which he found on metalwork from Finland. An example is to be found in his analysis of the brooch from Kakunmäki, where he comes to the following conclusion: "It is rare that a find of antiquity which must be reckoned as a splendid work of art is subjected...to so thorough a misunderstanding as was the Kakunmäki brooch discovered in 1883.- In an otherwise praiseworthy analysis Salin consider [the brooch] to be completely degenerate. He dares not attempt to identify any animal or individual limb. He only recognizes the masks on the frieze that frame the

brooch] to be completely degenerate. He dares not attempt to identify any animal or individual limb. He only recognizes the masks on the frieze that frame the square headplate and the biting heads at the top of the foot-plate. Hackmann (1906) agrees with Salin, and so have practically all the more recent investigators. However, the ornaments on the Kakunmäki brooch are distinct and logical, and the whole can be analysed in detail. All in all the brooch represents a logical and independent style variant of which only a few insignificant remains survive in Scandinavia or elsewhere" (1965:37). In using the term 'style variant' instead of 'style', Era-Eskö also acknowledges that different 'styles' (according to Salin's definition) may exist on a contemporaneous level. His reference to the geographical distribution of these style variants furthermore implies that he sees stylistic variation not so much as a result of the combined continuum of time and space, in the fashion of Salin but rather as the result of processes both in time and space but independent of each other. This is the kind of change of attitude in interpretation already referred to in relation to Haseloff. But Era-Eskö goes even further when he reconsiders Style I ornamentation within his sample of decorated artefacts from Finland. Thus he makes a methodological distinction between the particular features of the animal motifs and motif-attributes, and the particular shape and outline of these features. With this methodological distinction and his new results from it in mind, Era-Eskö criticises the way in which earlier and contemporary authorities have associated certain motifs, or elements of motifs, together with their shapes, with particular tendencies in cultural and geographical development. Reviewing the theory of Kendrick, for instance, who defends the idea that Salin's Style I originated in Anglo-Saxon England, he writes, "it seems strange that the 'helmet' motif and the 'gestus' position hold a central position among Finnish finds in this style. In other words, the very characteristics which are held to distinguish the Anglo-Saxon Style I from the Scandinavian variant are found to be common to both the Finish and the Anglo-Saxon examples of Style I" (1965:107).

Although Era-Eskö admits that a motif may indicate the place where the motif has been originally created, his criticism also suggests that a motif is independent of a fixed geographical area, and therefore also of a fixed period in time. According to the distinction he makes between the actual feature of a motif and its formal outline and shape, Era-Eskö rejects the idea that different motifs and the different composition of motif-attributes according to Salin's model are the immediate indicators of stylistic variation in time and space. Rather, he postulates that it is the common formal rendering of the motifs and elements of motifs, irrespective of their position which is the actual indicator of regional stylistic variation and change. Accordingly, the observations made in the course of his investigation have caused him to reject the cultural and chronological interpretations of the main body of authors who assume that the Style I phase of Germanic animal ornamentation is a deep-rooted Scandinavian phenomenon. "The observations made in the course of this investigation have caused rejection of the prevalent

theories regarding Salin's Style I. This does not, however, mean that the related problems will be solved in full. We may rather say that now a new group of problems all the more difficult to solve have come into our range of vision. In fact we have reached a very complicated situation: while the ornamental features of the objects convincingly indicate an English origin, their shapes suggest something very different" (1965:109). Era-Eskö uses his in some aspects new method of ornamental analysis to distinguish workshops and individual craftsmen on a contemporary level in space. Thus he finds at least four different style variants or different stylistic trends among the artefacts of the decorated Finnish material and can further establish that none of these variants are an organic chronological development from earlier artistic traditions rooted in Finland and that, with a few exceptions, they do not give the impression of developing out of one another (1965:111).

The ideas which lie behind Era-Eskö's partly new methodological approach to the classification of styles had already been developed ten years earlier by the Swedish archaeologist Almgren. In his book *Bronsnyklar og Dyreornamentik* (1955), Almgren writes a full chapter on his reassessment of the validity of Salin's original definition of styles of Germanic animal ornamentation. His critical attention was partly stimulated by the anachronism of three styles, the 'naturalistic' style, the 'gripping beast' style and style 'III/E', within the ornamental material of the Osebjerg ship and the mounts from Broa i Halla. Discussing the chronological validity of these styles which have been distinguished according to Salin's method he asks: are we really talking about different styles? Could they not simply be three different motifs executed at the same time? "Är det da verkligen fraga om olika stilar? Kan det iche istället vara olika motiv som utförts i en och samma tids stil?" (1955:88). Almgren states that it depends on the perspective from which one is looking, whether these three styles mentioned are transitory, mark distinct typological phases or comprise different hybrid forms. He refered earlier to Shetelig and Lindquist, who both studied the Osebjerg-ship carvings and came up with opposite results in their attempt to arrive at a chronological order for the styles, although both of their results were sound within the same methodological framework. Almgren also concludes from other stylistic evidence that the style attributes which have been selected for the distinction of the three styles do not necessarily have to be classified into separate groups. Instead, he suggests that there must be a common factor - but not the usual criteria of Salin (heads, feet and legs) - which indicates that different motifs and motif-attributes are executed in the style of the period (1955:88). He goes on to develop the idea that this common factor can be seen in the shape of the main lines of construction and, in the particular case of the Osebjerg and mount ornamentations of Broa i Halla, in the shape of the s-curves of the animal motifs (1955:89ff).

The example of Salin's formal analysis of Germanic animal ornamentation shows how he has adapted the current methodological framework of archaeological material reserach and art-history of his time to his typological and stylistic analysis.

The selected examples of Era-Eskö, Haseloff and Almgren show that stylistic analysis according to Salin's model has in principle been maintained up to today, but also that it has been found incompatible with more recent requirements and concepts of stylistic analysis and investigation. The incompatibility is manifest amongst the stylistic features of the material object itself, as well as in the form of 'stylistic anachronism'. This phenomenon has been assigned here to the changed conceptual framework of stylistic interpretation. Thus the comment Haseloff gives, and the example of Era-Eskö's analysis, could indicate that stylistic variation is now seen as a result of separate processes in time and space while (maybe at the same time) the focus of the stylistic enquiry has tended to shift from processes of general culture-historical importance (like, for instance, migration and trade) to more localized processes of artistic creativity on a contemporary level in space. This is also evident from the view Chadwick-Hawkes expresses in her discussion of the influence of the 'Jutish Style A' on the later Style I in Germanic animal ornamentation: "The extent of its influence on the later style, however, is not easy to define, and the reason for this difficulty lies in the complex process which gave birth to Style I. In writing about zoomorphic ornament, too many writers give the impression that there is some logical evolutionary system at work producing a coherent growth and decline, instead of merely a number of workshops, widely scattered and differing in artistic and technical standards, producing their own versions of a current fashion, without necessarily maintaining any direct contact with each other. There are as many faces to Style I as there were workshops producing it, and many of these local variations appear to have had little influence either on contemporary or subsequent trends" (1961:69).

The incompatibility of Salin's model of analysis with more recent concepts of stylistic investigation and interpretation has been found to be apparent in the different and often contradictory historical conclusions reached by different authorities in relation to time and space-bound processes. An example has already been provided here by Almgren, who mentioned the contradictory chronological interpretations of Shetelig and Lindquist, who worked within the constraints of the same methodological framework of classification. Another example is the chronological interpretation of the development of Germanic animal ornamentation, made by Salin and Müller. Salin speaks of all the three stylistic groups he established as degenerate. The reason for this is related to his historical conviction that Germanic animal ornamentation is a development from Roman provincial art (1904:176). Müller, on the other hand, thought of the same ornamentation as an indigineous development, which therefore must have brought about an improvement of the forms over time (ibid.). While both authorities maintain opposed standpoints, their opinions are based on the same methodological approach, and even on the same time-dependent concept of interpretation. The phenomenon of contradictory and differing historical results has not only been found in relation to the chronological interpretation of styles, but also in relation to space-bound

considerations, as Era-Eskö, for instance, demonstrates in his comparison of the many national and regional locations of Germanic animal art (1965:9ff).

It can be concluded that the methodological framework Salin introduced in order to analyse style in the sphere of archaeology yields to the most basic dilemma of stylistic analysis and interpretation, - that is, the ambiguity of the concept of style. Thus it has already been stated in relation to the art-historical terminology of styles that the terms given in order to designate styles vary not only according to formal stylistic aspects, but also according to art-historical judgements relating to cultural processes in time and space (sect.2b:4). In relation to archaeological material research, this statement can be extended to include an author's ideal prototype of a motif, i.e. his own perception of art styles, his own particular historical view, etc. Even his own nationality and other subjective aspects can have an influence on the final results of his classificatory work, and his stylistic judgement.

5. *Methodological reorientation towards a more scientific research into archaeological material research and stylistic analysis*

Bakka wrote in 1968, in a discussion of Malmer's classification and systematisation of Gold bracteates, that a noticeable feature of recent archaeological research is the great interest being shown both in methodological reorientation and the critical testing of older methods of research and their results, and that parallel with this there was an increased interest in the theoretical basis of archaeological research and methodology. This was undoubtedly connected with the idea that without a firm scientific foundation, new and scientifically reliable results cannot be achieved (1968:5).

In *Jungneolitische Studien and Methodproblem inom järnalderns konsthistorica* (1963) Malmer takes subjectivity in archaeological material research as a starting point to reconsider and improve the methodological foundations on which this research rests. He puts forward the view that material research has the potential to be more objective than documentary research as, for instance, in the history of art: "The narrative sources that make up a great part of the material of documentary research contain not a single passage that can be assumed to be objective. The artefacts, on the other hand, are all 'remains', relics of the actual historical course of events, and contain as such an objective truth that is immediately available" (1963:250). In trying to arrive at a more scientific method of typological classification, Malmer criticises past studies and their lack of logically consistent definitions and formulations. After discussing the fundamental concepts of the study of artefacts in archaeology, he takes his new systematic classification of the C bracteates as an example from which to draw conclusions on methodological grounds. In his systematization he determines typological, i.e. stylistic, elements

according to criteria not previously established for the ornamentation of the Gold Brakteates. However, he accepts the previous division of bracteate types into four main groups, and also the former model of typological analysis, which uses the physical similarity of motifs and motif-elements as indicators for stylistic variation and change in time and space. Thus the four groups have been established according to similarities in the combination of motifs and elements of motifs, and according to the presence or absence of particular motif-elements from a group of combinations. Malmer's main divisions are as follows:
(A) bracteates have human figures without feet, but no figures of animals or parts of animals.
(B) bracteates have human figures with at least one foot (animals or parts of animals may or may not be present)
(C) bracteates have both human figures without feet, and figures of animals or parts of animals.
(D) bracteates have figures of animals but lack human figures.

Malmer bases his new classification of the C bracteates (his groups C:I to C:IV) on six variations, defined in detail by the 'hair style' of the human figure; on three variations, defined by the position of the hindlegs of the animal ridden; and on a further variation of whether the animal has, or lacks, a head. He considers that he has examined a representative selection of the typological elements in the bracteate pictures. He can thus theoretically classify all the 'true' C bracteates into 36 different groups by dividing them first into 6 main groups according to the hair style, dividing each of these into 3 (a total of 18 subsidiary groups) according to the position of the hindlegs, and dividing each of these 18 again into 2 further sub-groups, according to whether the animal has a beard or not. These groups are arranged in a flexible system, where each element has its own symbol, i.e. roman numerals I-VI stand for the various positions of the hindlegs, and the arabic numerals 1 and 2 for, respectively, no beard or head. The various combinations of elements can thus be represented in an easily comprehensible way by combinations of 3 symbols, roman numerals, small letters and arabic numerals, each symbol always having the same conceptual content, in whatever combination it is found. This system of classification, following such principles, is flexible, clear and logical, and has the advantage that, should bracteates with hitherto unknown combinations of elements be discovered, they can without doubt be incorporated into the system.

It seems that these qualities give Malmer's system a great advantage when compared with older classifications which are not as clearly defined, and logically and systematically arranged. However, Malmer's classification cannot escape subjectivity, on the grounds already mentioned as regards the ambiguity of the concept of style. The selection of typological elements which Malmer terms "objectively recordable physical details or properties of an artifact" (1963:258), is a subjective selection of these typological elements from amongst other elements that he considers to be less objective and important. It is thus after the subjective selection

has been made that the objective treatment of the selected elements takes place. In this respect Malmers's system of classification is similar to Salin's system.

It is, however, surprising that Malmer should have embarked on such a classification system and such a method of analysis. In his general theoretical discussion of the concept of typology he takes up the point of discussion found in American archaeological literature as to whether stylistic types, and in particular artifact types, are to be regarded as existent *a priori* or not. He refers to two controversial views. One view is that the types are only a purposeful division of the material, created by the archaeologist. The other is that it is the job of the archaeologist to *discover* types, namely the types that the people of the far-off days themselves distinguished (Malmer 1963:254). Malmer agrees that the latter view can be said to be more correct: "The possibility of reconstructing the concrete situation seems namely to be greater the more 'congruent' the type is with the situation. And the probability of such congruence seems to be greater the closer the type coincides with a type distinguished by the men of ancient times themselves, and designated by them with a definite name and always used for a certain purpose or in certain situations" (ibid). Compared with these postulates Malmer's classification system, with its subjective delineation of typlogical elements, seems like an interesting logical exercise, but one which has no real value for the pursuit of culture-historical enquiry. He also contradicts his own theoretical suggestions as regards the discovery of types. Bakka, who sees Malmer's criticism of earlier research as a positive stimulation towards a more thorough reconsideration of the different aspects involved in the investigation of visual art, writes: "Art, among other things, is itself the result of subjective, aesthetic judgement on the part of whoever created the work of art, and the work itself has again been appraised in accordance with qualities in the society which welcomed it. Should one, then, in any art-historical study having scientific value exclude subjective, qualitative, and aesthetic judgement? Ought not one of our aims rather to be a scientific attempt to reconstruct the judgement of quality and complex of ideas which among other things form the historical (or pre-historical) situation from which a work of art has originated and in which it has its function?" (1968:8).

An approach to material classification that falls in line with the desire to discover artefactual and decorative types and styles as prehistoric people might have used and viewed them, can be seen in the work of lithic archaeologists. Their concern with the function of an artefact and its decoration in the cultural context has lead them to distinguish between formal elements that are due to technological constraints or choices, and formal elements that reflect the artisan's purposeful decoration of the artefact which may directly or indirectly convey a symbolic content, and therefore also reflect self-conscious groups. This is a methodological distinction which is focused on the differentiation of the various functions an artefact may have had, - either in direct relation to its use for particular tasks in the technological sense, or in a wider symbolic sense in terms of its cultural significance. Sackett, who is quoted here from his more recent article on approaches

to style in lithic archaeology, writes: "A key issue in lithic archaeology is how to identify the respective roles played by ethnicity and activity - that is style and function - in the formal variation exhibited by stone tools" (Sackett 1982:59). In order to explain the various functions of the formal properties of artefacts in terms of cultural processes in time and space, some lithic archaeologists employ the conventional 'systemic' concept established in American anthropological research, and differentiate between at least three different cultural realms: the material realm of technology and economics, the societal realm of social organisation and behaviour, and the ideational realm of ideas, beliefs, values and so forth (Sackett 1982:69). The demand for objectivity in typological and stylistic classification raises again the criticism that the methodological division of cultural domains and cultural subsystems is arbitrary and likely to be chosen from an ethnocentric perspective. It is, however, understood that the use of the concept of cultural subsystems in relation to the function of an artefact meets the pragmatic needs of archaeological research and is compatible with the demands of scientific investigation in general. Thus independent indicators of typological variation are recorded within the material and are related to the independent variables of cultural (functional) realms in order to provide a larger scope for the comparison and testing of the material and the hypothesis involved. "The advantage of this 'systemic' approach to culture is not that it is necessarily a more accurate representation of reality, but that, considering the nature of archaeological evidence and investigation, it will lead to more productive models, that is those which lead to testable hypotheses involving as many categories of evidence as possible" (Watson, LeBlanc and Redman 1971:64).

From the perspective, mentioned earlier (p.15), that art is itself the result of subjective and aesthetic judgement in cultural terms, the choice of typological and stylistic entities to be classified in archaeology should therefore become more relevent and valuable for such an investigation the more the investigator is able to *understand* the processes involved either in the manufacture of artefacts, or those processes involved in producing and perceiving visual images in the past. A step towards the evaluation of a similar position has been taken by Leigh in his analysis of the ambiguity of Anglo-Saxon Style I art. He stresses the adjustment of our visual perception to such complex visual imagery as he finds exemplified in the zoo- and anthropomorphic motifs on particular Kentish brooches (1984:37). Here he demonstrates that a recurring device is the use of images which have more than one meaning, depending on the angle at which they are viewed (see fig.3 for examples). To support and explain his hypothesis that ambiguity is an essential element in the metalworking art of the Anglo-Saxons, he draws attention to other cultural spheres in Anglo-Saxon society, such as literature and religious practice, where he finds the phenomenon of ambiguity well represented (1984:40). In relation to some kinds of visual ambiguity in the images of the Kentish brooches, i.e. where the combination of two profile masks create a single full-face mask, he also refers to a phenomenon of visual imagery investigated from

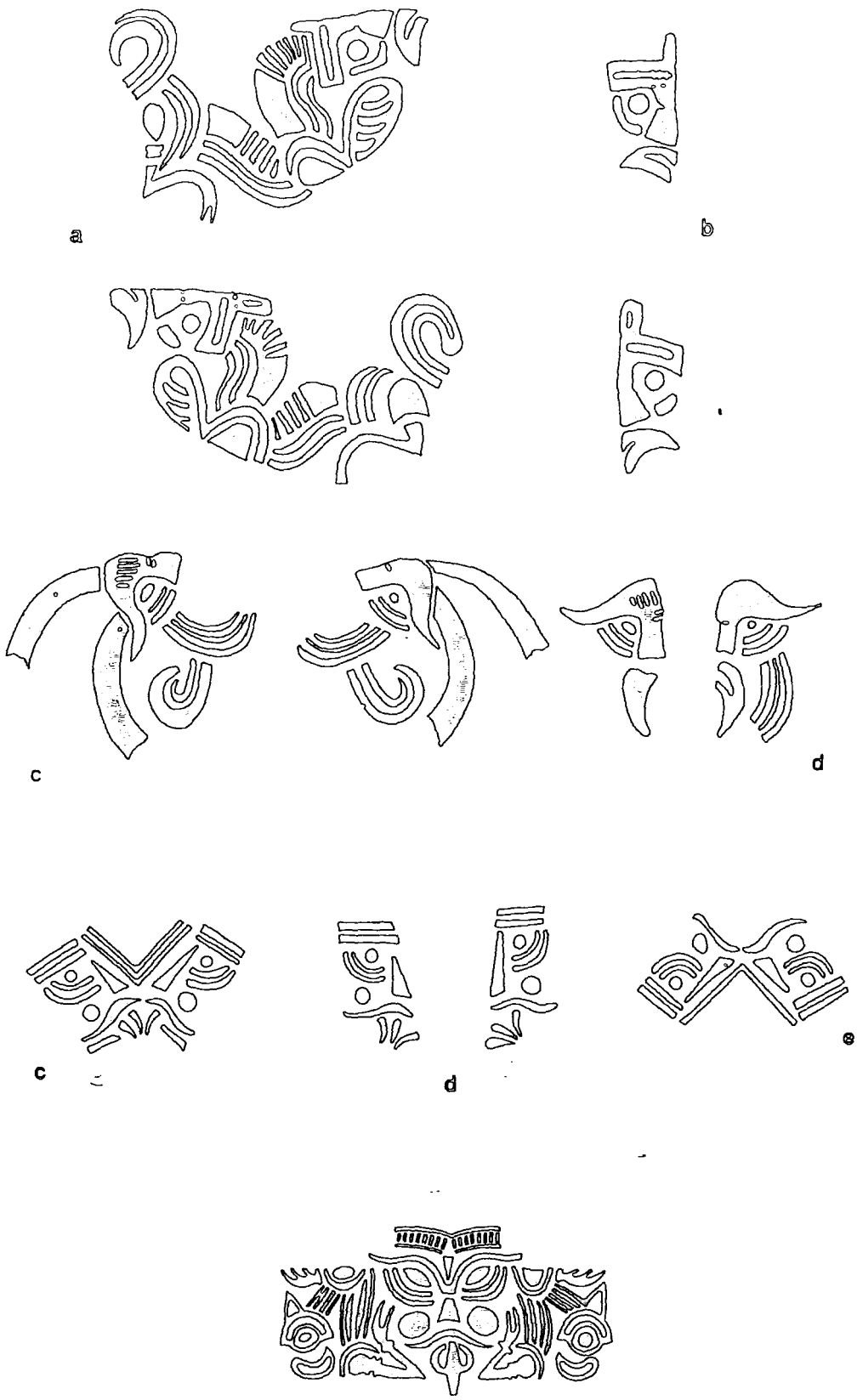


fig.3 Designs on brooches: a.-b. Bifrons, grave 63; c.-d. Herpes, France; e.-g. Bifrons, Kent, grave 41. From Leigh 1984 (figs. 2a.-d., 3c.-e.) and Haseloff 1981 (Abb. 75:3).

amongst the repertoire of recent Maori paintings, and which Levi-Strauss refered to as 'split-representations'.

Arrhenius' investigation of Merovingian garnet jewellery is another example which lies in the mainstream of such an methodological reorientation as is indicated in Malmer's and Bakka's theoretical criticism outlined above (p.14), -this time in relation to technological elements. She pays tribute to Malmer's differentiation between decorative and technological elements for the establishing of the 'physical similarity' of typological elements (1963:257). However, she also stresses that the selection of her 'significant typological elements' is rather dependent on an *understanding* of the technical processes involved in making the garnet objects. She characterizes the method therefore as 'manufacturing typology' (1985:17). Arrhenius also distances herself from a concept of typological interpretation that assumes an evolutionary development of techniques and which has already been mentioned in relation to Salin's stylistic classification of ornamentation (p:7). Instead she states that her technical research "has led to conclusions similar to those expressed by scholars who have criticised the Montelian theory of typological development. In relation to this she refers to Almgren (1955) who, amongst others, has criticised this theory (1985:17).

The principal technical features which Arrhenius investigates are: 1) the type of filling with which the garnet was fixed onto the metal base of the brooch; 2) the thickness of cell walls; 3) the height of the work; 4) the foil pattern; 5) the thickness of the garnet; 6) the garnet shapes; 7) the other inlays (1985:15, fig.1). Because of the varied and complicated techniques involved in the manufacture of garnet jewellery, Arrhenius is able to obtain evidence on different levels of investigation in space. Thus certain techniques provide the opportunity to examine long distance communication between different areas in Europe, while others throw light on more local distribution patterns among large central, and more local, workshops (1985:15). Arrhenius expresses, however, great caution about the use of her technological analysis for chronological evidence when it could be based on the repair work carried out on the profile garnet inlays (ibid). Arrhenius has also made an attempt to compare the results of her manufacturing typology with classification systems arrived at through the stylistic analysis of the decorative elements of garnet jewellery, in order to ascertain whether the objects in these groups of classification also display common stylistic features. Talking from her experience of classification of technological features on Merovingian garnet jewellery, Arrhenius again expresses, however, caution about such comparisons as "it is likely that even within the same workshop individual craftsmen would have developed their own particular methods and styles" (1985:16).

6. *Conclusion*

A prelimary conclusion about the concept of style and its changing use in the investigation of decorative art in archaeology and the history of art could be expressed as follows: the concept of style is a necessary construct in order to analyse and explain how forms of art relate to culture and cultural processes in time and space. Comparison of the various ways in which the stylistic concept has been used in the past and more recently, in archaeology shows that this concept is ambiguous, related on the one hand to the changing content and varied formal properties of an art-form, and on the other to the concept of interpretation, and the methodological framework of analysis, both of which are ruled by the spirit of the times. The typological and stylistic entities (or elements) chosen, and their interpretation in cultural terms, are bound up with the metaphysical concepts of time and space. Because of this complex relationship, the key aim of archaeological research is to find an appropriate methodological framework that allows for a greater degree of objectivity in the choice of typlogical and stylistic enities, to faciliate a better understanding of the meaning time and space had for the pre-historic people of any social group or culture. On this basis archaeologists have criticised and discussed early and more recent stylistic classification systems which depend on the traditional Montelian paradigm. In relation to the latter, it has been pointed out that similarities and differences are established regardless of the functional context of an artefact and its decoration within a pre-historic society, while interpretation is based on *a priori* postulates that are formed from the subjective and ethnocentric aesthetic and historical viewpoint of the investigator. More recent archaeological approaches to typological and stylistic investigation reflect the desire to remove this subjective element involved in the classification and interpretation of art styles. These approaches suggest that a better understanding of the function and meaning of a decorated artefact in technological and in symbolic terms as well as the understanding of the manufacturing processes involved may lead to more objective and therefore more scientific results.

Chapter two

Methodology

1. *Introduction*

Symmetry analysis is a method of classification and interpretation of decorated artefacts which uses the mathematically definable symmetrical properties of designs as an indicator of stylistic variation and change in time and space. Similar to the methods of typological stylistic analysis in archaeology, it is a model of stylistic investigation which is concerned with the analysis of the formal properties of visual images. However, in contrast to Salin's traditional concept of formal classification in archaeology, the stylistic entities are not chosen according to the physical similarities of individual motifs or elements of motifs that appear within a design, but according to the physical similarity of the spatial relationships of motifs and motif-elements, i.e. those relationships which lend (symmetrical) structure to a decorative pattern. Symmetry analysis is thus a method of classification which emphasizes the importance of the structural relationship of motifs to one another, rather than of motifs in isolation. This approach to stylistic classification reflects the concept that the meaning of art-forms is expressed by structural principles similar to those in other forms of art, and in common social forms of expression, such as poetry or language. The general methodological framework of symmetry analysis derives its basic principles from the structuralist approach to linguistics and, more directly, from the structuralist study of communication systems in anthropology,- of which this method forms one branch of investigation. Washburn, who has used symmetry analysis for the formal classification of decorative art on pottery in an ethnographic context, suggests that art-forms constitute the visual communication subsystem of a culture. A subsystem which, like language, possesses "a regular structure based on fundamental universal components that can be systematically classified" (1977:6).

With the structural linguistics of Saussure, the sign itself is seen as arbitrary. Thus every sound-image could signify, for example, the concept 'chief'. It is considered that there is no intrinsic relationship between the sound-image (signifier) and the concept signified (1966:67). If this were so in visual imagery, any single visual-image (motif) could signify 'chiefness'. Because of this arbitrariness, Saussure's analysis of meaning concentrates on structured sets of differences which

lead to conventional (arbitrary) associations of signifiers and meanings in particular cultural traditions. Thus the question that is asked in view of the meaning or idea lying behind a picture or a piece of verbal information is not: what does it represent? Rather, the more elaborate consideration is made: which words, i.e. single motifs, are chosen, and how do they relate to each other and to their surrounding space in order to 'spark off' a certain idea or concept to those familiar with the conventional code? Analysis is of the meaning of form not of content. For the structural anthropologist Lévi-Strauss, who has also dealt with the symbolic and representational aspect of visual imagery, meaning is closely bound up with form. He sees art as a language which conveys its meaning via profound homology between the structure of the signified and the structure of the signifier (Charbonnier 1969:89). Similar to the systems analysis in American anthropological research, already mentioned in relation to lithic archaeology (p.15), structuralism uses the concept of a system in order to explain and compare activities and behavioural patterns. Culture is viewed as a system which is itself divided into subsystems that are structurally related: "...the structure exhibits the characteristics of a system. It is made up of several elements, none of which can undergo a change without causing a change in all the other elements" (Levi-Strauss 1968:279). The emphasis is on the interrelationships between entities: the aim of both systems and structuralist analysis is to reveal some organisation which allows all the parts, i.e. subsystems, to fit into a coherent whole. In structuralism this coherence is seen to operate on the deeper level of structure. Thus, while art-forms in a given culture may, in one sense, be specifically iconographic or functional or decorative, it is suggested within this theoretical framework that such art-forms share, on a more basic level, fundamental similarities which are structural in nature (Washburn 1983:1). An example of the recognition of such structural similarity independent of the structuralist methodological framework is found in the work of Leigh. He has used the structural type of physical similarity between art and poetry, for example, as an argument to support his hypothesis of the intended ambiguity of visual images on Anglo-Saxon metalwork (1985:40). The concept of structural interpretation and its underlying methodological framework for analysis have been utilised by Washburn in order to test hypotheses that take account of cultural processes and ethnic groupings in a pre-historic context (1983:138). Washburn has based this application on the premise that the method of symmetry analysis "can more accurately form the basis for the process to pass on information and provides thus an indicator for the transmission of information and ideas to another region or, [on a more individual level], from craftsman to craftsman" (1977:5).

As regards archaeological investigation, this approach to the interpretation of the past falls methodologically in line with approaches in New Archaeology, where the attempt is made to establish a more scientific framework of analysis which is based on the explanation of the differences and similarities found among cultural material phenomena, and that presupposes an understanding of underlying

behavioural laws in the first place.(1) In a sense symmetry analysis represents therefore a method of classification in which the attempt is made to select typological stylistic entities more objectively according to fundamental insights of the processes involved in perceiving and creating visual images. This is similar to recent approaches in traditional archaeology towards a more objective handling of formal classification. Here stress is also placed on the understanding of the processes of creating and manufacturing art in the past, in order to avoid the subjective and ethnocentric selection of typological stylistic entities for classification. The difference is that symmetry analysis is based on the understanding of more fundamental principles of perception that could apply to visual imagery in both present and past, and in the context of different media, whereas the selection of entities for classification in traditional archaeology are culture specific or manufacture specific, as in the case of Arrhenius' investigation of garnet jewellery.

2. *Definition of style and quantification of formal stylistic variation and continuity for classification according to the method of symmetry analysis*

There is some difference in the way stylistic variation has been explained and methodologically dealt with so far. Sackett, who has been quoted earlier in relation to lithic archaeology and systems analysis (p.15), treats 'style' and 'function' as complementary when he defines formal stylistic variation in artefacts (1982:75). He equates 'style' with non-technical (non-utilitarian) aspects of formal variation, and 'function' with technical or utilitarian aspects of formal variation. The decoration of an artefact is considered by Sackett to belong to the non-utilitarian domain (1982:71). Within this non-technical domain of style he makes a further distinction between two different types of forms that can vary stylistically, and that are due to specific functions: a) iconological form, and b) isochrestic form. Sackett equates iconological form with "specific elements of non-utilitarian formal variation which function symbolically as a kind of social iconology to identify human groups" (1982:80). Isochrestic form, on the other hand, is identified as the spectrum of functionally equivalent means (forms) by which a given end can be achieved with an artefact (1982:72ff). Stylistic variation is thus explained by random cultural differences, rather than by the deliberate statement of human groups about their particular identity as in the case of iconological form.

Wobst (1977), Conkey (1980) and Wiessner (1983) offer slightly different explanations for stylistic variation. They are mostly concerned with the investigation of style in terms of information exchange. They avoid counterposing 'style' and 'function' by explicitly acknowledging that "much stylistic behaviour does have functions, at least in the sense of articulation with other variables in the cultural

(1) See Watson, LeBlanc and Redman (1971) for a full theoretical discussion of the background of archaeology and scientific explanation.

and ecosystem " (Wobst 1977:321). For the explanation of stylistic variation, a differentiation is therefore made here between two functions: a) the technical function that explains the form of an artefact as adaptive to its use, and b) the communicative function of an artefact, that explains form as a result of communication or information exchange. Wobst lists a range of possible types of communication, such as identification (class affinity, social group affiliation, and position along ranked scale), and messages of religious and political objectification (1977:323), but states that "the majority of functions of stylistic behaviour should relate to processes of social integration and social differentiation" (1977:327). Wiessner has distinguished a certain aspect of stylistic form, related to the function of information exchange, which she calls 'emblemic style'. She identifies 'emblemic style' with "that kind of formal variation in material culture that has a distinct referent and transmits a clear message to a defined target population about conscious affiliation or identity" (1983:257). This identification is similar to the explanation of stylistic variation suggested by Sackett in terms of the 'iconological' form of a style. A third possibility of explaining stylistic variation in terms of its function to communicate ideas is offered by Franklin in relation to Australian rock art. She maintains that a conscious statement of group affiliation can be expressed by formal stylistic means, which Wiessner refers to as 'emblemic style'. However, Franklin distinguishes also another type of stylistic variation which she labels 'stochastic style'. Here stylistic variation is explained in terms of a random variation of style which occurs within the boundaries of a culture and only occasionally coincides with an ethnographic boundary of some sort (Franklin 1986:122).

Within the context of stylistic analysis in this thesis it is held, as with Wobst, Conkey and Wiessner, that style can have several functions. The sample groups of objects and individual artefacts that have been investigated here according to the method of symmetry analysis, were produced within different media and applied to different design-fields. A differentiation was therefore also made between ornamentation that can be explained by the technical aspects mentioned above, and ornamentation that can be explained by processes of social integration or differentiation. When a pattern structure has been found to have the same symmetry as the design-field, it is considered as an adaptation of the shape, and therefore, indirectly, also of the use of the artefact. The function of this particular type of pattern structure has therefore been described as 'decorative'. When the types of design-symmetries could not be explained by their decorative function alone, they have been related to the function to convey information about the identity or affinity of social or ethnic groups. Within the ornamental context of most of the objects analysed within this thesis it was possible to assume that information revealed by the pattern structures was conscious, in that they transmit a relatively clear message to a defined target population about affiliation or identity. This explanation of stylistic variation and continuity is therefore similar to Wiessner's identification of 'emblemic' style and Sackett's identification of

'iconological' style. However, some types of design-symmetry could neither be explained by their function to decorate nor by the function to convey a conscious message about group affiliation. In this instance the types of pattern structure have been interpreted in terms of Sackett's identification of 'isochrestic' style, i.e. that kind of stylistic variation that can be explained by cultural differences, rather than by the deliberate statement of human groups about their identity or religious or political ideology.

In the context of stylistic investigation put forward in this thesis 'style' is defined as the recurrent use of particular formal elements and the recurrent combination of these elements into characteristic compositions (Layton 1981:134). Symmetry analysis focuses on the latter aspect of this definition of style. Formal stylistic variation is therefore measured in terms of the ordered juxtaposition, i.e. symmetric repetition, of motifs and motif-elements. The motifs can either be figurative or geometric. Continuity or variation of stylistic form amongst decorated artefacts is measured a) in terms of the similarity or dissimilarity of the types of pattern structure, defined by the symmetrical motion classes, that occur within the context of an artefact's decoration, and b) by the similarity or dissimilarity of the frequency of each motion class, appearing within the repertoire of the symmetrical pattern structures of an artefact's ornamentation.

Stylistic analysis is made on two major levels of investigation. On the first level, two groups of objects are analysed which have been produced within the same medium, in this case, Merovingian garnet jewellery. The objects chosen have previously been analysed by Arrhenius according to different types of manufacturing techniques (1985:fig.1). Symmetry analysis will be carried out here in order to test whether the grouping of garnet objects achieved by this method of analysis is similar to the grouping derived by Arrhenius' classification. Both groups have been identified by Arrhenius as belonging to two distinct workshops or areas of garnet jewellery production. The first sample group of garnet objects has been associated with a workshop situated in the North Sea area, while the second sample group has been associated with a central ecclesiastical and related secular workshop in Trier (see Chap.3:fig.1). Both sample groups contain two main types of artefact, chosen in order to test whether the result of the symmetry analysis has been influenced by the particular shape of the design-fields decorated with garnets. Each group of garnet jewellery contains, therefore: a) brooches and a plaque with round, disc-like design-fields, and b) sword-pommels and a purse-handle with a triangular-shaped or, so called, 'cocked-hat' design-field. The latter level of investigation is designed in order to test whether the symmetrical structure of the ornamentation is dependant on the particular function, i.e. shape of the artefacts decorated. Investigation on the former level of analysis is designed in order to test whether symmetry analysis can be used as a method to identify stylistic variation and continuity not defined by the function (i.e. shape of the artefact) but rather defined by the identity of a group of craftsmen working for

or within a culturally and socialy specific community, or even within different cultural contexts.

Another set of materials investigated by means of the method of symmetry analysis consists of decorated artefacts which have been produced again within at least two different social contexts; one is defined by ecclesiatical activities, the other is defined by objects which were used within a secular context. The former group of materials consists of a manuscript painting from the Book of Kells and the Lindisfarne Gospels, in this case the letter 'Chi'. The other group of objects consist of two selected items from the garnet jewellery of the Sutton Hoo ship-burial. The purpose of this test is to see whether symmetry analysis can be used to indicate stylistic variation as a measure of the distinct secular and ecclesiastic social milieus of both groups of artefacts.

3. *The method: Principles of symmetry as a basis for the classification of patterned design*

In short, the method of symmetry analysis involves the use of the principles of symmetry to describe the geometrical motions which generate *repeated* designs, whereas the assignment of the resulting symmetry class defines the *structural* arrangement (compositional layout) of elements of design within a given design field. According to the non-mathematical definition, which can be found in a standard English dictionary, symmetry describes the congruence or correspondence in size, shape and relative position, of parts that are on opposite sides of a dividing line or meridian plane, or that are distributed about a centre or axis. This definition of symmetry focuses upon the symmetrical figure as an *end product* of a series of motions across a plane or about a point. Washburn adopted the principles of symmetry, however, in order to classify symmetrical figures in a *repeating* pattern, and is thus more concerned with the axial arrangements and the *motions* used during the process of their transformation, rather than with their end product. In this perspective "symmetry can also be described as "a process by which the basic asymmetric parts of a figure, called *fundamental parts*, pass through specified motions on specified axial arrangements or loci until they reach identity with themselves or superposition with the next figure"(Washburn 1977:12). In her report Washburn uses a comma (,) to symbolize an asymmetric fundamental part, and I shall maintain this symbol for the schematic depiction of the motion classes later on in the analysis tables. Accordingly, a pattern is defined by Washburn as "any design with regularly repeated fundamental parts, parts which move along the axis by one or a combination of several geometric motions"(Washburn 1983:138). It is these motion classes which are used to describe a particular repeated pattern. On the following two pages two tables (fig.1 and fig.2) are introduced showing the model figures which belong to the most common symmetry motions discussed in the next point.

3.1. *Description of the motion of symmetry classes*

All symmetrical patterns are based upon one or more of the following four motions:
(a) *Translation*
(b) *Rotation*
(c) *Mirror reflection*
(d) *Slide reflection*

Translation involves the simple movement of a fundamental part or parts along a line axis. This is the simplest geometrical transformation, and can be exemplified schematically by a series of commas along a single line axis. That is "the generation of a pattern by translation is accomplished by successively superimposing commas along a line axis"(Washburn 1983:139). Given the linear orientation, translated patterns can only be present in one- and two-dimensional categories. This means the fundamental part cannot only be generated in one direction along a line axis, but also along two line axes, i.e. along the horizontal (x-) axis and the vertical (y-) axis (see fig.1 Translation).

As a rule for the definition of the motion classes of any design, Washburn reminds us at this stage that "all other symmetrical designs which are generated by more complex motions also can be said to be *translated* designs"but that "the symmetry of any given design is always described by the most complex motion or motions which generate that design"(Washburn 1983:139).

Rotation requires the fundamental parts to be moved about a point axis. This motion class can describe designs generated in all three plane-pattern categories considered here, i.e. *finite, one-dimensional and two-dimensional.* Thus, "patterns whose parts move about a point axis are called finite, because eventually the parts will move full circle to superimpose upon the orginal starting point"(Washburn 1983:138). In order to make the analysis clearer some general rules can be established here about the relationship between the three categories and the rotation of fundamental parts. In finite designs the parts can rotate around the central point axis any number of rotations. In one-dimensional designs only bifold (twofold) rotation is allowed, since any other number of rotations would move the parts off the line axis. In two-dimensional designs only two-, three-, four-, and sixfold rotations are possible.

Mirror reflection requires the fundamental parts to be reflected across a line axis in a mirror-image relationship. This motion class is present in all three plane-pattern categories. *Slide reflection* is another type of reflection. It combines the motion of mirror reflection of design parts across a line with the translation along that line axis into the succeeding position. Because line axes are involved,

CLASSES		DIMENSION			ONE-DIMENSIONAL	TWO-DIMENSIONAL
DEFINITION	FINITE	ONE-DIMENS.	TWO-DIMENS.	FINITE		
TRANSLATION	100	1-100	2-100			
MIRROR-REFLECTION						
A. HORIZONTAL	110	1-110	2-110			
B. VERTICAL	101	1-101	2-101			
COMBINATION: HORIZONTAL & VERTICAL MIRROR-REFLECTION	211	1-211	2-211			
SLIDE-REFLECTION:	-----			----------		
A. HORIZONTAL		1-100 $_H^1$	2-100 $_H^1$			
B. VERTICAL		1-100 $_H^1$	2-100 $_H^1$			
ROTATION:						
A. BIFOLD	200	1-200	2-200			
B. THREEFOLD	300	-----	2-300			
C. FOURFOLD	400	-----	2-400			
D. SIXFOLD	600	-----	2-600			
COMBINATION: ROTATION & HORIZONTAL-VERTICAL MIRROR-REFLECTION	A. 301 B. 411 C. 611	1-201				

Fig. 1

Symmetry motion classes within the three categories of plane patterns and their figure models for monocolor designs with the nomenclature adapted by Washburn 1977 (figs. 15, 16, 18, 20-24)

Fig. 2 Symmetry motion classes within the three categories of plane patterns and their figure models for counterchanged designs with the nomenclature adapted by Washburn 1977 (figs. 17 and 19)

the motion of mirror reflection of design parts across a line with the translation along that line axis into the succeeding position. Because line axes are involved, the motion of slide reflection is present in only one and two-dimensional patterns. Figure 3 below illustrates all four of the above discussed basic symmetry motions.

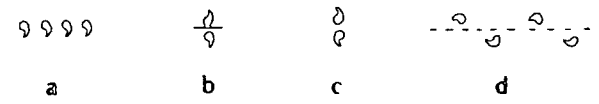


Illustration of the four basic symmetry motions,
Washburn 1977, fig.3
fig.3

In this figure and in all the model figures employed in the analysis table of this thesis, the locus of rotation is indicated by a dot, the locus of mirror reflection by a solid line and the locus of slide reflection by a dotted line.

In the above, a basis is provided for the classification of repeated designs. Only the patterns whose fundamental parts are of identical size, shape, and colour can be assigned to these basic or 'pure' motion classes. In practice, however, there are patterns, also among the Anglo-Saxon material, whose constituent fundamental parts have the same shapes, but are in different colours. According to Washburn's experience, this most frequently occurs in an alternating *A - B - A - B* fashion although theoretically any number of colour alternations may be admitted (Washburn 1983:140).Such patterns are said to have 'colour reversal' or 'counterchange', and can be depicted as in the next model figure:

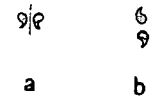


Illustration of the principle of counterchange,
Washburn 1977, fig.4
Fig.4

In my use of Washburn's model figures I confine myself to the models for the basic motion classes in order to clarify the geometrical generation of the analysed designs in the tables. An extra column is used to indicate occurence of colour reversal or other colour variations. Colour reversal will also be discussed along with the nomenclature explained in the following section.

3.2. *Washburn's nomenclature for the symmetry classes*

Within any plane-pattern category there are numerous *classes* or different ways the symmetrical motions can be combined to form both monocolour and counterchanged designs. In her process of classification Washburn therefore uses a nomenclature where all of these classes are systematically described with mutually exclusive names. The two tables which have been introduced earlier on also account for these for the basic monocolour (fig.1) and for the counterchanged classes (fig.2). Together with the model figures they describe the basic symmetry motions within the three categories of plane patterns. In short, the prefix indicates the category , i.e. '1' for one-dimensional, '2' for two-dimensional, and a blank space for finite designs. The first digit indicates the number of translations or rotations; '1' or '0' in the second digit is used to indicate the presence or absence of horizontal mirror reflections; and the third digit indicates the presence or absence of vertical mirror reflection (Washburn 1983:140). Since slide reflection is a motion which results from the combined operation of mirror reflection and translation movements, and since it can move along either the x-axis or the y-axis in two-dimensional patterns, it is represented by Washburn in her nomenclature by placement of an 'x' and/or 'y' after the three-digit number to indicate the presence of slide reflection along either of the two axes (Washburn 1977:17). The tables show the most common forms of monocolour and counterchanged finite, one-dimensional, and two-dimensional designs.

3.3. *Classification of symmetry operations 'within' and 'between' design units in a continuous pattern*

The nomenclature for counterchanged patterns is more complex, since it is necessary to indicate not only whether counterchange occurs in each symmetry motion, but also whether this counterchange occurs *within* or *between* the design units. This distinction between design units has to be made, since this type of analysis, as Washburn points out, can be concerned with individual decorative motifs as well as with continuous patterns (Washburn 1977:15). Of course this applies also to monocolour designs. Figure 5 will clarify the distinction made here:

In this figure it is clear that commas '2' and '3' are in vertical reflection with one another as perfectly as are the commas '1' and '4'. However, if this structure is considered in a pattern format, as in the schematic depiction on the right (fig.5b), "it is clear that fundamental parts '1' and '2' are more naturally associated as a decorative working unit than are parts '2' and '3'. Therefore, although the vertical reflection axes A and B promote the identical symmetry operation, it is desirable to differentiate between the vertical mirror reflection (across axis A) that occurs *within* two symmetry unit and the vertical mirror reflection which occurs *between* two symmetry units (across axis B)"(Washburn 1977:15).

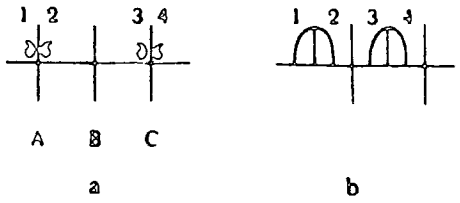


Illustration of the difference between a symmetry operation within a symmetrical unit and between symmetrical units, Washburn 1977, fig.5
fig.5

According to this distinction Washburn defines a *design unit* as a "symmetric figure composed of at least two fundamental parts"(Washburn 1977:17). For example, two triangles in bifold rotation constitute a design unit. If this symmetric figure stands alone, it is possible to speak only of the counterchange that can occur *within* this figure, that is between the two fundamental parts that comprise the design unit. However, if a series of these design units is arranged along one or two line axes, then counterchange can occur on reflection, rotation and slide reflection axes that pass between the design units, as well as within each unit.

3.4. *Washburn's nomenclature of colour counterchange*

In order to indicate precisely which symmetry motions are counterchanged, superscripts and subscripts are employed by Washburn in her nomenclature. A subscript indicates the presence of counterchange *within* a design, whereas a superscript indicates the presence of counterchange *between* design units. For counterchange within the unit around the two mirror reflection axes, and along the slide reflection axis for x- and y-digits, superscipt '2s' are used. Subscript '2s' are employed for counterchange between unit figures on two mirror reflection axes as well as on the 'x' and 'y' slide reflection designators. For example, class '2- $21_2^2 1_2^2 x_2 y_2'$ has counterchange both within and beween the units on both mirror and slide reflection axes. Counterchange between rotation units is indicated by three different digits. A subscript '1' indicates counterchange around the vertical y-axis (Class '2-$2_1$00'); a subscript '2' indicates counterchange around the horizontal x-axis (Class '2-$2_1$00'); and a subscript '3' indicates counterchange around both the x-axis and the y-axis (Class '2-$2_3$00').

4. *Procedure of analysis*

In relation to that which has just been proposed, symmetry classification can be made at several different levels: "the symmetry of the structure of the design, the symmetry of the design, the symmetry of the constituent elements and motifs, and the symmetry of the whole design"(Washburn 1977:18). Speaking of pottery decoration, Washburn defines the *structure* of a design as refering to "the basic constructional lines used to subdivide the vessel surface area to be decorated"(Washburn 1977:18). She refers to this elsewhere as the *design field.* In the case of the material investigated here, be it the decorated metalwork from Sutton Hoo, the illuminated Chi-Rho's from the early Insular manuscripts, or even stone-crosses of that period (not analysed here), the entire surfaces of these artefacts can be characterized as such 'design fields'. This differs from most of the ceramic decoration Washburn analyses, where only certain areas on the artefact are defined for the purpose of ornamentation.

The all-over spread of decoration on early Anglo-Saxon period artefacts is a striking feature, about which archaeologists and art historians have commented before, and which now gains importance again in view of the systematic and comparative symmetrical analysis. According to Washburn, "the structure of a design may be manifest in several different forms. In the simplest form the subdividing lines are the basic constructional lines of the design unit"(Washburn 1977:18). These patterns are easily classified since the symmetry of the *structure* and the symmetry of the *design* are identical, except, of course, if the units are colour-counterchanged. In the analysis tables, two columns are provided to account for this similarity or difference of symmetry. In the case of mere colour-counterchange the *class* of symmetry remains unaltered. In more complex designs the symmetry of the structure and the symmetry of the design, however, may be different. In these cases, the design field is subdivided into smaller spaces that will, in turn, be filled with design motifs. In a symmetrically subdivided design field these spaces are of uniform size and shape and, therefore, have a symmetry of their own. Two examples may illustrate what has been outlined so far. In the next figure the 'design field' is a long narrow band which has been demarcated by two narrow horizontal parallel lines:

This field has been subdivided into parallelogram panels, each of which has Class 200 bifold rotational symmetry (indicated here by the commas in fig.6a). These parallelogram panels have been filled with bifold rotational motifs (fig.6b). In this case, since the symmetry of the motif inserted is identical to the symmetry of the structure (here, 'design field'), the symmetry of the *whole design* is still characterized by bifold rotation. In the example shown in figure 6c the bifold rotational parallelogram panel has been filled with a fourfold rotational motif. Thus, the symmetry of the structure is class 1-200, the symmetry of the motif is 400, but the symmetry of the 'whole design' is only 1-200, since bifold rotation is the motion which moves the entire pattern along the horizontal axis. When

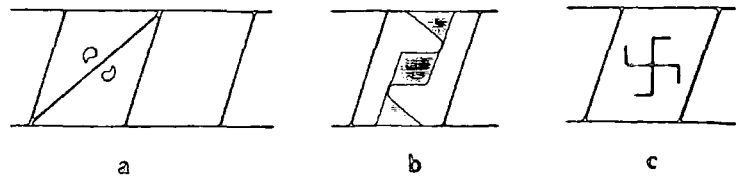


Illustration of an identical symmetry structure housing different design symmetries, Washburn 1977, fig.8
fig.6

defining the 'whole design', as Washburn suggests as the last step of analysis, the more complex symmetry of the motif is reduced to that of the more simple one of the structure, which characterizes the structure as well as the design unit. As this study is focused on the symmetry of the individual designs and motifs, and their relationship to the structure, this last point, which provides a compromise and a simplification of the symmetry analysis, is omitted from the present investigation.

5. *Presentation of the garnet jewellery and the two Chi-Rho illuminated pages from Lindisfarne and the Book of Kells*

On the pages preceding the analysis tables in chapter four, some artefacts are introduced with a colour picture others with a black and white copy of their original appearance. This is followed on the next page by an outline drawing of the decorated surface of each artefact. Here each decorated panel is numbered in the sequence in which the analysis will proceed. In the tables, the first column contains the key to these numbered panels, followed by two columns in which the design field, the composition of the motifs and the filling ornament are depicted in order to define their symmetrical movements in the next column. The fifth column contains the defined model of the symmetry motion, using 'commas' to symbolize the mode of symmetry in each case. A sixth column accounts for the axial arrangement of the structure or design and also for whether its category is finite, one-dimensional or two-dimensional. After the design has been assigned to one of these three categories the reader is then directed to a bigger column labelled 'comments'. These comments concern issues which could not be accounted for in the symmetrical analysis, such as the artistic effect of a design in its entire make-up, its method of construction as suggested by archaeologist's reconstructions or the question of how the design relates to other (functional) parts of the artefact. As mentioned before, there are also certain aspects of colour variation, within the

decoration of the garnet jewellery and the two manuscript pages, which cannot be accounted for in the original analysis, either because the counterchange is irregular, or has other artistic qualities. The next column, then, is provided to indicate colour-counterchange in the symmetrical sense, whereas the last column contains the full nomenclature of the previously analysed symmetry movements.

Chapter three

The Material Examples

1. *Merovingian Garnet Jewellery*

1.1. *Sample group one: The North Sea group*

Arrhenius has identified a group within Merovingian garnet jewellery according to her manufacturing typology which she refers to as the 'North Sea Group' (see fig.1). The distinctive feature of this group is the use of calcite putty in order to fix the garnets onto the metal base of the artefact (1985:139). This group is based on 15 objects, 5 of which are from two graves, and counted as one sample each. The objects chosen from this group for the symmetrical analysis are:
a) the disc-brooch from Dover (Chap.4:fig.1);
b) the disc-brooch from grave 91b Köln-Müngersdorf (Chap.4:fig.11);
c) the purse-handle from Köln-Müngersdorf (Chap.4:fig.12);
d) the disc-brooch from Marilles (Chap.4:fig.3);
e) the composite brooch from Faversham (Kent) (Chap.4:fig.7);
f) a disc-brooch from the Rheinland (Chap.4:fig.9).

Arrhenius was not able to identify the exact location of a workshop for this group of objects, but she suggests that one may have existed either in Anglo-Saxon England or on the Continent near the North Sea coast (1985:141, see fig.1). According to her chronological assessment of the sand putty group, Arrhenius concludes that the calcite group occured a little later than other sand putty groups of jewellery. The earliest objects with calcite putty belong to a phase which is exemplified by the Cologne grave, and calcite putty is also present on the brooches from St Denis. The latest objects with cloisonné set in calcite putty appear to be those from Sutton Hoo (ibid). The material analysed by Arrhenius in connection with the sand putty technique includes also a group of sword-pommels with gold cloisonne of a triangular, so called 'cocked-hat form'. The four objects are:
a) the sword pommel from Hög Edsten (Chap.4:fig.19);
b) the sword-pommel from Väsby (Chap.4:fig.17);
c) the sword-pommel from Vallstenarum (Chap.4:fig.21);
d) the sword-pommel from Sutton-Hoo (Chap.4:fig.15).

fig.1 Distribution map showing satelite workshops and objects with cloisonné with sand putty and the central workshop and its objects in fused paste technique; Large star = Central workshop, probably situated in Trier; Large dot = Satellite workshop, probably situated somewhere on the North Sea coast; from Arrhenius 1985, Distribution map II.

Both the sword-pommel from Hög Edsten and the one from Väsby contain pure quartz putty in the setting paste used as a technical device, forming another type of sand putty. According to Arrhenius these objects were probably manufactured and designed in workshops of the Trier-Cologne area, where quartz putty is concentrated (ibid). However, Arrhenius has also found that these two sword-pommels are closely related to the sword-pommels of Vallestarum and Sutton Hoo, both of which have been hypothesized by Arrhenius as belonging to the workshop of the North Sea group. Evidence for the close association of the two pairs of sword-pommels is based on the similarity of some garnet-shapes on the sword-pommmel from Vallstenarum and Väsby, and their common association with the cement-technique (ibid). Other evidence derives from the similarity of the garnet motifs alone. Thus Arrhenius points out that the design with opposed boar's heads found on the sword of Vallestarum is very similar to a design in garnet cloisonné on the disc-brooch from Marilles (North Sea Group). This design can be seen more clearly on the sword-pommel from Hög Edsten (ibid). From this combined evidence of the type of sand putty used and the feature of some garnet-shapes, Arrhenius has also hypothesized that the sword-pommels from Sutton Hoo and Vallestarum, as well as the brooches from St Denis and Marilles, came from the same workshop (ibid). Because of the evidence refered to above, it seemed worthwhile to include the sword-pommels from Väsby and Sutton Hoo and the disc-brooch from St Denis (Chap.4:fig.5) in the symmetrical analysis of this first sample group of objects.

1.2. *Sample group two: The central West European workshop for cloisonné.*

The distinctive features of the group of garnet jewellery analysed here as the second sample group are, according to Arrhenius' analysis, a) the use of fused paste in order to fix the garnet onto the metal base of the artefact, and b) the use of the so called f- and g-templat for shaping the actual garnets (1985:162). The individual objects from this group used for the symmetrical analysis are:
a) the disc-brooch from Schretzheim, grave 23 (Chap.4:fig.25);
b) the disc brooch from Soest, grave 106 (Chap.4:fig.27);
c) the plaque from the Trier-Egbert shrine (Chap.4:fig.23);
d) the buckle from Tongeren (Chap.4:fig.29);
e) the sword-pommel from Skrävsta (Chap.4:fig.31).

Arrhenius suggests that the disc-brooches and mount were directly manufactured in an ecclesiastical workshop situated in Trier, and that the sword-pommel from Skrävsta was, together with another sword-pommel from Uppsala Västhög, produced in a workshop with a close association to this central ecclesiastical workshop. Unfortunately the ornamentation of the latter sword-pommel did not remain intact so that it could not be analysed and used for comparison. The

most important and precious object, which is directly associated with the ecclesiastical workshop is the Egbert-plaque. It is the only object with fused paste that has been found in Trier itself (1985:169). The plaque consists of an outer oval frame with a broad border of mushroom-shaped cloisonné cells set with garnets in the shape of quatrefoils and surrounded by a row of rectangular garnet cells, whose outside cell walls form the toothed edge of the plaque. The quatrefoil border is interupted in four places by a design of pear-shaped relief-cut garnets (probably representing animal heads) set in the shape of a cross. This setting has a raised centre with a coin from Justinian surrounded by a beaded border, outside of which, and following the oval outline of the inset, is a double border of alternate red and green glass inlaid in cloisonné. These borders are interupted in four places by cross-arms also made up of cloisonné with rectangular cells. In the panels between the cross-arms and the borders are decorations in niello consisting of triangular and T-shaped stamps of different designs in each of the panels. Rademacher (1936:155) considers the whole central section to be an Ottonian addition, while Vierck (1974:362) maintains that only the raised central panel is Ottonian. Rademacher's opinion is partly based on his assumption that the cloisonné of the inner borders was inlaid in red and green glass. According to Arrhenius' opinion, however, the green glass only occurs every four cells, and the intended composition involved a sequence of inlays with green glass, pale red glass, almandine garnet, pale red glass again, followed by green glass. As the glass has corroded, the sequence of the glass inlays is difficult to determine (Arrhenius 1985:169). Arrhenius suggests that the Egbert-plaque was originally used as a pendant. Vierck, however, considers that the plaque came from an earlier Merovingian reliquary from Eligius' workshop. According to Arrhenius' opinion, the plaque from Trier is one of the finest examples of Merovingian Garnet cloisonné, and can hardly have been produced after about 600 AD (ibid). Kendrick (1973:37) emphasizes the similarities between the Trier-plaque and Anglo-Saxon pendants of Bacton type; Bruce-Mitford (1949:37) takes this argument a stage further when he suggests that the plaque was manufactured in the workshops at Sutton Hoo. Arrhenius suggests, however, that pendants of this kind are not exclusive to Anglo-Saxon England; they were probably equally common in the Merovingian lands, and would have derived from Byzantine enamelled medallions. The whole jewelled plaque was mounted on the Egbert shrine, probably with the specific intention to emphasize Trier's tradition of garnet work. The latter could be seen as evidence of a Byzantine tradition (Arrhenius 1985:170). Because there is a strong Byzantine element in all the fused paste work, Arrhenius thinks it possible that Byzantine goldsmiths and gem-cutters worked in Trier (ibid). There is also reason to assume that the design of the Egbert-shrine was strongly influenced by the contemporary local scriptorium in Trier (Westermann-Angerhausen 1973:137). As regards the social function of the plaque, Arrhenius assumes that it could have been a symbol of Byzantine Trier, whose apostolic traditions confirmed Egbert's primacy (1985:172).

The disc-brooch from grave 106, Soest is another object directly associated with the Trier-workshop and the Egbert-plaque. All the inlays of the brooch are intact. The brooch has been described by Arrhenius as unusually polychromatic; the central rosette has a trefoil design inlaid with almandines surrounded by yellow glass, while the four concentric borders' green transparent glass and pale blue opaque glass alternate with almandine and stones which may be either hessanite garnets or pale red glass. On the back plate a runic inscription indicates that the brooch was a gift (Arrhenius 1985:178). According to Arrhenius the brooch is linked to the Trier-plaque primarily by its polychromatic character, but also by the cell shapes, which are cut from the g-templet. These also occur an the mushroom-shaped garnets on the Trier-plaque (ibid). The design on the Soest brooch is completely geometrical with no animal ornamentation.

The golden buckle from Tongeren, another object directly related to to the central workshop in Trier, was found in the cathedral in Tongeren. Tongeren belonged to the diocese of Trier, and lies at a distance within the range of the Trier workshop (Arrhenius 1985:175). The Tongeren object is now very fragmented and has been reworked at the hinges at an unspecified date. The hinge may have been the mount of a reliquary, or possibly a pyxis (ibid). The mount consists of two rightangled cloisonné borders which meet at the actual hinge, while the opposite, rectangular plate has three domed stones interspersed with two small cloisonné panels with designs of two backward-biting animals. These panels are very similar to the animal ornamentation on the shoulder-clasps from Sutton Hoo. As in Sutton Hoo, some of the cells are lidded. The gold panels dominate the design by the strong contrast in colour between the gold and the garnets. There is no actual chemical proof that the Tongeren mounts are fused paste work, but Arrhenius has emphasized strong visual evidence for the use of this particular technique with the L-shaped mounts. Figure 29 (Chap.4) shows a hypothetical reconstruction of their original form. Arrhenius suggests that the Tongeren mounts may have been used in a Christian context like the Egbert-plaque (ibid.).

The objects refered to so far are regarded by Arrhenius as the product of an ecclesiastical workshop situated in Trier. This workshop is characterised by the use of sulphur paste, and a high frequency of stepped garnets, and polychromatic inlays of enamel and glass (1985:180). Because of the use of very small garnet-shapes and step-patterns, including those from f- and g-templats, Arrhenius has dated these objects to a period around the 560s AD. (ibid). The decorated sword-pommel from Skrävsta, included in the list of objects above, appears to be closely related to the hypothesized ecclesiastical workshop in Trier (1985:181). There is no evidence that this object was produced in the workshop in Trier itself as the latter was probably managed by the Church. Arrhenius assumes, however, that a secular workshop with close contacts with the stone-cutting in Trier may have been responsible for its production (ibid). The sword-pommel is of high quality, and calcite/wax paste, another variation of fused paste, has been used to fix the garnets onto the metal base of the object. According to Arrhenius, cut garnets

of fine quality, and suitable for complicated patterns, could have been purchased from the Trier workshop. Sulphur paste was, however, probably not available to this secular workshop, and has been replaced by calcite/wax paste from another source (1985:182). Because of this close association of the garnet-shapes, the sword- pommel has been included in the analysis of the garnet objects believed to be from Trier. The material where calcite/wax paste has been used as a technical device does not suggest a location for a certain workshop. Arrhenius suggests that it was most likely situated in Anglo-Saxon England, but that a location of this workshop in the Frankish kingdom or even in Uppland was also probable. Arrhenius has established that fused paste first appears in Scandinavia early in the Vendel period, together with garnet-shapes and motifs which are associated with the fused paste work of the Continent and Anglo-Saxon England described here (1985:86). The two sword-pommels from Valsgärde (graves 5 and 7, figs.35 and 33 respectively), and a sword-pommel from Vendel (fig.37), have been produced in this early period between 600-650 AD. They contain, however, a type of garnet suggesting that the workshop which produced f- and g-stepped garnets no longer existed (ibid). The Scandinavian sword-pommels from Vendel I and Valsgärde have been included in the analysis of this second sample group in order to provide a larger scope for comparison.

2. *The Sutton Hoo purse-lid and shoulder-clasp*

2.1. *Historical setting and dating of the Sutton Hoo ship-burial and its jewellery*

In his 'Recent theories...'(1950) on the social and historical background of the Sutton Hoo ship burial Bruce-Mitford states that "it is not until the remaining mounds of the grave field have been excavated before many questions receive their final answer"(1950:1). Thus until now the question of the historical significance of Sutton Hoo remains largely based on the material of the gravegoods and their interpretation in typological and art-historical terms.

With respect to the wealth of the gravegoods and the type of burial which has close parallels to Swedish Vendel period ship burials, it is not doubted that "the Sutton Hoo burial is royal in the sense that it reflects the royal court and illustrates the topmost stratum of Saxon society"[with the treasures buried in it reflecting] "at least tribal treasures from a national treasure-store"(Bruce-Mitford 1960:4). The burial itself reflects Swedish customs. However, the armour, i.e. shield, helmet and sword, are considered now to have Continental links. It has also been maintained that the person commemorated in Sutton Hoo was an East Anglian king, i.e. belonged to Anglo-Saxon society.

The type of burial, part of its buried armour and the cultural milieu indicated by the Sutton Hoo burial finds its parallels in the heroic poem of *Beowulf*. Bruce-Mitford has shown that some passages in this poem contain a description of

armour that closely relates to the armour found in the Sutton Hoo ship burial, like the helmet, for instance. The ship-burial itself is essentially dated according to the Merovingian gold coins found in it, which maintain a terminus post quem date of A.D. 620-625 (ibid).

The Sutton Hoo jewellery covers a diversity of pieces which may indicate different local origins of make and date. But Bruce-Mitford who was particularly concerned with the technical details and the skill of the Sutton Hoo artist stresses not only the achieved homogeneity of the jewelled objects in the cloissonné medium but also the uniqueness of the objects, and ascribes them therefore to a single workshop. A workshop which was probably closely associated with or under the patronage of the East Anglian court, "Sutton Hoo has revealed a level of sophistication and material culture at the East Anglian court not suspected hitherto...It was a milieu capable of producing the finest jewellery of its era to survive in Europe, having wide contact..." (1974:96).

2.2. *Description of the artefacts and the material used for decoration*

The decorated objects analysed in this chapter belong to the jewellery and fittings found in the body space of the Sutton Hoo ship burial. Together with the other gold cloisonné work, such as buckles, strap-ends and mounts, both types of artefact, the purse-lid and the shoulder-clasps, have been subject to extensive investigation in R.L.S. Bruce-Mitford's publication on the *Sutton Hoo Ship Burial* (1978). I therefore refer frequently to his work in the next sections, which deal with the state of preservation of the artefacts, and the technical details of their production (1978:432ff). I also adapt most of the sketch-drawings published in the mentioned volume; this concerns not only the outline of the analysed objects, but also the detailed schematized drawings of the minute cell-shapes that have been identified by the author. Bruce-Mitford came to conclude that of all the jewelled objects investigated by him "the purse-lid and the shoulder-clasps are the most complex and unique pieces" (1978:432).

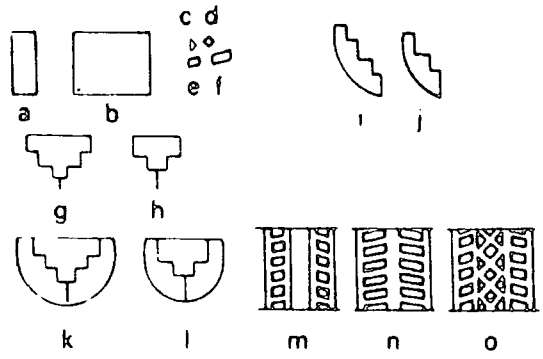
2.3. *State of preservation and technical details of production*

The lid was restored in the British Museum Research Laboratory in 1945, and this restoration was on exhibition until 1972 and has appeared in all illustrations of the purse-lid so far published, according to Bruce-Mitford (1978:439). The construction of the curved frame in relation to the plaques and to its own inner tray is as shown in figure 1. In the new, post-1972 reconstruction the plaques have been raised one millimetre in relation to the frame. There is otherwise no difference from their positioning in the previous reconstruction (ibid:498). According to the investigator "the chief difference is that the postulated upper layer of bone or ivory (?) in which the plaques and studs were supposedly set has been removed, leaving them free-standing on the lid-surface"(ibid). The fabric of which the purse bag has been made, and to which the clasp-tongue was attached, has perished without trace, as has the original substance of the lid. The pair of massive curved shoulder-clasps lay face upwards, and have been described as being in first-class condition. They strongly suggest that they were placed in the burial chamber as found, having been removed from the garment to which they had been attached (ibid:442).

2.4. *The material used for decoration on the purse-lid*

The frame. The frame of the purse-lid is of solid gold. It is 19.05 cm long and 8.3 cm wide, and there are three hinges attached to it, for the strap of the belt by which it was worn and a sliding clasp (see pl.2). The frame itself consists of a straight bar at the top and a curved portion below. While the straight bar contains small rectangular cell-panels jewelled with cut red garnet, the curved portion of the frame has polychrome inlays, consisting of fine blue and white millefiori (chequered glass) designs, and an edge-binding of filigree wire, which could best be described as "jewel work, made with threads and beads"(Oxford English dictionary: 'filigree'). "The straight bar is the only part of the frame to have features in relief. On it are five barrel-shaped projections. The projections are set with garnets. Some of these, in the three projections, are of minute shape"(Bruce-Mitford 1978:492).

The field within the frame is entered by four round-ended inward projections (see fig.2 k and l) from the straight bar that forms the top element of the frame. These four projections each carry, in cloisonné work, that which the same author calls, "a clear, simple theme of a T-shaped cell supported on a stem"(ibid:498). The projections are in the form of stilted semicircles, the sides being slightly prolonged. Two of the projections are of smaller size, two larger, but their arrangement is the reverse of the studs; the outside projections are the smaller, the inner ones the larger, providing a "subtle balance with the disposition of the studs"(ibid:491). The small projections occur at the extreme ends of the bar.



Cell forms and patterns used in the frame (a)-(h) forms; (i), (j) residual shapes; (k)-(o) themes of patterns. (Scale:3/2). Bruce-Mitford 1978, fig.359
fig.4

The large,[x] in the middle, separate the central double plaque from the hexagonal plaques to either side of it. The smaller cells show a simple one-step T-shaped cell. In the larger projections the T-shaped cell is correspondingly large and has two steps.

The cloisonné plaques and studs. The frame encloses seven garnet-jewelled ornamental plaques and four circular studs. The four different themes appear in identical pairs. The investigator stresses that the placing of the plaques is not in doubt, since they were recorded undisturbed 'in situ' (ibid p.491)(see fig.3). The themes are depicted on the plaques with thin slices of cut and polished garnet, offset with blue and white chequered glass and fine gold filigree and are mounted on backings of gold foil (ibid:448). According to the same author, each plaque is of high technical quality, which is especially visible in the delicate cloisonné of the two hexagonal plaques (ibid:432), each outer border of which contains close upon one hundred minute cells with garnets (Jessup 1950:90).

The double plaque with zoomorphic interlace. The design of the double-plaque is wholly zoomorphic. It is 2.3 cm in height, and 4.3 cm in length. The plaque depicts four erect animals in facing pairs with interlacing, or better interlinking, limbs and jaws. According to the investigator the plaque consists actually of two plaques, whose distinction is maintained by a reentrant triangular space at the bottom of the plaque between the two animals (Bruce-Mitford 1978:489). The cell-forms are irregular and dictated by the animal's anatomy. Lines of minute parallelogram cell-forms are used as bordering devices. The investigator

x) projections

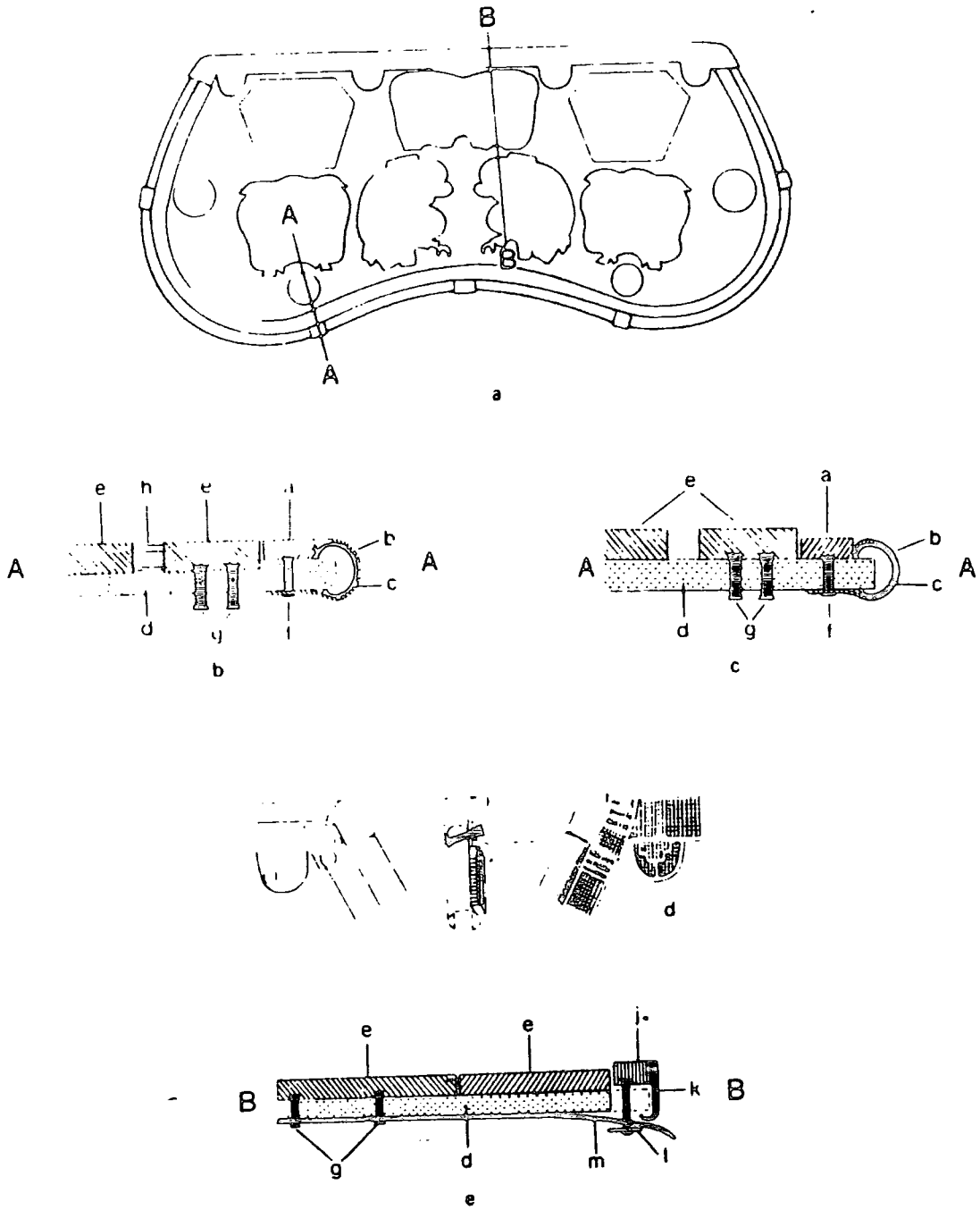


fig.2 The purse: (a) sketch of the purse showing the location of the sections; (b) (c) cross-sections of the purse lid (A-A) as reconstructed (b) in 1945 and (c) in 1972; (d) drawing illustrating the method of attachment of the straight and curved parts of the frame; (e) sectional drawing through the purse-bar and lid (B-B) showing the method of attachment of the (?) leather of the bag. Bruce-Mitford 1978, fig.363

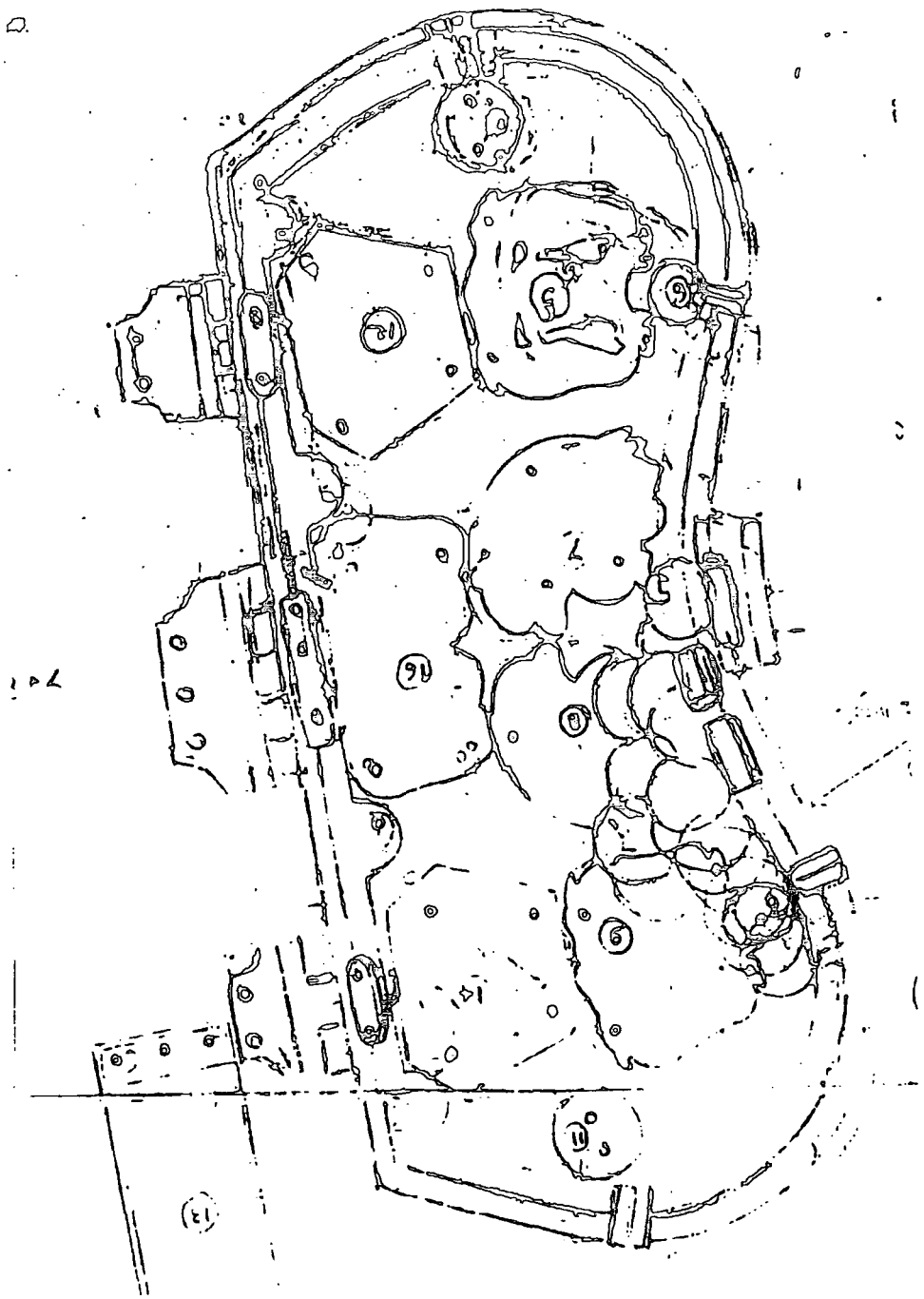
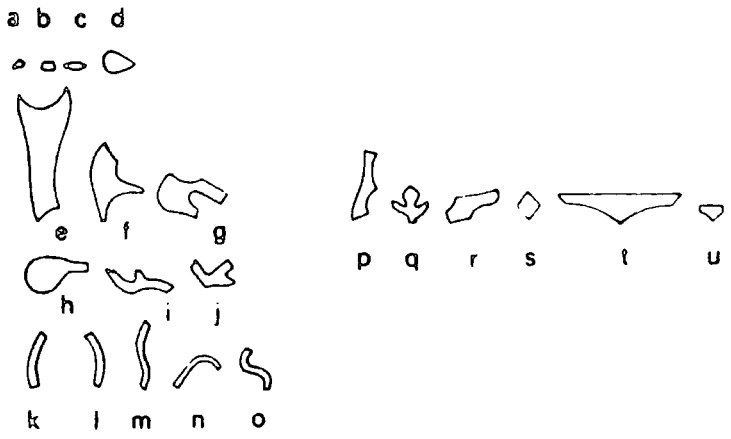


fig.3 The purse-lid upside down in the ground, as drawn by Stuart Piggott (Scale: slightly reduced). Bruce-Mitford 1978, fig.360



Cell shapes used in the zoomorphic double plaque: (a)-(o) standard bordering cells and unique forms devised in executing the animal design; (p)-(u) select background cells sealed by gold lids. (Scale:3/2). Bruce-Mitford 1978, fig.368
fig.5

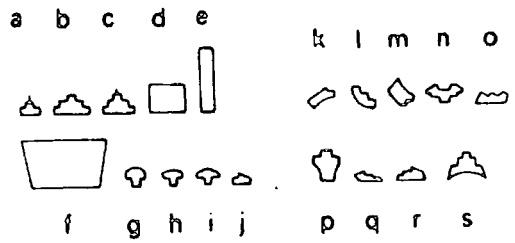
distinguishes also residual or background cell-shapes, which are filled with garnet-cutting, eliminated by use of the 'lidded cell-technique' (ibid:503). In figure 5 all the cell-shapes used to make up the double-plaque are depicted.

The two hexagonal plaques. The hexagonal plaques measure 2.8 cm in height and 3.3 cm in length. Their display surface is completely covered with a small-scale geometric cloisonné design around a large central cell that did contain a single expanse of millefiori. The latter has not been remounted onto the purse-lid in its present reconstructed version. The millefiori rod used for this central cell, however, is that seen also among the ones used for the frame of the purse-lid (see fig. 12/cell-no.1, 4, 11 and 14; type O).

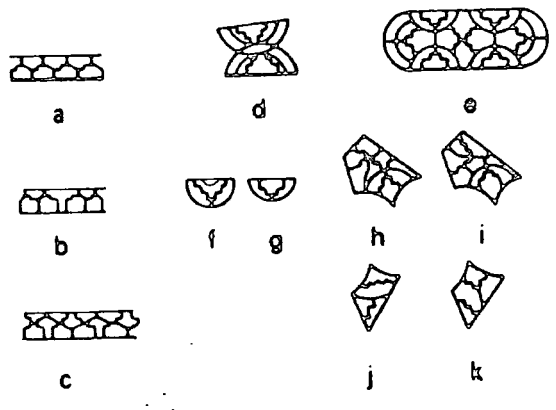
As with the cells of the zoomorphic double-plaque, Bruce-Mitford distinguishes between 'residual' and 'basic' cell-shapes, as seen in the figure above.

There are minor differences observable within the pattern layout of the irregular 'residual' cell-shapes in the panels of the two hexagons. This is made clear in the sketch drawing in figure 6 (see fig.6 h-k in particular).

The two bird plaques. The bird plaques are slightly different in size. While the one situated on the left side of the lid is 2.8 in diameter, the other one measures 3.1 in height and 2.8 cm in length. The bird's plaques form the only pair which is reversed and this is, as the investigator stresses, remarkable for the large garnets



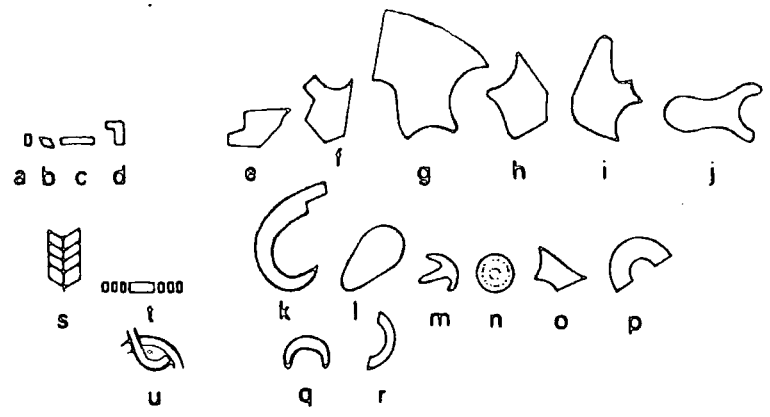
The hexagonal mounts: (a)-(j) basic and (k)-(s) residual cell shapes. (Scale:3/2). Bruce-Mitford 1978, fig.370
fig.6



Hexagonal mounts: (a)-(k) cloisonné themes and (f)-(k) show differing passages from corresponding fields in the two mounts. (Scale:3/2). Bruce-Mitford 1978, fig.371
fig.7

used for the bodies of the birds, and the minute cloisons representing the features of the tails and wings. There are minor differences in the design, notably in the cloisonné treatment of the tails of the larger birds, where on one plaque the small-cell chevron pattern is carried further up the body, coming to a triangular point, and in slight variations in the wing shape of the ducks or smaller birds (ibid:511).

Apart from the small rectangular parallelograms (or sometimes triangular shaped cells which, the investigator thinks, are probably due to inaccuracies in production), used in the bordering and for the feathers, the cell shapes are irregular and follow the outline of the bodies. The design of the birds is executed in a



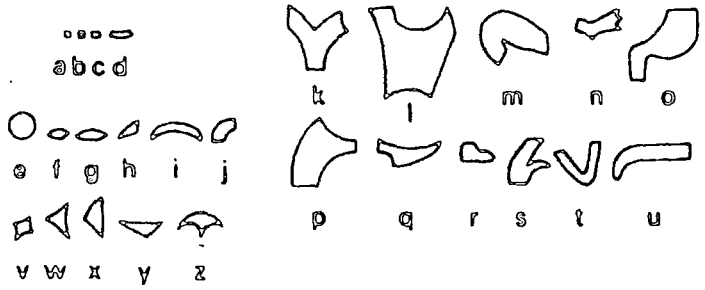
The bird plaques; cell forms and themes: (a)-(d) basic shapes; (e)-(r), unique forms devised in realizing the birds; (s), (t) geometric themes; (u), use of the lidded cell, occuring in one of the plaques. (Scale:3/2). Bruce-Mitford 1978, fig.374
fig.8

naturalistic and almost narrative fashion, and in this stylistic aspect is similar to that of the man-between-beasts plaques.

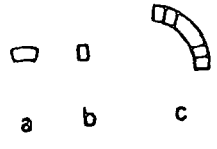
The two man-between-beast plaques. These are identical in form and height (3.0 cm), and only slightly different in length; while one is 3.3 cm long, the other has a length of 3.2 cm. The plaques contain garnet and millefiori inlays, and important use of the lidded cell technique is made here (ibid:512). As can be seen in figure 9, a range of irregular cell shapes has been used to fit the bodies of the man and the two flanking upright animals.

Both the bird plaques and the man-between-beasts plaques are composed as polychrome designs, and match the frame in that they contain single expanses of millefiori inlays in particular regions of the bodies.

The four circular studs. The four circular studs appear in pairs of two. The larger ones are 12 cm in diameter, and the two smaller ones are 8-9 cm in diameter. All of them contain garnet and millefiori inlays, which were cut to fit plain rectangular or trapezoidal cell-shapes, as seen in the figure below.



(a)-(z) Cell shapes in the plaques depicting a man between beasts: (a)-(d) basic shapes; (e)-(u), shapes devised in realising the design; (v)-(z), selected residual cells covered by gold lids. (Scale:3/2). Bruce-Mitford 1978, fig.376
fig.9



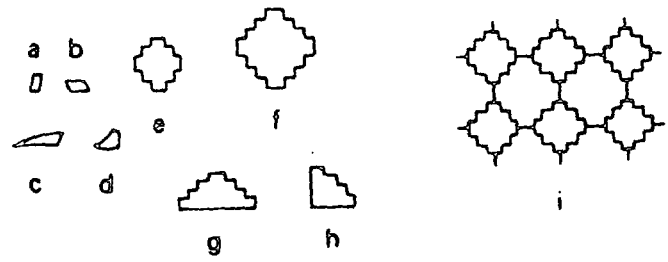
Cell shapes and theme from the border of a stud. (Scale:3/2). Bruce-Mitford 1978, fig.378
fig.10

2.5. *The material used for decoration on the shoulder-clasps*

The two shoulder-clasps each consist of virtually identical halves which join to form a hinge (ibid:525). Both clasps have the same width of 5.4 cm, and vary only in their length, which is 11.3 cm in one case, and 11.8 cm in the other. In the analysis only one shoulder-clasp is being examined as an example (see pl.3).

They are provided with twenty strong, gold staple-like, loops at the back, and this is one of the reasons why these jewelled objects are surmised by Bruce-Mitford to serve as shoulder-clasps, sewn very firmly on to the shoulder parts of the particular garment (ibid:432). Each half of the clasp consists of a central rectangular field of geometric cloisonné work, framed on all four sides by panels containing zoomorphic interlace cut in garnet and enhanced by use of the 'lidded cell' technique. Both of the curved ends adjoining these rectangular parts contain a design of pairs of naturalistically rendered overlapping boars, facing inwards and with their bodies intersecting. The spaces between the legs and heads of the boars are filled by gold panels carrying filigree ornament. According to the

same investigator it differs from the range of filigree work elsewhere in the Sutton Hoo artefact material; both 'granulation' and 'annular filigree' is uniquely used, rendering zoomorphic ornament in the form of snakes and small animals who can be recognized by their hips and feet (ibid:527) (see fig.10). This decorative use of filigree work side by side with the cloisonné decoration, provides a differential texturing of the ornamented surface of the clasps, and can be counted as an additional artistic effect. It serves, however, also as an important filling ornament for the spaces that remained free between the boar's legs. Likewise 'granulation' is used in the hips of the animals, to represent eyes, and as infill for confined spaces. The superior position of the filigree work in relation to mere granulation is, however, secured by the fact that in the zoomorphic ornament on the clasps, snake or animal bodies are contoured, a thick inner beaded wire being flanked by beaded gauge (ibid:609).



The pair of shoulder-clasps: cell forms and patterns. (a)-(h) basic shapes; (i) geometric theme. (Scale:3/2). Bruce-Mitford 1978, fig.388 fig.12

The cell-forms comprise: (a) irregular cells of special shapes and sizes dictated by the unique zoomorphic requirements of the garnet interlaces and the naturalistic boars depicted. (b) small rectangular bordering cells and terminal border shapes. (c) stilted cruciform step-pattern cells; that is, cruciform step-pattern cells that are supported away from the edges of the field containing them, and from adjacent cells, by straight gold walls or ligatures (see fig.11 above).

2.6. *Technical devices used for ornamentation and their artistic implications on the design of the Sutton Hoo artefacts*

Among the techniques used for the ornamentation of the above mentioned artefacts from Sutton Hoo there are some devices that occur for the first time in the context of jewelled objects of this period (Jessup 1950:91). Technically speaking,

the most interesting feature is the above mentioned *lidded cell technique*, a technique that had been developed from the original *cloisonné technique*, and that has been used on some plaques decorating the purse-lid and for the interlace borders around the rectangular panels of the shoulder-clasps. The artistic effect is described as such that "the garnets in parts of the design have the appearance of being sunk into solid metal"(Bruce-Mitford 1978:547), when in reality the plain fields between and around these garnet elements in the design are cells which have been sealed with thick gold lids (Jessup 1950:91). Bruce-Mitford, who was the first to recognize this *lidded-cell technique* observed that in this way new and unique cell-shapes could be devised to match the animal-body's anatomy (Jessup 1974:272).

Another technical device discovered as novel in this context by the same investigator is the use of the so-called *beaded cell* created by the overlap of the ends of two consecutive S-elements, and sealed with a gold lid, which serves as a pivot for each twist of the cloisonné 'rope' (Bruce-Mitford 1983:463). The artistic effect derived from this technical device is "a fluent interlace with the avoidance of both angularity and incoherence"(ibid).

In the light of the achievement of the fluent interlace within the cloisonné medium and with the technical device of the 'beaded cell', the intersecting boars on the semi-circular plaques of the shoulder-clasp provide another good example of penetration (ibid:505). Here above the triangular reentrant in the profile of the plaque at the bottom center, the bodies of the two animals intersect, the backbone of the animal on the left being clearly seen to pass through the body of the other animal. The fact that the usual 'openwork method' (the method where the cells are being set with stones) is replaced by an extensive use of *lidded cells*, makes it possible to "effectively block out the background areas"(ibid). Several examples of penetration are also observable in the zoomorphic interlace of the great gold buckle from Sutton Hoo.

The reason why those technical devices and especially the *lidded cell* are used throughout to create this fluency and accuracy, is seen by Bruce-Mitford in the fact that the fragile nature of the mounts would have made any attempts to reproduce the design in openwork impractical (ibid:505). But he concludes that "it is also the use of the 'lidded cell' combined in the case of the 'man-between-beasts' plaques and the 'bird plaques (purse-lid) with openwork design, which allows the figural themes achieved in cloisonné-work to be made explicit, clear and uniquely effective"(ibid).

2.7. *Implications on the use of technical devices in relation to the composition of the different styles depicted on the discussed artefacts*

It has been made explicit by Bruce-Mitford, in his discussion of the technical devices, used by the Sutton Hoo craftsman, that the 'lidded' and 'beaded' cell techniques must have been especially invented for the purpose to depict or imitate the fluency of interlace ornament and the regular and naturalistic styles of the animal ornamentation (1978:597ff). As he states, these novel techniques have been "fully developed and confidently deployed" and with them "the effective realization of the figural scenes are all encountered for the first time in Sutton Hoo" (ibid).

The decorative exploitation of these new techniques in addition to the common openwork techniques, known for instance from Kentish jewellery (Bruce-Mitford 1968:60), implies that the Sutton Hoo craftsman made a deliberate attempt to let such structurally complicated patterns, like interlace for instance, appear no longer inferior to the other cloisonné designs. From their technical description it appears that the latter are mostly geometrical in character, like the step-patterns found in the two hexagonal plaques, or in the rectangular design fields of the shoulder-clasps.

It is here there lies a strong argument in favour of the idea that there is a marked stylistic integration observable in the way different styles of equal technical and artistic quality appear juxtaposed within the same artefactual context. Bruce-Mitford finally concludes that "this, with the use of millefiori is the key to the unusual impact of these pieces [of jewellery], while no comparative material has been found even in the Continental context of technical devices and their decorative exploitation" (ibid).

2.8. *Distribution of millefiori design in the purse-lid and the shoulder-clasps and their implications on stylistic composition and colour variation on the decorated items*

The chequered blue-and-white and red-and-white millefiori inlays, used as decorative elements on the purse-lid and on the shoulder-clasps, occur in a variety of seventeen different designs (Bruce-Mitford 1983:582). In figure 13 a colour chart accounts for the different types of chequer-patterns, which cannot easily be identified on the purse-lid or the shoulder-clasps themselves (see also plate 1 for comparison). The chequer pattern provides a certain ambiguity within the symmetrical layout of millefiori design, as the blues and reds are the dominating colours and meet the eyes first. A key has been provided by Bruce-Mitford, however, to account for their particular distribution both within the decorative fields of the purse-lid and in the shoulder-clasps where they have been denoted by capital letters (see fig.12). Apart from their symmetrical order, which will be discussed later, it can be seen that the millefiori designs have been given great

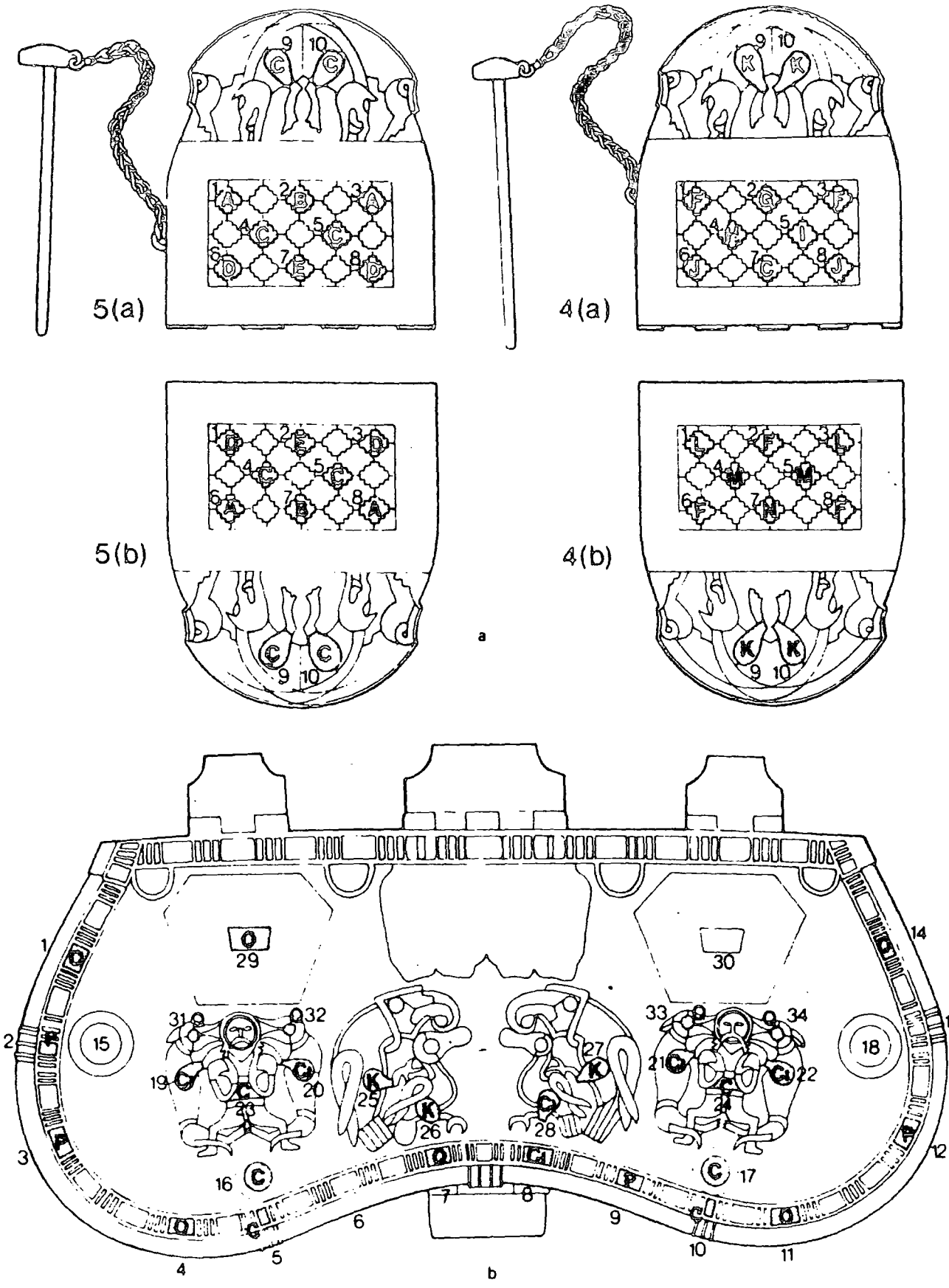


fig.12 Key to the millefiori inlays in (a) the shoulder-clasps and (b) the purse-lid, showing the distribution of the different inlays (Plate 24). Bruce-Mitford 1978, fig.429

prominence among the garnet-jewelled decoration. Thus, within the decoration of the purse-lid they appear along the curved portion of the frame, within the center of the circular studs, and apparently on six of the seven ornamental plaques. On the figurative plaques of the purse they occur on the front legs and the eyes of the two animals flanking the man on both sides, the indriffs on the spreadeagled men, and on the legs on each of the reversed pair of birds. A single expanse of millefiori filled the trapezoidal cell in the middle centre of the hexagonal plaques, where it served as an important filling ornament, and according to Bruce-Mitford must have had a "striking bullseye effect" (ibid:591).

The millefiori inlays on the shoulder-clasps play a very prominent role in decorating the central rectangular field on each symmetrical half. They also appear on both hindlegs of the intersecting boars and function here, as in the case of the hexagonal plaques, as an important filling ornament of clearly defined spaces. Due to their polychrome nature of consistency they add a considerable variety of colour to the figural designs of the purse-lid and the shoulder-clasps.

From their particular distribution on the surface of the purse it appears that the individual millefiori designs used for the plaques reflect the types used for the frame, and vice versa. This maintained balance contributes to the integrity of the different styles of ornament found together on the surface of the lid.

3. *The Lindisfarne Gospels and its Chi-Rho illuminated page*

3.1. *Historical setting of the manuscript*

The historical setting of the Lindisfarne Gospels is well documented, with a colophon on the last leaf naming the four men who made it. The colophon reads: "Eadfrith, Bishop of the Lindisfarne Church, originally wrote this book, for God and for Saint Cuthbert and - jointly - for all the saints whose relics are in the Island. And Ethelwald, Bishop of the Lindisfarne islanders impressed it on the outside and covered it - as he well knew how to do. And Billfrith, the anchorite, forged the ornaments which are on it on the outside and adorned it with gold and with gems and also with gilded-over silver - pure metal. And Aldred, unworthy and most miserable priest, glossed it in English between the lines with the help of God and Saint Cuthbert..."(Backhouse 1981:7). What is now called the monastery of Lindisfarne, was founded about 635 on Holy Island. It lies among the sands about a mile and a half off the Northumberland coast. There was close contact between Lindisfarne and the double monastery of Wearmouth / Jarrow, only 40 miles apart, during the later seventh and early eighth centuries. Textually the Lindisfarne Gospels has close relations in the two Wearmouth - Jarrow manuscripts, the Codex Amiatinus and the Stonyhurst Gospels

(Backhouse 1981:21). All three manuscripts are members of the so called 'Italo-Northumbrian' group, which contain one of the early forms of the Vulgate text (ibid).

3.2. *Authorship of the script and ornamentation* script

According to the Colophon it is not doubted that the Lindisfarne Gospels was written by the Saxon Eadfrith, who was bishop of Lindisfarne from AD 698-721 (Bruce-Mitford 1960:5). This is also confirmed in a historical source - Symeon of Durham who, writing in the early twelfth century, says quite categorically that Eadfrith wrote the book with his own hand (Backhouse 1981:13). According to Bruce Mitford's careful examination made for the facsimile edition of the manuscript, there is also abundant evidence, that the scribe and illuminator were the same person (1960:7). Thus "the initials were drawn in the actual process of writing the text, and as part and parcel of its setting-out and progress"(ibid). There are also places, as on the Chi-Rho page where the original scheme of letters (here:'autem generatio') was sketched out but was not finished or changed before the page was finished (Backhouse 1981:14).

Analysis of style, of the repertoire and employment of ornament, and the pigmentation shows also that the artist of the great monogram and decorated text pages also executed the carpet pages, and the evangelist's portraits. The examination also suggested that the book had been designed and made in a single campaign, without major interruption, and that it probably took at the very least two years to complete (Bruce Mitford 1960:8).

3.3. *Design and structure*

The Lindisfarne Gospels contains two versions of the Gospel texts. The first is the Latin, copied out by Eadfrith, and the second the Anglo-Saxon linear gloss added two and a half centuries later by Aldred. The Latin Gospel text is that of Saint Jerome's Vulgate, a revision of the Latin Bible made in the late fourth century. In the Lindisfarne Gospels it is preceded by the text of Saint Jerome's letter to Pope Damasus, by the prologue to Saint Jerome's commentary on Matthew and by a series of Eusebian canon tables. There are fifteen elaborate fully decorated pages in the Lindisfarne Gospels. Each of the four Gospels is preceded by an illustration depicting its author with his symbol, and is introduced by a cross carpet page and a major initial page. A second major initial page occurs in Matthew (1:18), to mark the beginning of the story of the Incarnation. There is a further cross-carpet page and a major initial page at the very beginning of the manuscript, introducing Saint Jerome's letter to Pope Damasus. The general arrangement of the manuscript's decoration is very similar to that of the Book

of Durrow, whose designs are, however, far less complex and the range of colours very limited. There are also close connections too of the MS AII.17 (Durham Cathedral) to the Lindisfarne scriptorium. (Backhouse 1981:36).

3.4. *The details of ornamentation*

The artist of the Lindisfarne Gospels employs a range of ornamental themes. These ornamental themes have been distinguished as zoomorphic, curvilinear geometrical, rectilinear geometrical and interlace patterns (ibid).

Curvilinear geometric design in the Lindisfarne Gospels
Bruce-Mitford 1960, fig.46 / f.139
fig.14

Curvilinear geometrical ornament. This category of ornament consists of motifs like the spiral and trumpet-patterns, interlocked trumpet-peltae, trisceles and roundels. In combination, these motifs dominate the spreads of curvilinear geometrical ornament in the Lindisfarne Gospels. The design shown in figure 14 below is an example of this recurrent theme.

The pelta design. A characteristic example of the exploitation of the theme of interlocked peltae can be seen within the circle of the 'Rho' on the Chi-Rho decorated page (f.291) and again in a stretch of ornament lying between the end of the upper right-hand limb of the Chi and the curve of the Rho. The pelta are set off against a black ground, as is all the ornament in the codex.

Various pelta designs from the ornamental context of the Chi-Rho Lindisfarne,
Bruce-Mitford 1960, fig.46, f.29.
fig.15

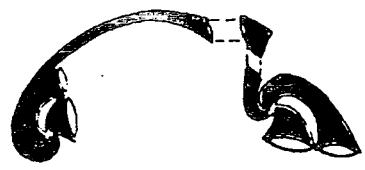
The pelta theme is developed in late provincial and Celtic art as a motif of two coils and roundels linked by a humped curve (Bruce Mitford 1960:206ff).

The roundel. This ornamental theme is considered to be the second dominating element of Lindisfarne's curvilinear geometrical repertoire (ibid). Roundels are characterized by Bruce-Mitford as "large open 'hair spring' coils with mauve grounds"(ibid). They are prominent between the arms of the 'Chi' to the right, between it and the Rho, with the biggest one of all in the panel of ornament thrown off by the top right hand extremity of the letter Chi.

Various roundels from the Chi-Rho page in Lindisfarne, Bruce-Mitford 1960; fig.46, f.29.
fig.16

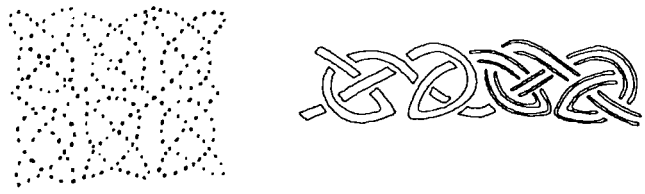
Bruce Mitford sees the principle roundels on this page and others as developments of the terminal serifs of the letters and directly descended from the simple incipient features little more than hooks in the Cathach of St. Columba (ibid). The latter is now generally thought to have been made in the early seventh century (Alexander 1978:9). The black and ivory borders of the great letters run straight into the coils which frame the roundels, passing into them in a seemingly spontaneous uninterrupted diminuendo. According to Bruce-Mitford's investigations, the passages are all set out on rigid, accurate and often perfectly symmetrical geometrical framework (1960:206). The roundels in the manuscript have a great variety of which some examples are seen in figure three above.

The trumpet -design. This particular design looks somewhat curious on its own with its broadening bell-shaped mouth as seen in the figure below.



Trumpet-design in isolation, Bruce-Mitford 1960, fig.46, f.139).
fig.17

Interlace. There is a considerable variety of types of 'pure' or abstract interlace represented in the codex. In figure 18 some simple plait and knot-work interlace is shown, which also appears in the panel of the letter Rho.



Simple plait and knot interlace in the Lindisfarne Gospels, Bruce-Mitford 1960, figs.48,45.
fig.18

In addition to pure interlace, much of the animal ornament has the character of zoomorphic interlace. This appears quite dominantly in the panel decoration of the Chi-Rho page. Tails, necks, and limbs of the birds or dogs are freely prolonged into interlacing patterns in their own right, or interlace with the bodies to which they belong as with neighbouring bodies. Apart from this there are also friezes or processions of birds and animals with interlocked limbs and extremities, which are built up on the same principles as pure interlace, and with the same technique of spacing and measuring (Bruce Mitford 1960:197). Friezes of interlaced animals occur in all the framing devices on the Chi-Rho illuminated page.

As regards the zoomorphic ornament, Bruce-Mitford notes here that "the feeling, impetus and method of interlace transfuses and conditions much of the animal ornament of the book. It is as though animals were seized and forced to conform with a geometrical scaffolding of the type normally used for the construction of interlace"(ibid).

4. *The Book of Kells and its Chi-Rho illuminated page*

4.1. *Historical setting-of the manuscript*

Like the Lindisfarne Gospels the Book of Kells belongs to the Insular group of manuscripts. They are located off the west coast of the European continent and have many features of text, of script and illustration in common.

There is strong presumption that the Book of Kells was written in Ireland and at Kells in Co. Meath (Alton 1951:18). The Book can be assigned to the family of Irish manuscripts. This is apparent in its Vulgate text, which consists of a strong admixture of 'Old Latin' reading, especially in *Matthew* and is thus similar to the

Book of Armagh, the Egerton, Lichfield and RushworthGospels (ibid). However, on account of its close resemblance to the Lindisfarne Gospels some suggest that it was written, or at least begun, at Iona from which the isle of Lindisfarne was colonized about the year 635 (ibid). The Book of Kells has some features which indicate its possible link to the early Church of Northumbria, but it has also been placed much later around the eighth or ninth century, on the basis that it has some features which link it to Ireland (Brown 1985:7). The monasteries of Iona and Kells both belonged to the group of Columban monastic foundations. The Scandianvian raids on the island of Iona led its monks to move to Kells in the year 806-7(Brown 1985), a historical factor which also strengthens the possiblity of an Irish manufacture of the Book of Kells.

The Book takes its name from Kells (or Kelles, formerly Kenlis or Cennanis), a town with castle, round tower, abbey and famous cross. Kells is situated on the Blackwater, a tributary of the river Boyne; it lies about fourty miles north-west of Dublin. This was an ecclesiastical centre of importance, and St. Mary's Abbey, Kells, traced its descent from St. Columba. In that abbey the Book of Kells with its golden 'cumdach', known as the Book of Colum or Colum Cille, remained for centuries (Alton 1951:14). Evidence for the connection of the manuscript with Kells is furnished by the seven Irish charters on deeds, all concerning properties near Kells, which were copied into the manuscript in the latter part of the 12th century (ibid).

4.2. *Design and structure of the manuscript*

The Book of Kells is essentially a Gospel-book, penned and decorated by scribes and artists in honour of the life of Christ. Like the Lindisfarne Gospels, it was probably meant originally for liturgical use and for display on the altar (Alton 1951:18). The manuscript contains the text of the four canonical Gospels in the Latin tongue and in the order *Matthew, Mark, Luke, John.* It is interesting to note that this order is different from the Old Latin order of *Matthew, John, Luke, Mark* so long established and cherished within the Celtic ecclesiastical tradition. The Latin version was the result of the task of St. Jerome, an outstanding biblical scholar, who was commissioned by Pope Damasus in 382, to undertake an improved latin translation of the Bible.

His revised translation of the Gospels formed an early part of Jerome's contribution and the *editio vulgata* was commonly accepted in place of the Old Latin version throughout most of Europe by the and of the 6th century, although there was a reluctance of the Celtic Church to change to the new text (Brown 1985:18). In the Book of Kells, we also find references made to the Old Latin order in the *Argumentum* of John (19r), although the order is already that according to St. Jerome (Alton 1951:18).

According to Brown (1985:83) it is difficult to know exactly how the overall arrangement of the illustration for the Book of Kells was planned, particularly as some decorated pages are perhaps missing. However, the plan for the decorated pages of the four Gospels emerges from the examples of St. Matthew and St. John.

According to Brown (1985:83) it is difficult to know exactly how the overall arrangement of the illustration for the Book of Kells was planned, particularly as some decorated pages are perhaps missing. However, the plan for the decorated pages of the four Gospels emerges from the examples of St. Matthew and St. John. Thus it seems "that the plan was to have at the beginning of each Gospel three fully illustrated pages: the symbols of the four Evangelists, a portrait of the Evangelist whose gospel follows, and a highly decorated page for the opening words of the Gospel (Brown 1985:83f). This plan conforms with what is found in the Lindisfarne Gospels (see relevant section 2.).

As is also the case with other Gospels of Insular providence, the St. Matthew Gospel is frequently treated as having two beginnings, with what is called the Book of Generations regarded as a separate section, and a second beginning made at the birth of Christ. (Brown 1985:74). It is here that the full-page decoration of the Chi-Rho in Kells appears. As in the Lindisfarne Gospels it marks the beginning of verse 18, where the account of the birth of Christ beginns "XPI (Christi) autem generatio...". The Chi-Rho decorated page belongs to the group of five highly decorated text pages which introduce the text of the Gospels in Kells and provides "by far the most intricate"of them all (Brown 1985:87). Like in the other decorated text pages the ornament fills the page entirely while the text on the page is subordinated to the design. Thus the remaining words on the Chi-Rho page 'h aut generatio' appear bleakly at the foot, completely dominated by the networks of shapes, faces and animals that cover the whole page. Apart from the many figural depictions of angels, men, cats, and an otter holding a fish in his mouth, the ornament of the Chi-Rho page is geometric in character.

4.3. *Illumination and the artists*

Henry (1974) has made it clear that the decorations in the Book of Kells represent the work of a group of experts, both scribes and artists working together. However, she does identify three personalities among the artists: 'the Goldsmith, who produced the effect of metalwork; the Illustrator, a very different person whose interest and expertise lay in the painting of figures and who was fond of violet colours and striking washes of purple and green; and the Portrait Painter. She considers the Book of Kells as the most thoroughly Insular in style and the least representative of the group although its general trend of decoration conforms with that found in the other manuscripts of the group (1974). In addition Brown states, it is essentially the decoration of the text pages including the Chi-Rho illuminated page, that single out the Book of Kells from the other Insular manuscripts (Brown 1985:91).

the methods of construction of the ornament he investigated in the Lindisfarne Gospels (1960: 205ff). What is considered as most remarkable in the context of the Book of Kells is the "microscopic scale on which the most intricate lines are painted [so that] frequently it is only in the enlarged details that we can trace the minute forms and shapes that make up a pattern"(Brown 1985:91).

Spiral ornament. The spiral ornament in the Book of Kells consists of the same elements as that in the Lindisfarne Gospels, but there is a marked difference in the manner of execution. While the spiral-whorls in the peltas of the Lindisfarne Gospels show more of the black background and are more loose and springy, in Kells the spiral is enclosed in a framed panel as a regular composition and even the free wheel-endings show a marked tendency to symmetry.

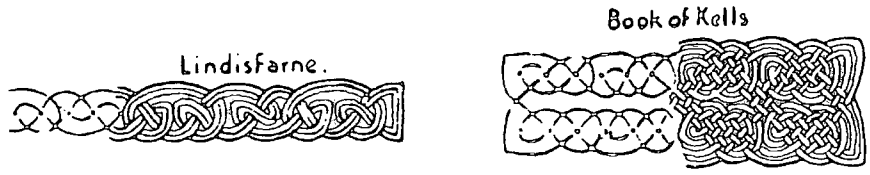
Spiral design of Kells and Lindisfarne in comparison
fig.19

The difference in size between the largest and smallest medallions is much greater in the spiral ornament of Kells than in Lindisfarne.

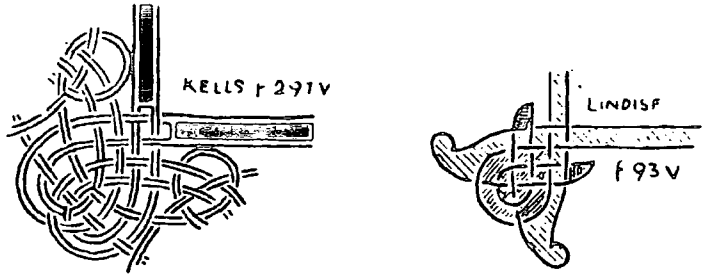
Interlacing. The interlacing found in Kells is very accurate in the weaving and sharpness of the line and the bands (strands) of interlace are very delicate and thin. This extreme delicacy of the ornament in the Book of Kells is, according to Meyer (1951:34), clearly seen in that even bands of about 1.2mm in width appear to be 'broad'. According to Henry (1974:105) the interlacings in Kells, however, show great virtuosity, comparable to the interlacing on Irish crosses and metalwork. The interlace pattern in Kells is closely associated with zoomophic ornament. A threefold-knot or a plait is frequently a means of linking spirals together, and this with such ease and spontaneity that the motifs seem, in the mind of the artist, to have fused into a more complex one (Henry 1974:206).

Interlacing with double strands is also typical of Kells illumination and far more common than simple ribbon interlacings (Meyer 1951:35) found frequently for example in Lindisfarne.

Angular patterns. The fair number of angular patterns in the manuscript can be classified as step-patterns and the more elaborate key-patterns. The latter is especially common in the decoration of the Book of Kells (Henry 1974:206). These patterns are often of microscopic size and are used as fillings for framed panels. Their appearance is often regarded as "monotonous, tedious ornament"(Henry

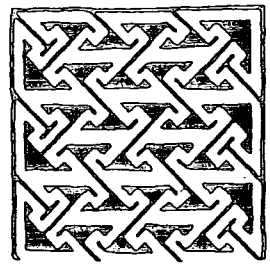


Interlacings of Lindisfarne and Kells in comparison, Bain 1950, pl.E fig.20



Interlacing in Kells and Lindisfarne, Meyer 1951, fig.10. fig.21

1974:106, Meyer 1951:35). In respect of their complicated symmetrical layout, as we see later in the symmetry analysis, this statement is not quite justified. Thus the key-pattern occuring in two panels in the letter Chi in Kells comprises a two-dimensional twofold rotational design (class 2-200) and is therefore rather intricate in symmetrical terms.

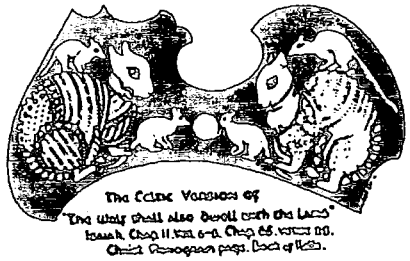


Key pattern with class 2-200 rotation symmetry, G. Bain 1950, Pl.14 fig.22

Zoomorphic and human ornament. As Henry describes it this is a whole category of decorative elements "which is of an infinitely more elusive nature, richer and more varied in its effects, liable to all sorts of changes, capable of passing from the most straightforward likeness to strangely arbitrary deformations. While the humans and animal figures comprise independent entities within the vignettes

provided for them between the letters, the figures occuring in the framework and the letter-panels are part of a design and intertwined at the same time. This is the case in the rhombus structure of the letter Chi or in the frame panel which contains four human figures.

The question if there was any symbolic meaning intended for these figures is for most parts answered positively. Thus Henry assumes that the cats and the mice appearing in the open-space panels on the Chi-Rho page are not engaged in a homely comedy. "Whatever their exact meaning, they are gathered around a cross-bearing disc which brings them into line with the other symbols on the page"(1974:207).



'Cats and mice' or 'the wolf shall also dwell with the lamb',
Bain 1950, p.19
fig.23

A lot of symbolic meaning is also adducted from the numeric value of figural designs in Kells and this not only with special regard to the Chi-Rho monogram as may be seen in a later discussion but also with regard to the whole manuscript. Thus we are reminded by Meyer that "structurally, the harmony of the Four, or the quadriform Unity, is the artistic centre of the Book of Kells. The architect has woven this theme into the very fabric of the Preliminaries, and has set it in the ground-plan of the text. The [four] evangelic symbols appear in panels of the first extant page, a Glossary. They dominate page after page of the Eusebian Tables, and they recur throughout the text with repeated emphasis and with renewed invention, beauty, and resource"(1951:18).

Figural and numerical symbolism are thus very closely interrelated with each other in the manuscript and one can assume that this is also vital for the meaning of the Chi-Rho illumination. It is interesting to note at this stage that figures, which are repeated in a design like the figures in the rhombus panel, or like the (46) marigolds contained in the square panels, and thus of potentially numerical importance, are confined to the panels of the Chi-Rho letters and the frame, while the individual and geometrical motifs, which may carry symbolic images via analogy to humankind, are only found outside the main panels in the outside-vignettes.

while the individual and geometrical motifs, which may carry symbolic images via analogy to humankind, are only found outside the main panels in the outside-vignettes.

5. *The Chi-Rho monogram as an iconographic type in Insular manuscript art*

The Chi-Rho monogram is found widely as a decoration or substitute for the words 'Christi' in the second beginning of *Matthew*. Sometimes as merely enlarged letters in a page of text, sometimes, as in Kells, dominating the page (Brown 1985:89). Art-historians consider that other than in Continental manuscripts, there has emerged a tradition in Insular art where a group of letters like the Chi-Rho became fixed in their form and were developed like iconographical types (Werckmeister 1964:688).(1) In the course of this development they were enlarged, while the text was more and more reduced until the initials fill the whole page. The following figure shows that there may have been such a development in the case of the Chi-Rho initial pages in the Book of Durrow, Lindisfarne, Lichfield and Kells.(2)

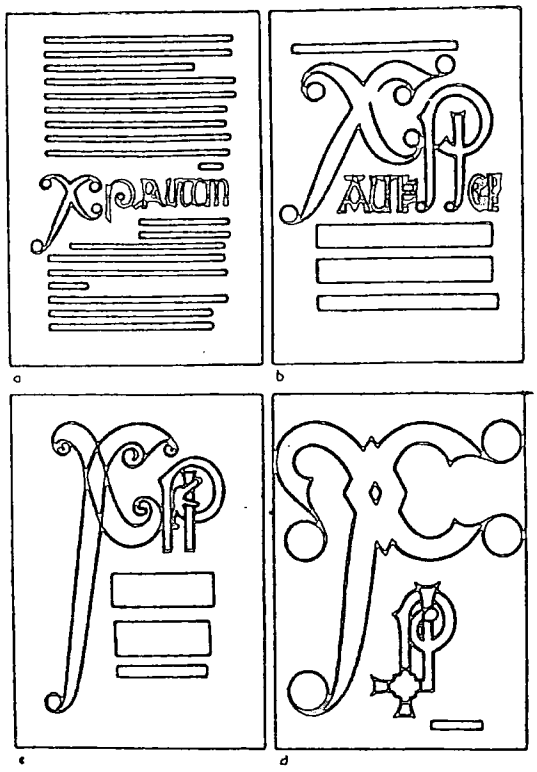
The Chi-Rho initial in Durrow is considered as standing at the beginning of this development in Insular book illumination. Both the Durrow and the Lindisfarne letter Chi, which is possibly thirty years older than Durrow (Bruce-Mitford 1960), is of a simple form, which also appears throughout in the texts written in Irish majuscle.

As may also be seen from the comparison of the four monograms above the initials in Lindisfarne and Kells are not embedded into the text of the page, but appear juxtaposed to the text and are much enlarged. The latter is a sign, according to Alexander, that these initials gain importance in symbolic terms (1978:9). In art-historical terms this general theme of expansion would not only have reached an extreme in Kells but it also breaks with this former tradition. It seems here that the greek Chi-Rho is not conceived any more as a formal group; rather the letter Chi reaches over the whole page, becomes its dominating theme and is totally disconnected from the Rho which appears, much smaller, near the bottom of the page (Werckmeister 1964:688). Another variation of the iconographic tradition of Insular Chi-Rho decorative schemes provides the feature of the rhombus panel situated right in the center of the four crossarms of the letter 'Chi' in Kells. According to Meyer (1951:43) the segmentation of panels into compartments is a recurring feature in the decoration of the manuscript and serves to emphasize the corners after the fashion of joints (1951:43). The rhomboid panel may thus be taken as just such an example.

Besides this segmentation of panels for joints, the dissection of panels into smaller compartments through transverse bars is also typical for the decoration in Kells. "The strips of the frame and the limbs of letters consist without exception of single or multiple border with ornamental fillings"(Meyer 1951:43).

(1) Compare also Jantzen 1940:507-513

(2) The Chi-Rho in the Lichfield Gospels represents another iconographical type which provided a formal link between the Lindisfarne Chi-Rho and that of St. Gallen, see Zimmermann 1916:5



The Chi-Rho monogram as seen in:
a. The Book of Durrow
b. The Lindisfarne Gospels
c. The St. Gall Gospels
d. The Book of Kells,
T.D. Kendrick 1938, fig.20

fig.24

According to the evidence given above the structure of the rhombus and the segmented panelling of the Chi-Rho initials in Kells reflect the internal style which pervades the whole of the manuscript decoration in this Gospel-book. Because these typical stylistic features have also shaped the appearance of the Chi-Rho panelling they cannot wholly account for the break-up of an overall stylistic tradition of Chi-Rho illumination. The size of the letter Chi, its disconnected representation and the different shape of the letters seem to yield more evidence in respect of an overall stylistic development. In relating the ornamental layout of other Chi-Rhos (Lichfield and St.Gall) to the one in Lindisfarne, Bruce-Mitford notes that the panelled style is wholly absent from the Lindisfarne Gospels...[but that] this folio is more traditional in design than the other elaborate monogram pages or adhered to an older more traditional model...Its layout follows the model of the Book of Durrow"(1960:239).

Another aspect is interesting in relation to framing devices on the illuminated Chi-Rho pages, also in view of the later symmetric analysis of the ornamentation.

Discussing the Chi-Rho in Lindisfarne Bruce-Mitford observes that here "the frame is somewhat unusual in design and this is due to the fact that the axis of the monogram is horizontal rather than vertical"(ibid). But according to the same author the artist was not ready to modify the traditional design of the monogram for the sake of the frame. "The constrictions in the upper right half probably led to a corresponding, balancing thinness below and at the bottom [so that] it lacks the weight of the other frames"(ibid). In comparison the vertical axis of the monogram in the Book of Kells appears more dominant in relation to the horizontal axis. This is also the case with Durham A II 17, the St. Chad's Gospel and several other MSS.

In view of the formal development of the Chi-Rho, from Durrow to Kells, a distinction has to be made between internal stylistic measures which can vary the shape and panel layout of the Chi-Rho independently from the external overall stylistic features. The latter seem to be manifest mainly in the growing size of the Chi-Rho initials, their spatial disconnection from the written text on the page and their growing embellishment with ornamentation. The assumption that these aspects might indicate a later stage in the development receives support through some principle considerations about the decorated and undecorated letter from Alexander: "Script is legible in so far as it is composed of clearly defined forms which are regularly repeated with the same significance. A vital aspect of the training of the scribe of the Middle Ages was in obtaining this regularity and distinctiveness of letter forms since any ambiguity or variation could only lead to confusion and illegibility. On the other hand, ambiguity and variation are vital elements in many forms of mediaeval decoration and certainly this is true in the case of the decorated Chi-Rho initials in later Insular Mss like Lindisfarne and Kells. Thus, from this stage onwards, the decorated letter was an illogical combination of opposed requirements in so far as the decoration varying from letter to letter might result in a loss of legibility, and also in so far as it might render the expected form of the letter unrecognizable by distorting or altering it"(1978:8).

According to the above matter of facts the growing independence of the Chi-Rho from the text via its size and position on the page stands in close relation to its embellishment. Following this development in size and shape the growing importance of the Chi-Rho in terms of its symbolic meaning in the Christian background is so also implied. The further embellishment of the monogram was probably a way to enhance this symbolic meaning. It is therefore the character of the decoration the Chi-Rho which may give further clues for this particular development of Insular Chi-Rho illumination which were perhaps linked with new ideals in the ecclesiastical background.

The monasteries of Iona and Kells both belonged to the group of Columban monastic foundations. The Scandinavian raids on the island of Iona led its monks to move to Kells in the years 806-7 (Brown 1985), a historical factor which also strengthens the possibilty of an Irish manufacture of the Book of Kells.

Chapter four

Analysis Tables

Merovingian garnet jewellery

a) North sea group

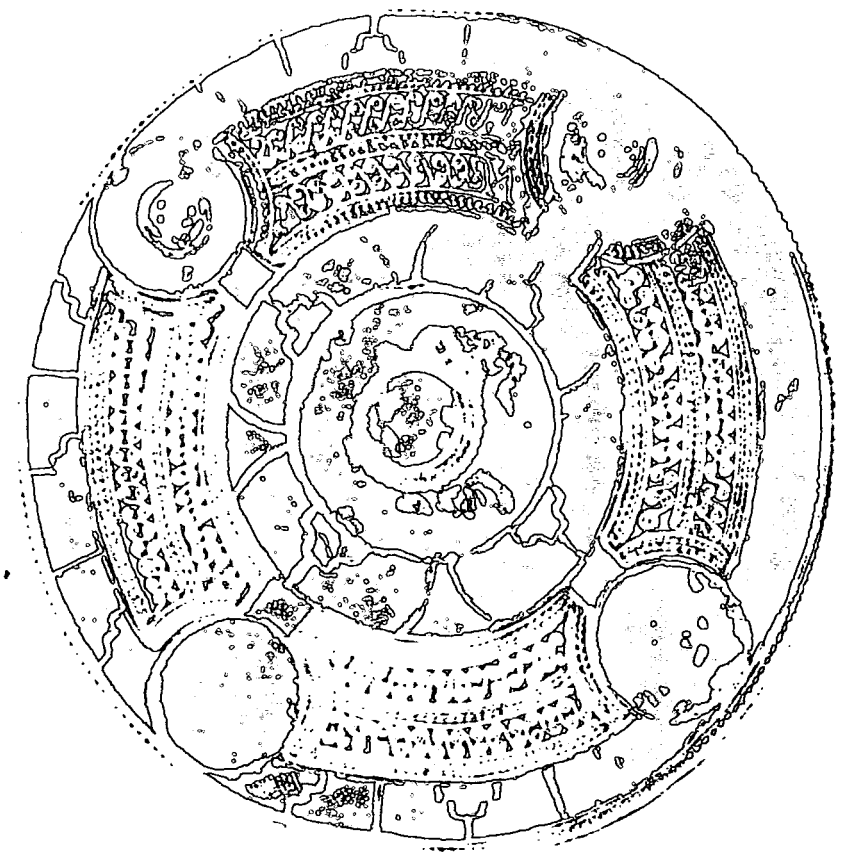


fig.1 The composite disc-brooch from Dover; from Avent 1975, pl.64:174.

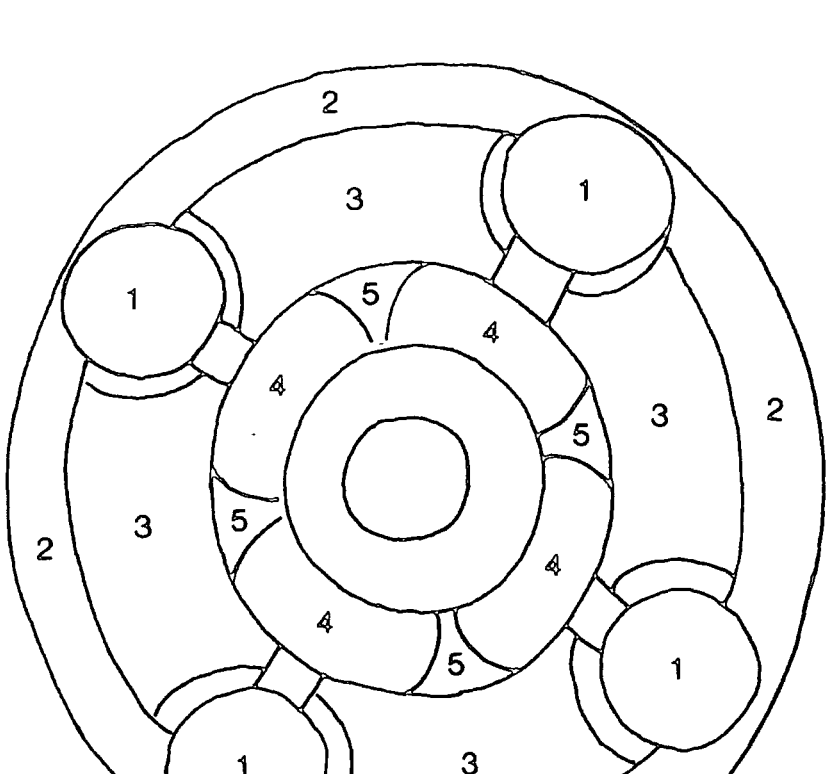
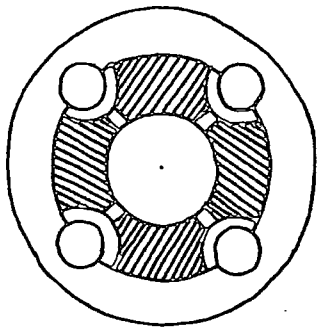
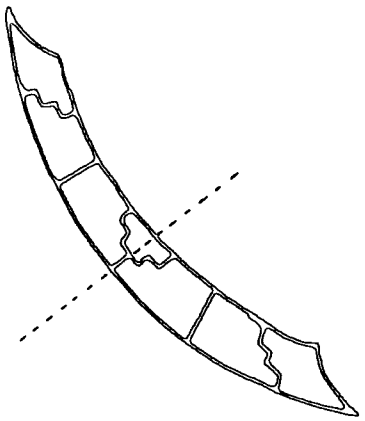
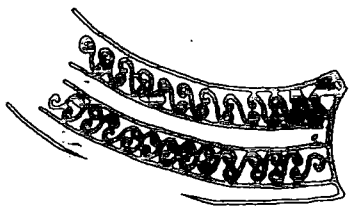
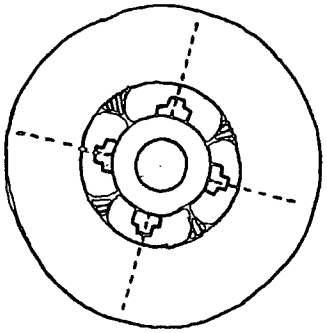
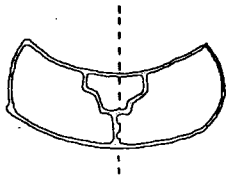
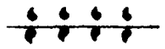


fig.2 Sketch drawing: composite disc-brooch from Dover with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1-5
ARTEFACT:	Composite disc-brooch
CONTEXT:	Dover / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
1		2	
		3	
		4	
		5	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Fourfold Rotation		Finite				400	
2	Combined Mirror Reflection Fourfold Rotation			Finite				411
3	Mirror Reflection							1-110
4	Combined Fourfold Rotation Mirror Reflection		Finite				411	
5	Fourfold Rotation		Finite				400	

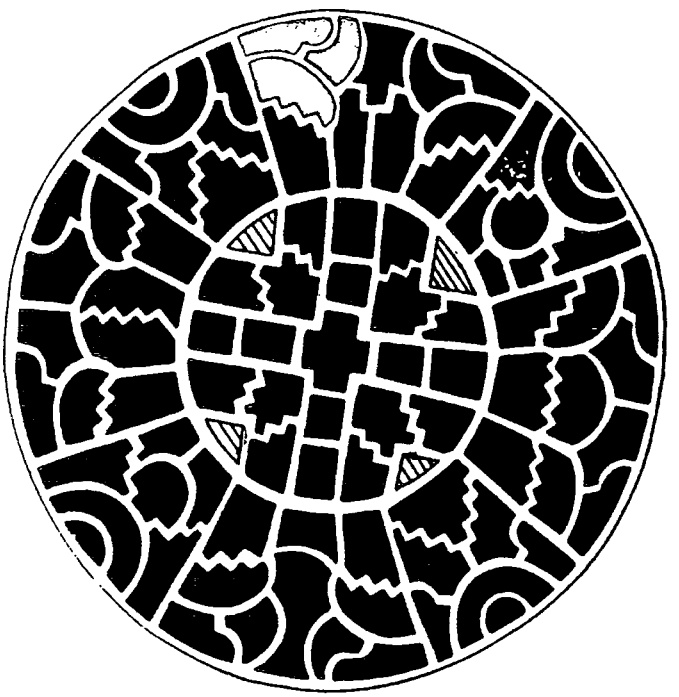


fig.3 The disc-brooch from Marilles; from Arrhenius 1985, fig.160.

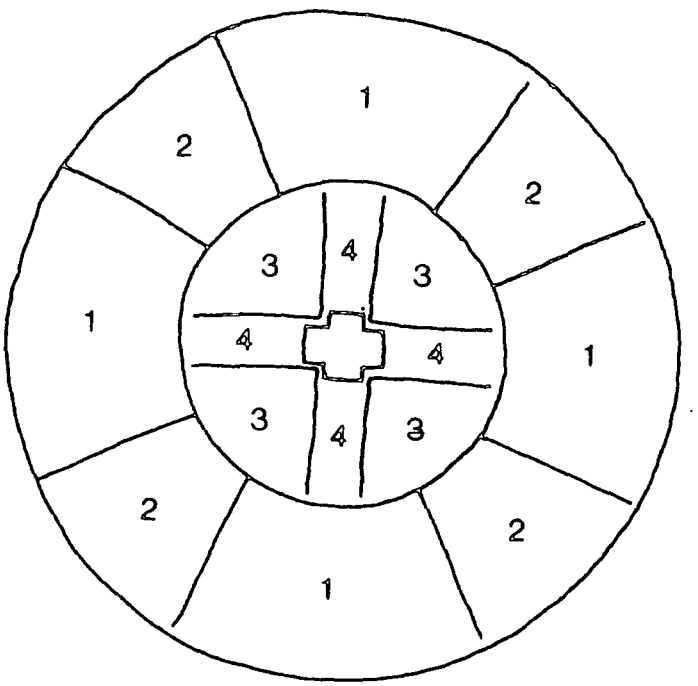
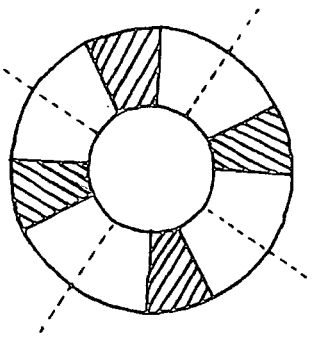
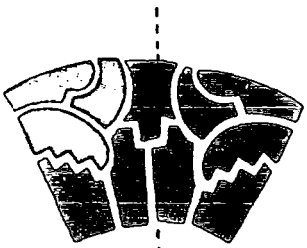
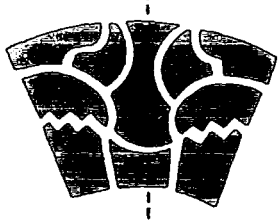
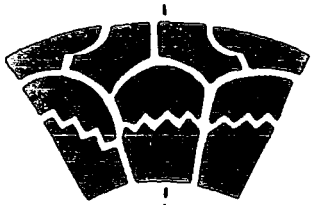
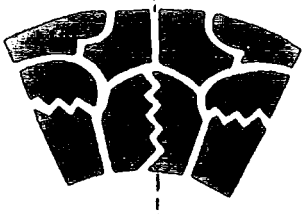
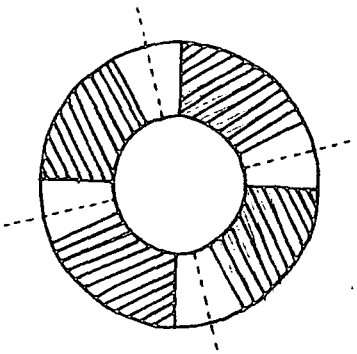
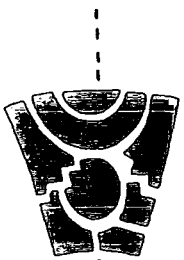
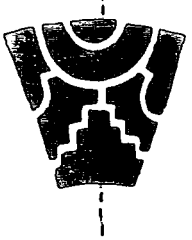


fig.4 Sketch drawing: disc-brooch from Marilles with key section for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1
ARTEFACT:	Disc brooch
CONTEXT:	Marilles / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
1		1	
		1	
		1	
		1	

ANALYSIS - PAPER:	Sect.no.2
ARTEFACT:	Disc brooch
CONTEXT:	Marilles / North Sea group

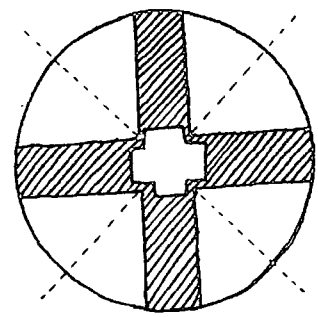
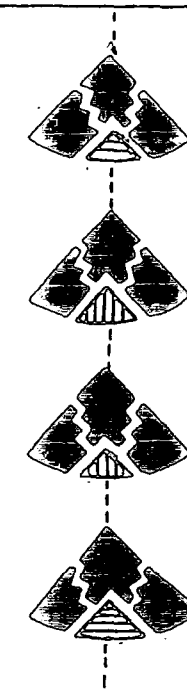
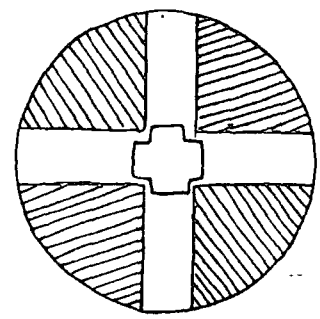
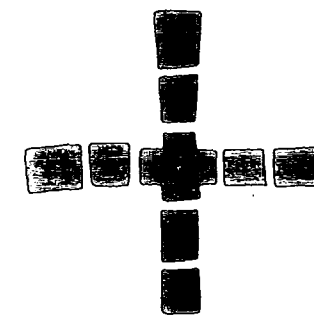
KEY FIG.	DESIGN STRUCTURE		DESIGN
2		2	
		2	
		2	
		2	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	DES.
1	Combined Mirror Reflection Fourfold Rotation		Finite				411	

Bound incorrectly

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
3	Combined Fourfold Rotation Mirror Reflection		Finite				411	
4	Fourfold Rotation						400	
4	Translation							1 - 100

ANALYSIS - PAPER:	Sect.no.3 ◦ 4
ARTEFACT:	Disc brooch
CONTEXT:	Marilles / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
3		3 3 3 3	
4		4	

Bound incorrectly

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
2	Combined Fourfold Rotation Mirror Reflection		Finite				411	

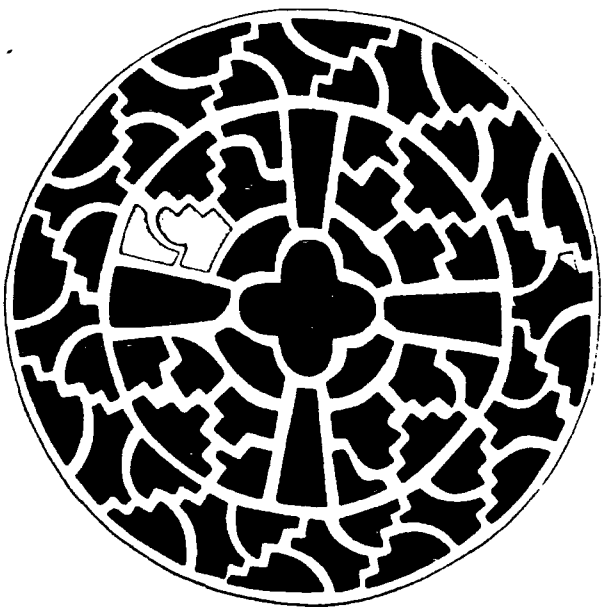


fig.5 The disc-brooch from St. Denis; from Arrhenius 1985, fig.175.

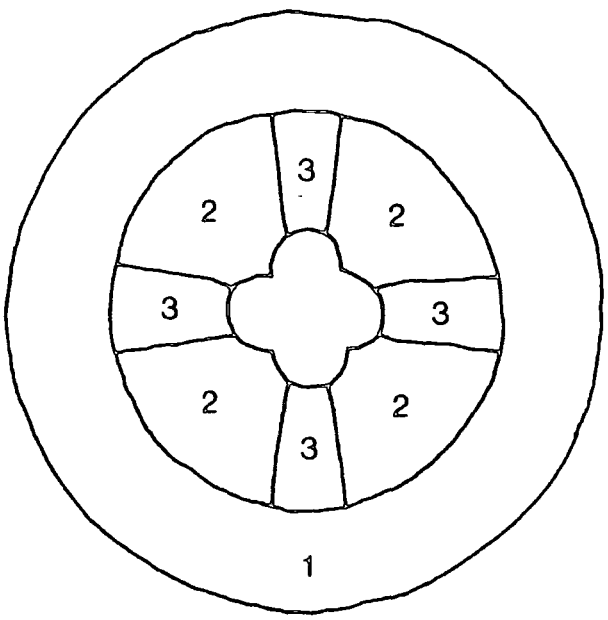
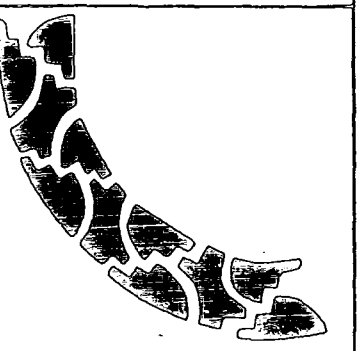
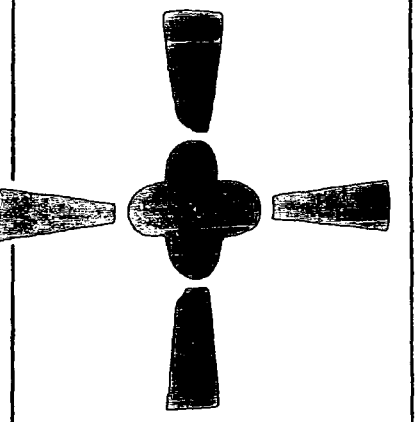


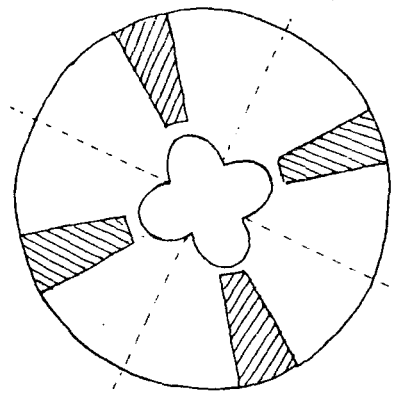
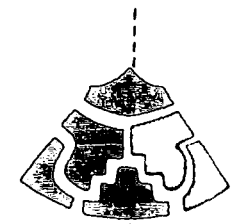
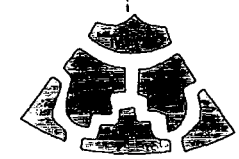
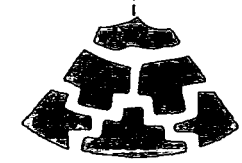
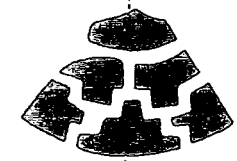
fig.6 Sketch drawing: disc-brooch from St. Denis with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1-3
ARTEFACT:	Disc-brooch
CONTEXT:	St Denis / Assoc. with North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1	
		a	
		b	
		3	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1a	Translation							1–100
1b	Twofold Rotation							1–200
3	Fourfold Rotation			Finite				400

ANALYSIS - PAPER:	Sect.no. 2
ARTEFACT:	Disc-brooch
CONTEXT:	St Denis / Assoc. with North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
2		2	
		2	
		2	
		2	

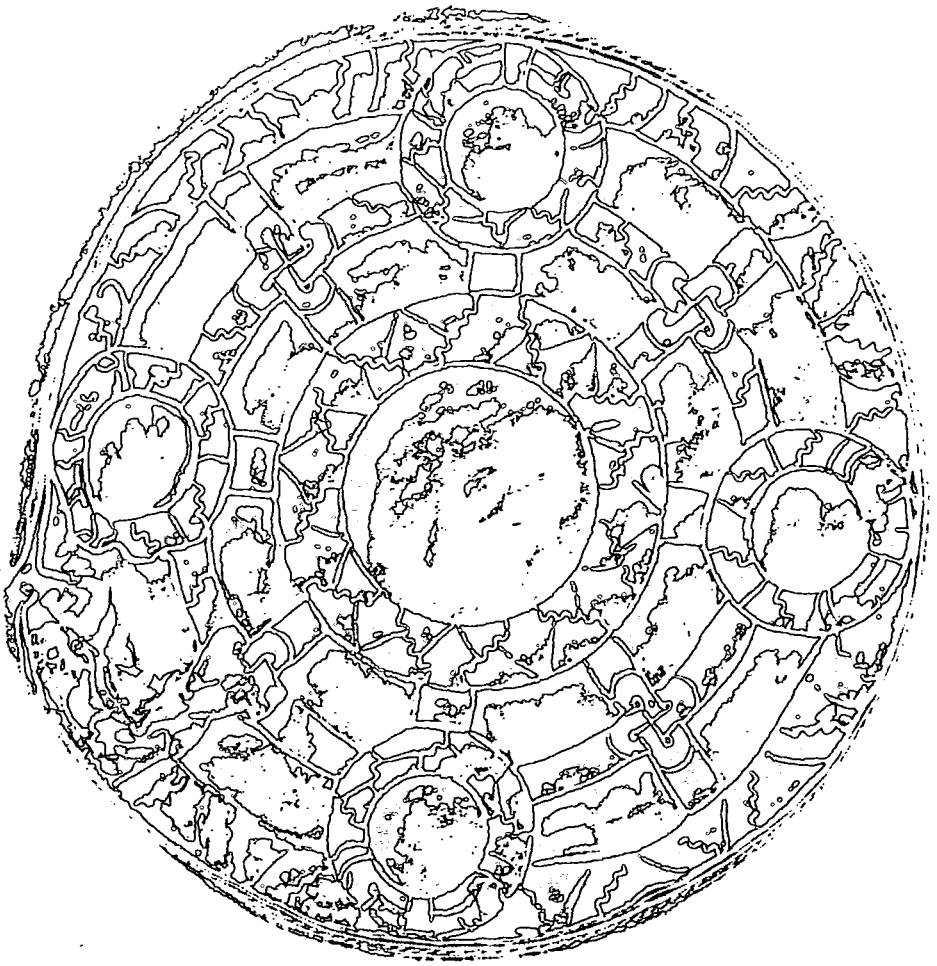


fig.7 Composite disc brooch from Faversham (Kent); Scale 2:1. From Kendrick 1933, pl. V.

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
2	Combined Fourfold Rotation Mirror Reflection		Finite				411	

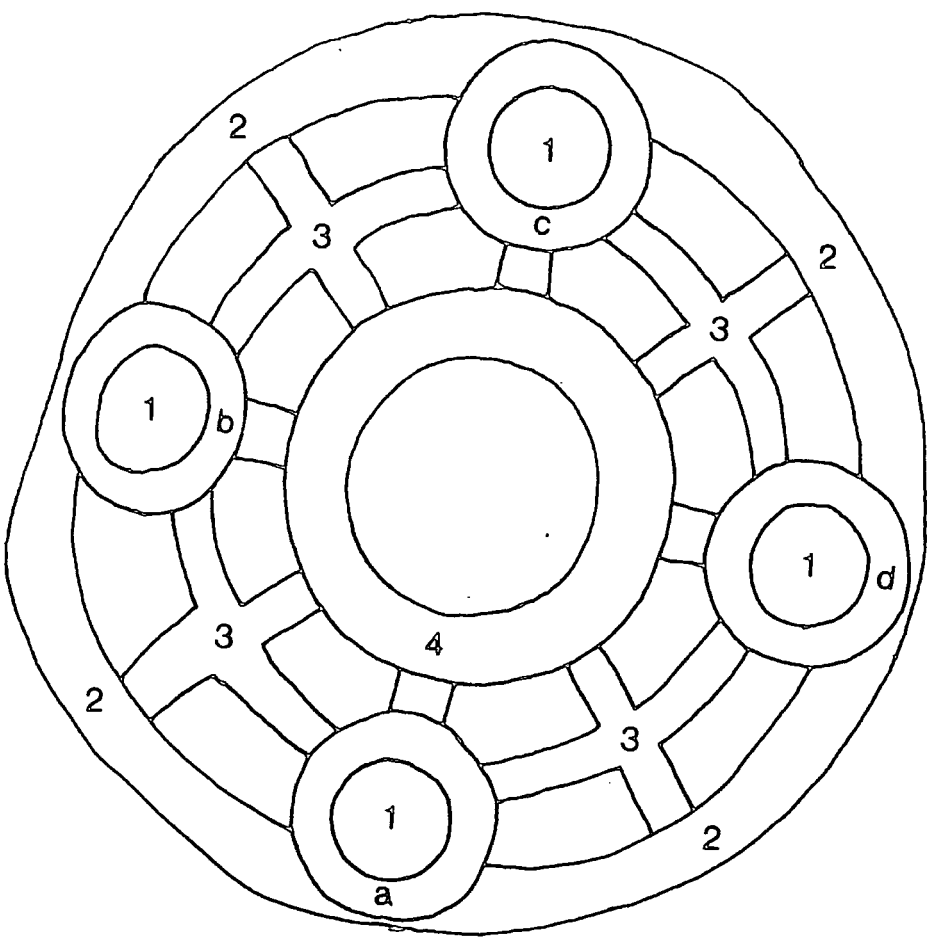
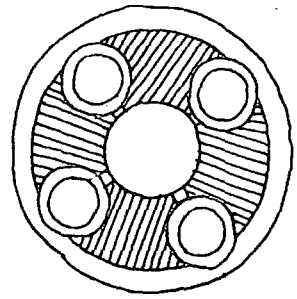
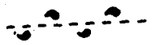


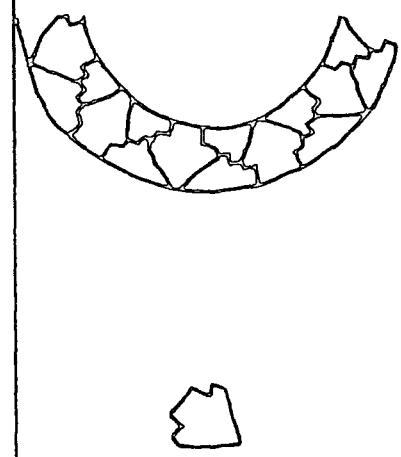
fig.8 Sketch drawing: Composite disc brooch from Faversham (Kent) with key sections for analysis.

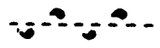
ANALYSIS - PAPER:	Sect.nos. 1-3
ARTEFACT:	Composite disc brooch
CONTEXT:	Faversham / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
1		1 a / c	
		1 b / d	
		2	
		3	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Fourfold Rotation		Finite				400	
1 a/c	Twofold Rotation							1-200
1 b/d	Combined Mirror Reflection Fourfold Rotation			Finite				411
2	Slide Reflection							1-100x[1]
3	Fourfold Rotation			Finite				400

ANALYSIS - PAPER:	Sect.no. 4
ARTEFACT:	Composite disc brooch
CONTEXT:	Faversham / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
		4	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
4	Slide Reflection							$1-100x^1$

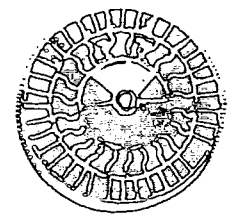


fig.9 Disc brooch from the Rhineland; Scale 1:1. From Smith 1923, XV:3.

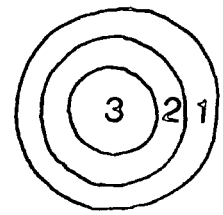
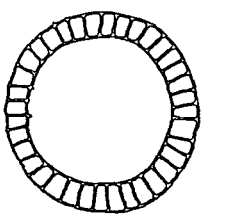
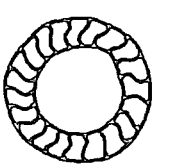


fig.10 Sketch drawing: disc brooch from the Rhineland with key sections for analysis.

ANALYSIS - PAPER:	Sect.nos. 1-3
ARTEFACT:	Disc brooch
CONTEXT:	Rheinland / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1	
		2	
		3	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Translation	‘‘‘‘‘						1 – 100
2	Translation	’’’’’						1 – 100
3	Translation	’’’’’						1 – 100

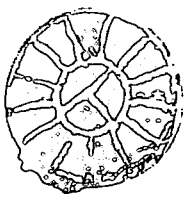


fig.11 The disc-brooch from Köln-Müngersdorf, grave 91b; from Fremersdorf 1955, pl.90:10.

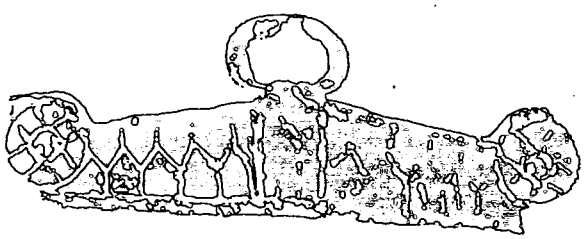


fig.12 The purse-handle from Köln-Müngersdorf; from Fremersdorf 1955, pl.92:3.

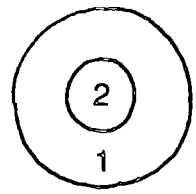


fig.13 Sketch drawing: disc-brooch from Köln-Müngersdorf with key sections for analysis. Scale 1:1.

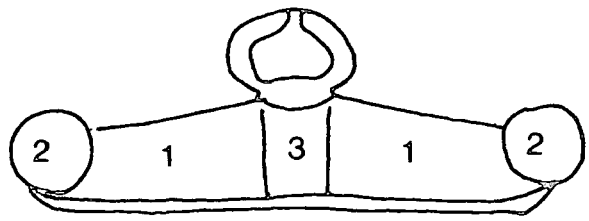
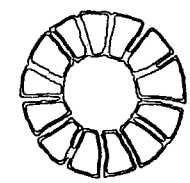


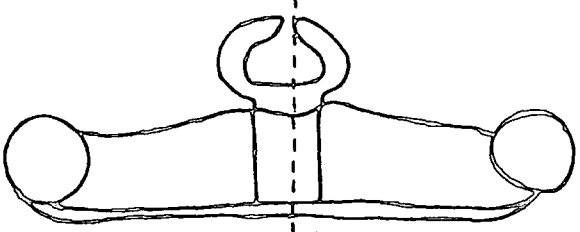
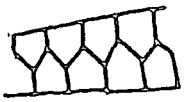
fig.14 Sketch drawing: purse-handle from Köln-Müngersdorf with key sections for analysis. Scale 1:1.

ANALYSIS - PAPER:	Sect.nos. 1 and 2
ARTEFACT:	Disc-brooch
CONTEXT:	Köln-Müngersdorf / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1	
		2	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Translation							1-100
2	Mirror Reflection			Finite				101

ANALYSIS - PAPER:	Sect.nos. 1-3
ARTEFACT:	Purse-handle
CONTEXT:	Köln-Müngersdorf / North Sea group

KEY FIG.	DESIGN STRUCTURE	DESIGN
		
1		
2 a		
2 b		
3		

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
	Mirror Reflection		Finite				101	
1	Slide Reflection							1-100x[1]
2a	Fourfold Rotation			Finite				400
2b	Fourfold Rotation			Finite				400
	Mirror Reflection			Finite				101

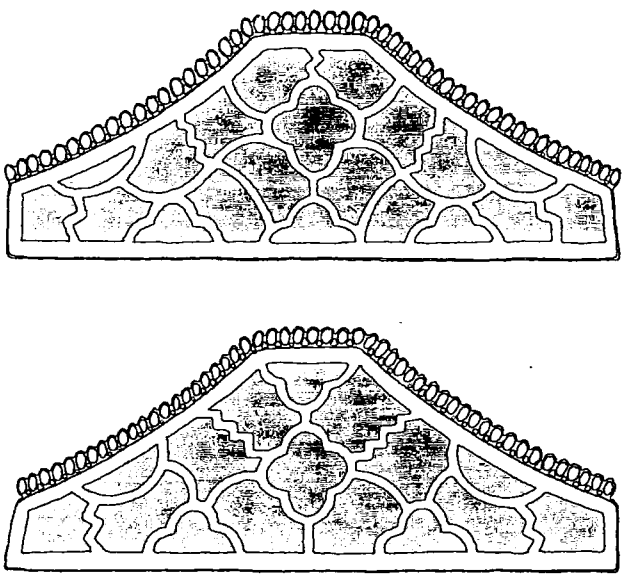


fig.15 Cloisonné panels on the sword-pommel from Sutton Hoo; from Arrhenius 1985, fig.178.

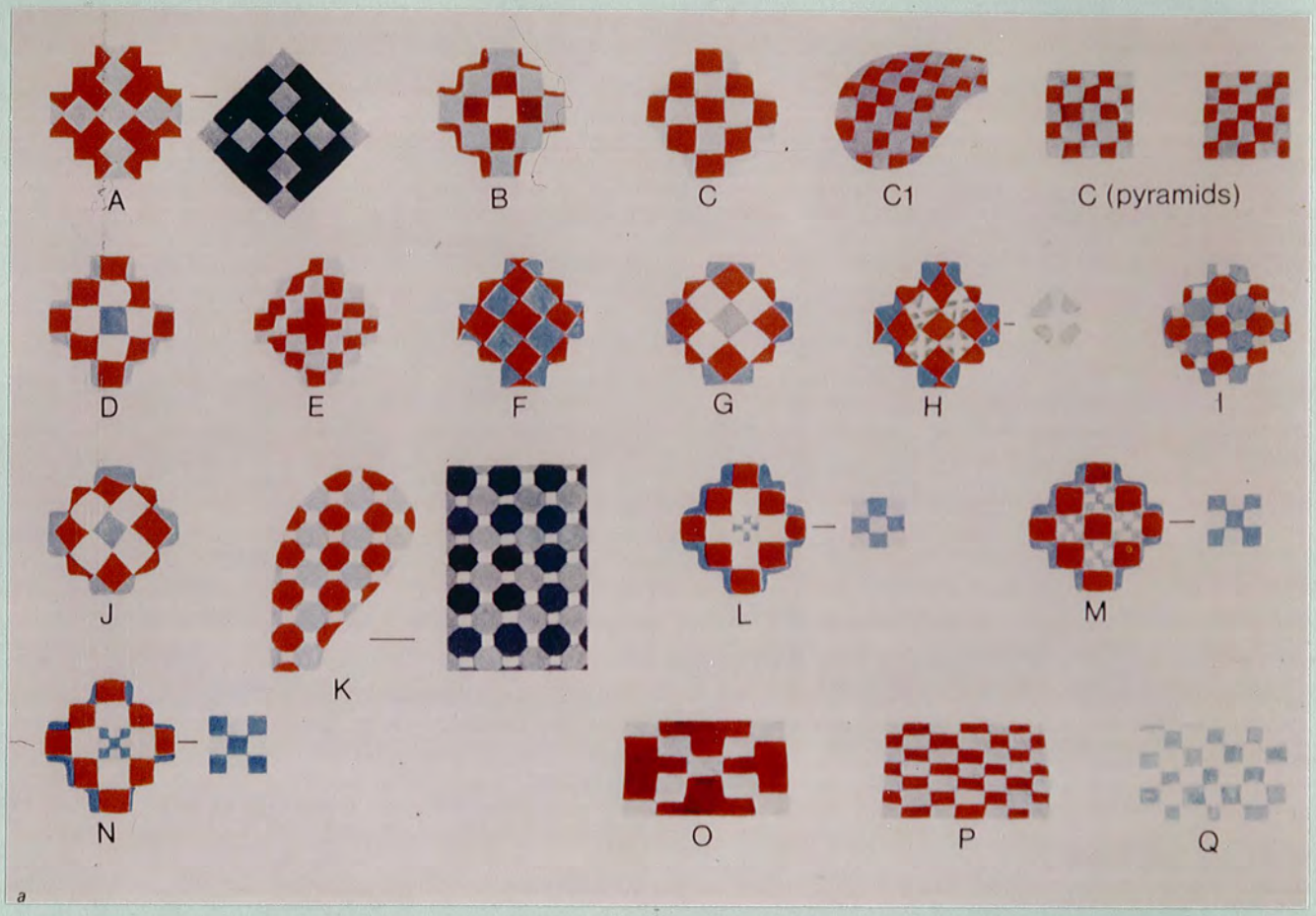


Plate 1

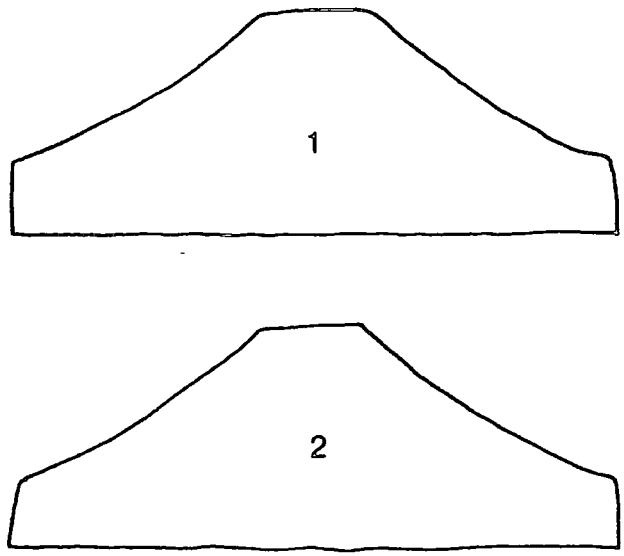
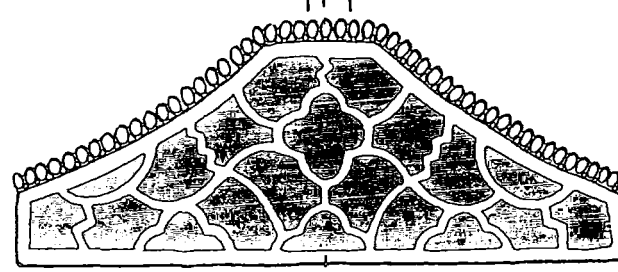
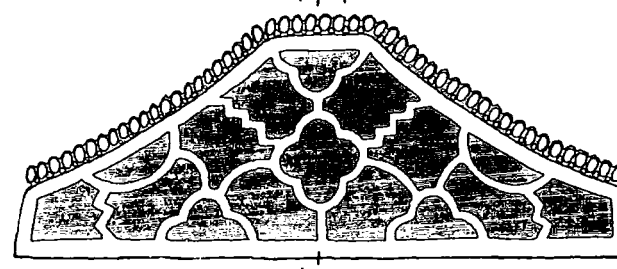


fig.16 Sketch drawing: sword-pommel from Sutton Hoo with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1 and 2
ARTEFACT:	Sword-pommel
CONTEXT:	Sutton Hoo / North Sea group

KEY	DESIGN STRUCTURE	DESIGN
1		
2		

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Mirror Reflection		Finite				101	
2	Translation		Finite				101	

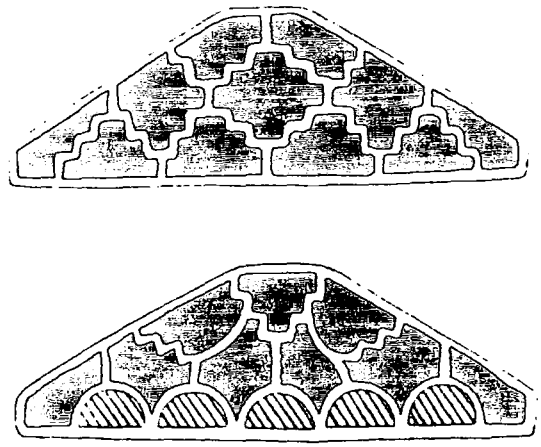


fig.17 Cloisonné panels on the sword-pommel from Väsby; from Arrhenius 1985, fig.176.

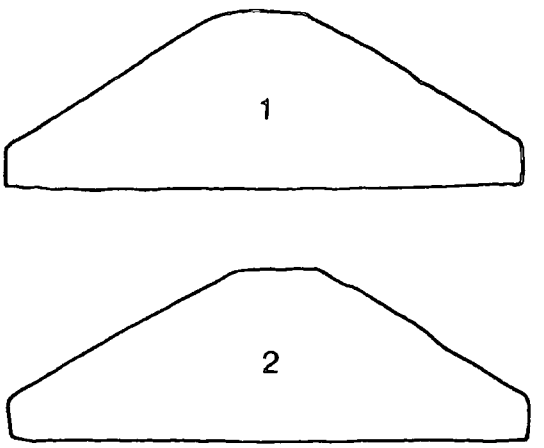
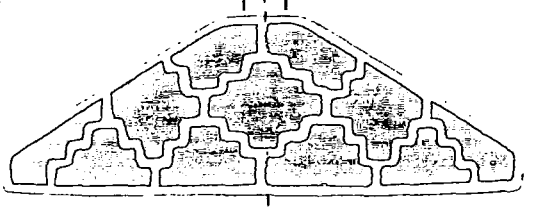
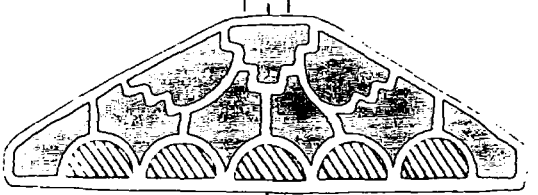


fig.18 Sketch drawing: sword-pommel from Väsby with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1 and 2
ARTEFACT:	Sword-pommel
CONTEXT:	Väsby / Assoc. with North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
1			
		a	
2			
		b	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Mirror Reflection		Finite				101	
2	Mirror Reflection		Finite				101	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Mirror Reflection		Finite				101	
1a	Translation							1 – 100
2	Mirror Reflection		Finite				101	
2b	Translation							1 – 100

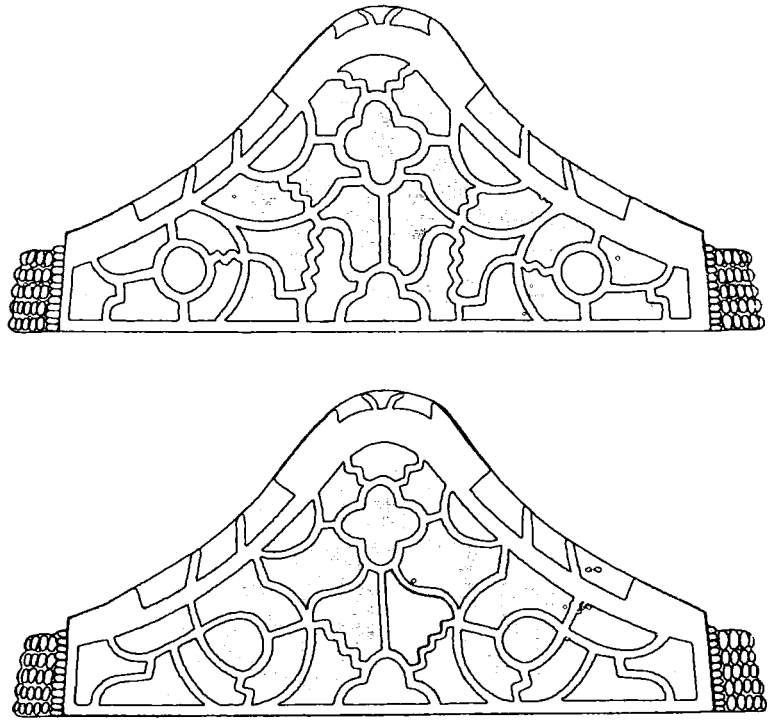


fig.19 Garnet cloisonné on the sword-pommel from Hög Edsten; from Arrhenius 1985, fig.169.

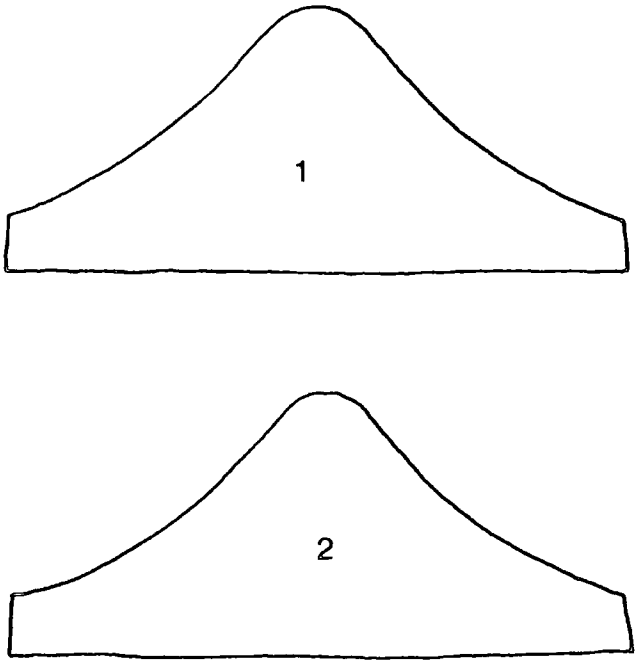
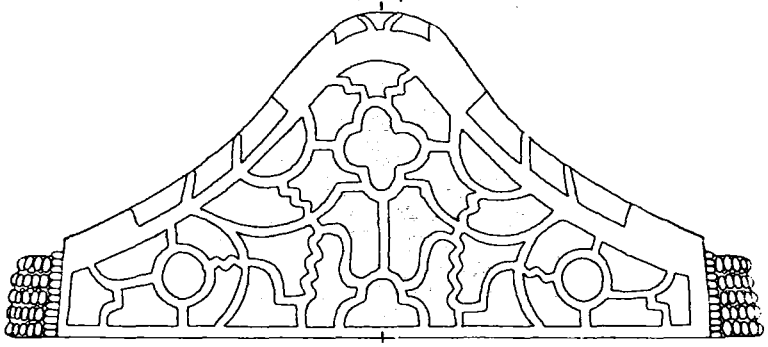
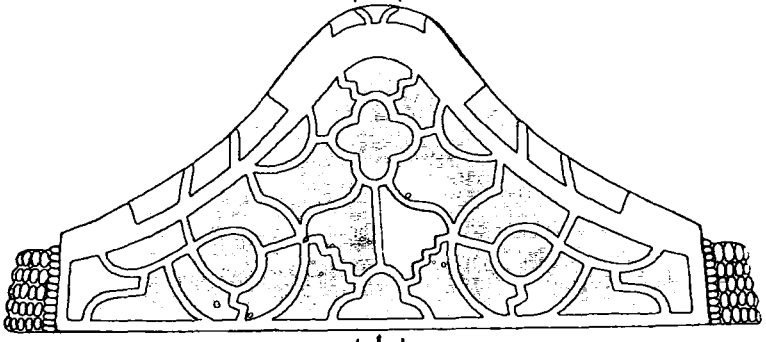


fig.20 Sketch drawing: sword-pommel from Hög Edsten with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1 and 2
ARTEFACT:	Sword-pommel
CONTEXT:	Hög Edsten / Assoc. with North Sea group

KEY FIG.	DESIGN STRUCTURE	DESIGN
1		
2		

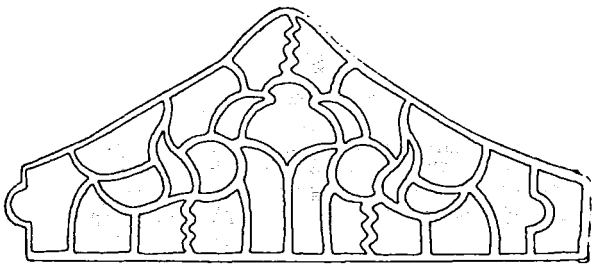


fig.21 Garnet cloisonné on the sword-pommel from Vallestarum; from Arrhenius 1985, fig. 173.

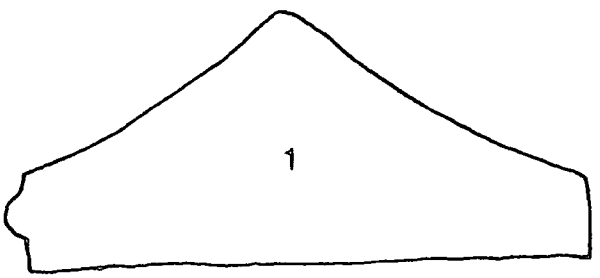
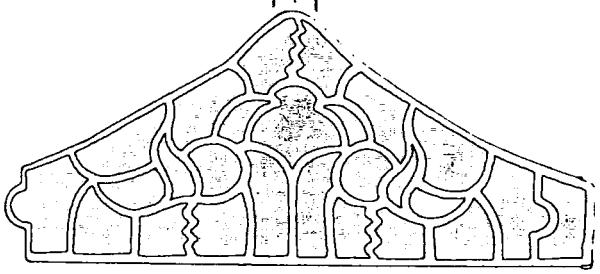


fig.22 Sketch drawing: sword-pommel from Vallestarum with key sections for analysis. Scale 2:1.

ANALYSIS-PAPER:	Sect.no. 1
ARTEFACT:	Sword-pommel
CONTEXT:	Vallstenarum / North Sea group

KEY FIG.	DESIGN STRUCTURE		DESIGN
1			

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Mirror Reflection		Finite				101	

Analysis Tables

Merovingian garnet jewellery

b) Trier workshop and comparative material

fig.23 The plaque from the Egbert-Shrine in Trier; from Arrhenius 1985, fig.204.

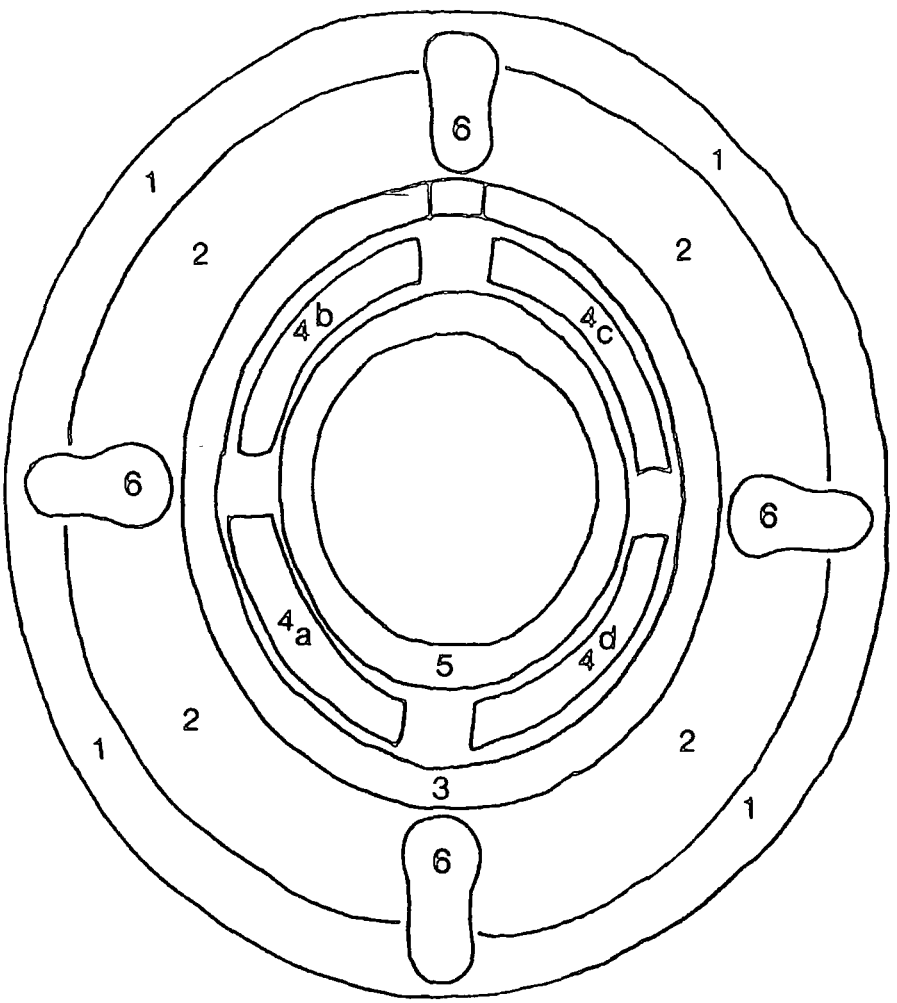
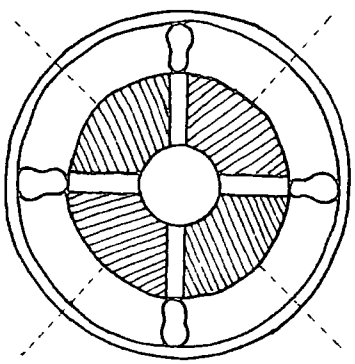
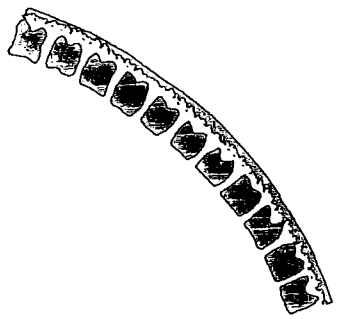
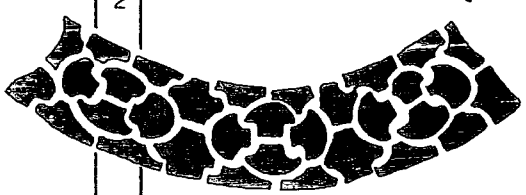
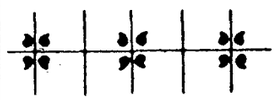


fig.24 Sketch drawing: plaque from Trier with key sections for analysis. Scale 2:1.

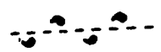
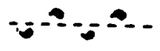
ANALYSIS - PAPER:	Sect.nos. 1-3
ARTEFACT:	Plaque
CONTEXT:	Trier / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1	
		2	 
		3	

KEY	MODE OF	MOTION	DIMENSION		COMMENTS	COLOUR	NOMENCLATUR	
FIG.	SYMMETRY	MODEL	STR.	DES.	ARTISTIC & OTHERS	VARIATION	STR.	DES.
1	Translation	,,,,,						1 - 100
2	Combined horizontal and vertical Mirror Reflection							1 - 211
3	Translation	,,,,,						1 - 100

ANALYSIS - PAPER:	Sect.nos. 4-6
ARTEFACT:	Plaque
CONTEXT:	Trier / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		4 a	
		4 b	
		4 c	
		4 d	
		5	
6			

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
4a	Slide Reflection							$1-100x^1$
4b	Slide Reflection							$1-100x^1$
4c	Translation							1-100
4d	Translation							1-100
5	Translation							1-100
6	Fourfold Rotation			Finite			400	

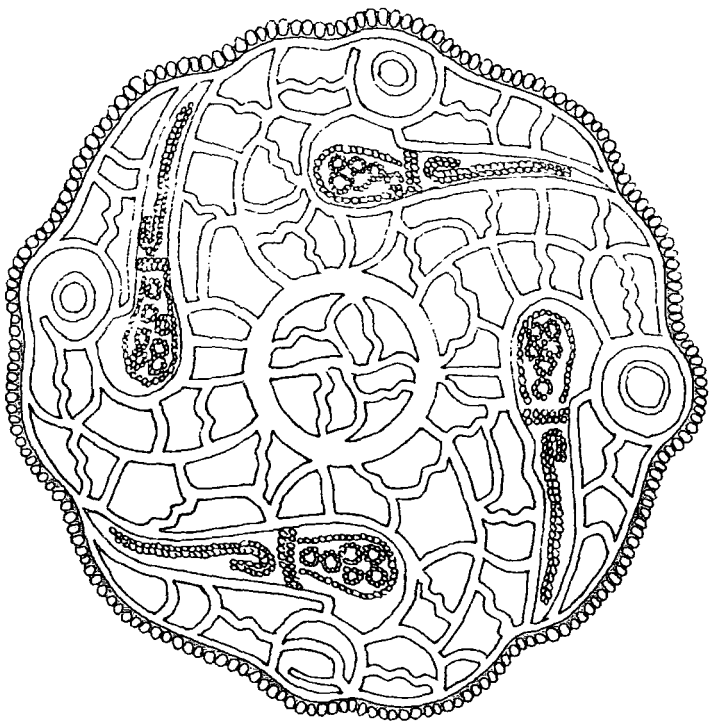


fig.25 The disc-brooch from Schretzheim, grave 106; from Arrhenius 1985, fig.218.

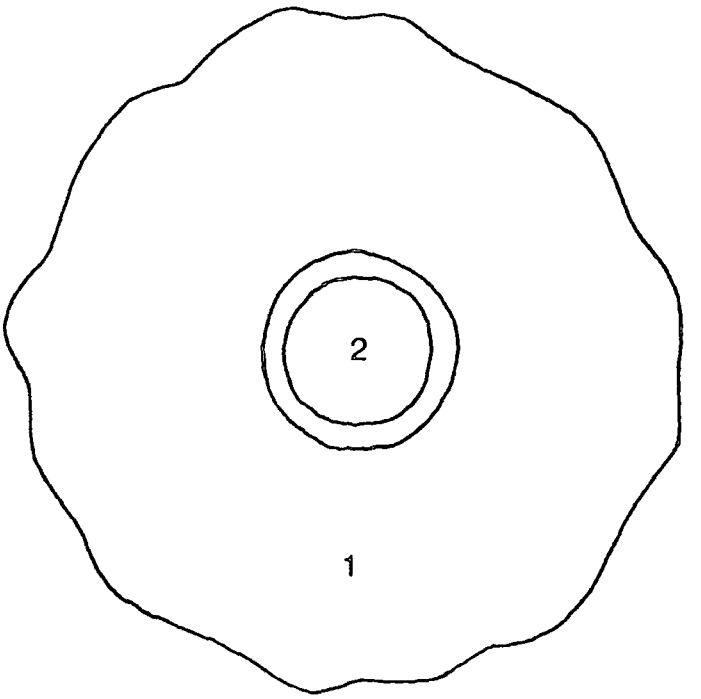
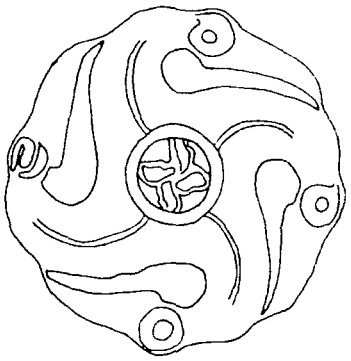
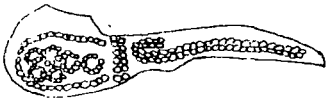
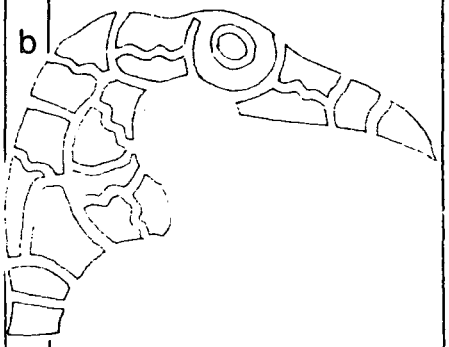


fig.26 Sketch drawing: disc-brooch from Schretzheim with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1 and 2
ARTEFACT:	Brooch
CONTEXT:	Schretzheim / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
1		a	
		b	
		2a	
		2b	

KEY	MODE OF	MOTION	DIMENSION		COMMENTS	COLOUR	NOMENCLATUR	
FIG.	SYMMETRY	MODEL	STR.	DES.	ARTISTIC & OTHERS	VARIATION	STR.	DES.
1a	Fourfold Rotation			Finite				400
1b	Fourfold Rotation			Finite				400
2a	Fourfold Rotation			Finite				400
2b	Fourfold Rotation			Finite				400

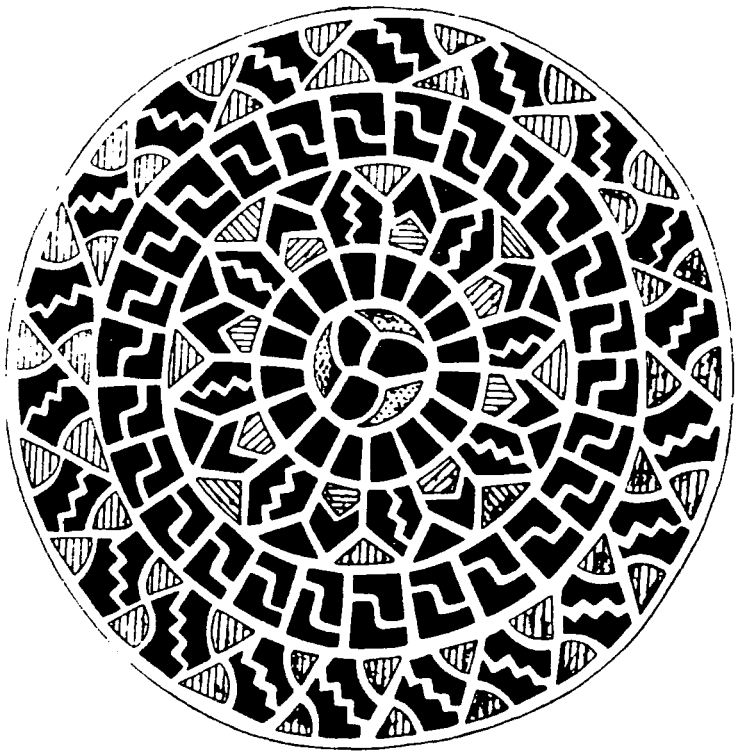


fig.27 The disc-brooch from Soest, grave 106; from Arrhenius 1985, fig.212.

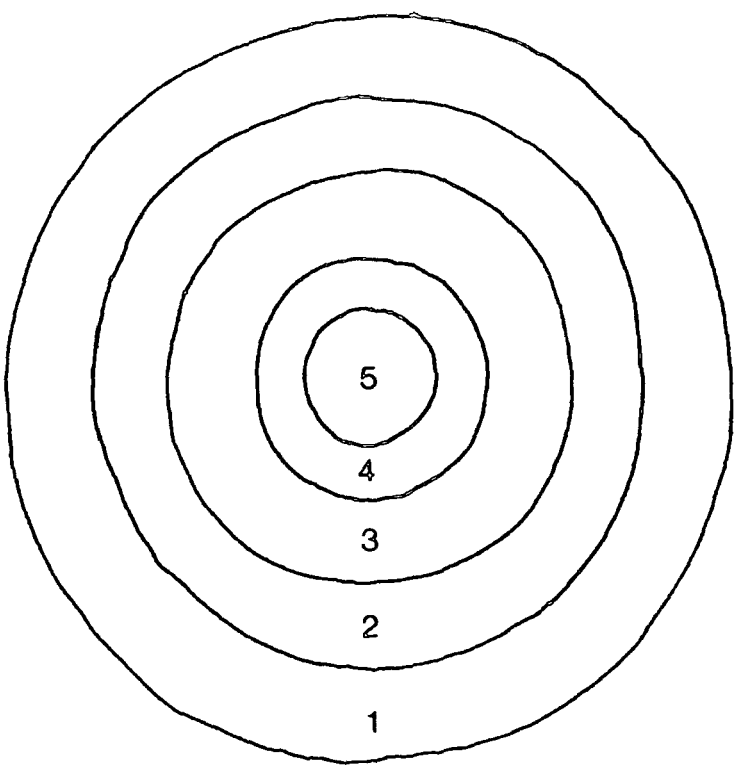
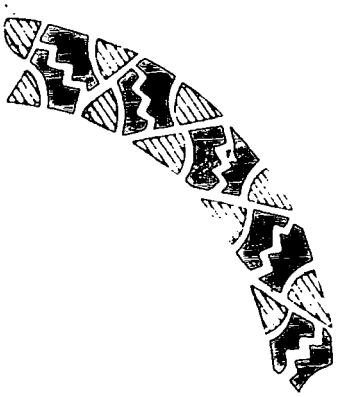
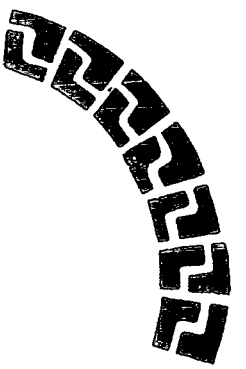
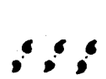
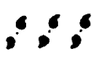
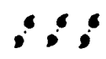


fig.28 Sketch drawing: disc-brooch from Soest with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1-2
ARTEFACT:	Disc-brooch
CONTEXT:	Soest / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1	
		a	
		b	
		2	

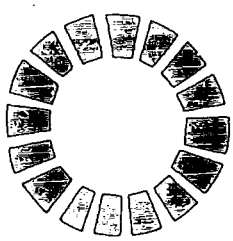
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1a	Twofold Rotation			1				1-200
1b	Twofold Rotation			1				1-200
2	Twofold Rotation			1				1-200

ANALYSIS - PAPER:	Sect.no.3
ARTEFACT:	Disc-brooch
CONTEXT:	Soest / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		3	
		a	
		b	
		c	
		d	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
3a	Translation							1 – 100
3b	Translation							1 – 100
3c	Slide Reflection							1 – 100x[1]
3d	Translation							1 – 100

ANALYSIS - PAPER:	Sect.nos.4-5
ARTEFACT:	Disc-brooch
CONTEXT:	Soest / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		4	
		5 a	
		5 b	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
4	Translation							1 – 100
5 a	Threefold Rotation			Finite				300
5 b	Threefold Rotation			Finite				300

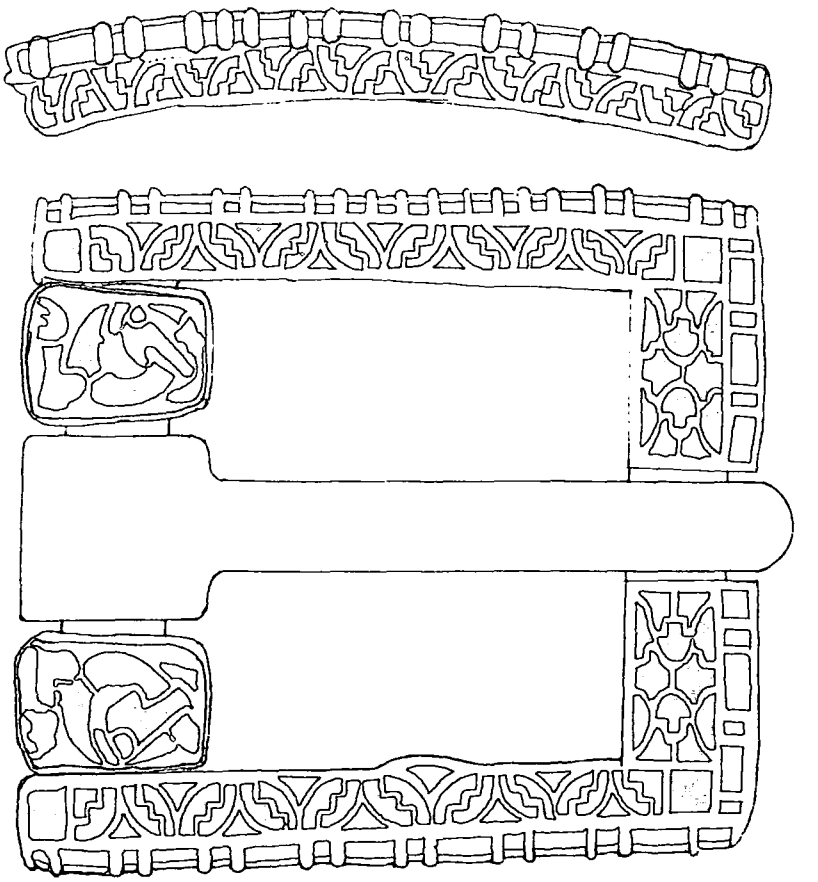


fig.29 The buckle from Tongeren; from Arrhenius 1985, fig. 207a-b.

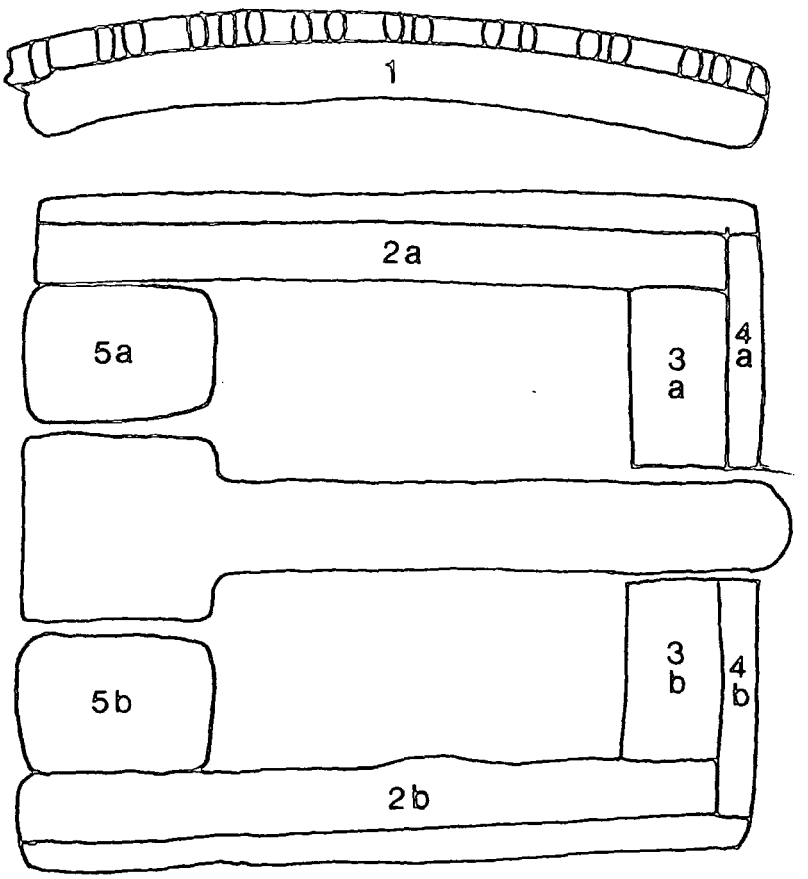
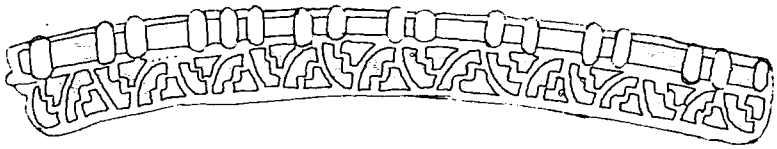
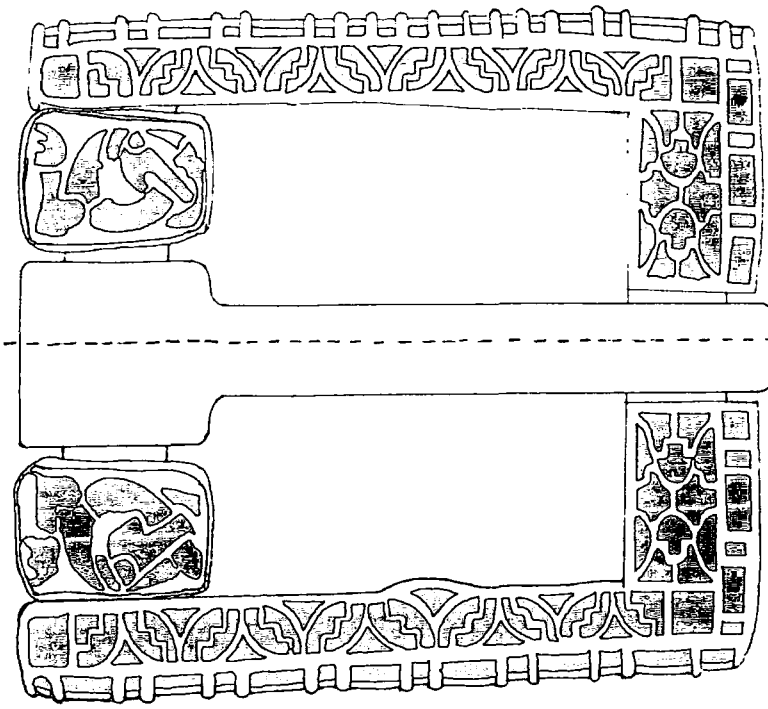
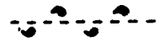


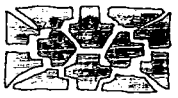
fig.30 Sketch drawing: buckle from Tongeren with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1-2 and 5
ARTEFACT:	Belt-buckle
CONTEXT:	Tongeren / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
1			
2			
5			
5			
2			
2			

KEY	MODE OF	MOTION	DIMENSION		COMMENTS	COLOUR	NOMENCLATUR	
FIG.	SYMMETRY	MODEL	STR.	DES.	ARTISTIC & OTHERS	VARIATION	STR.	DES.
1	Slide Reflection						1 – 100x[1]	
5	Horizontal Mirror Reflection		Finite				110	
2	Mirror Reflection							1 – 101

ANALYSIS - PAPER:	Sect.nos. 3-4
ARTEFACT:	Belt buckle
CONTEXT:	Tongeren / Central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		3	
		4	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
3	Combined horizontal and vertical Mirror Reflection			Finite				211
4	Translation							1–100

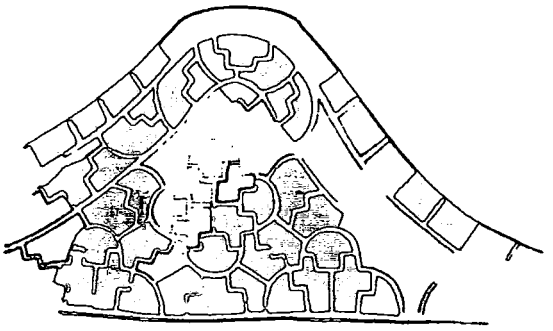


fig.31 The garnet cloisonné sword-pommel from Skrävsta; from Arrhenius 1985, fig.213.

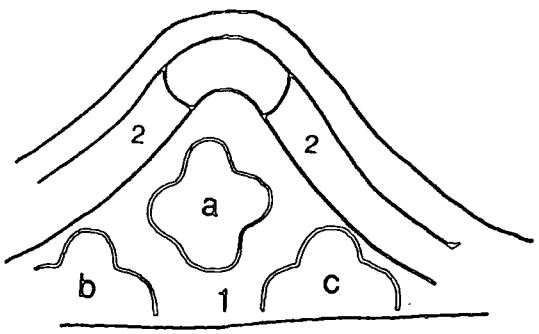
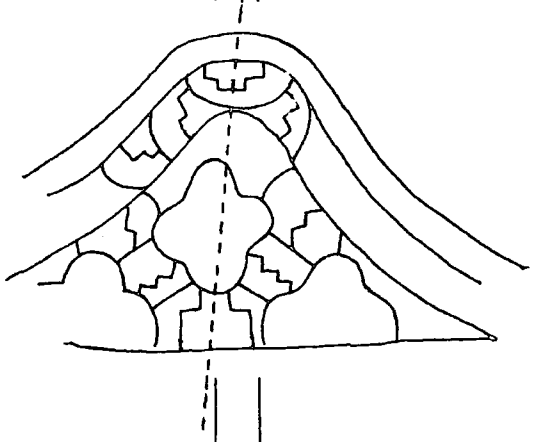
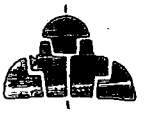


fig.32 Sketch drawing: sword-pommel from Skrävsta with key section for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1-4
ARTEFACT:	Sword-pommel
CONTEXT:	Skrävsta / Assoc. with central workshop (Trier)

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1 a	
		1 b	
		1 c	
		2	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
	Mirror Reflection		Finite				101	
1	Fourfold Rotation			Finite				400
1	Mirror Reflection			Finite				101
1	Mirror Reflection			Finite				101
2	Slide Reflection							1 - 100x[1]

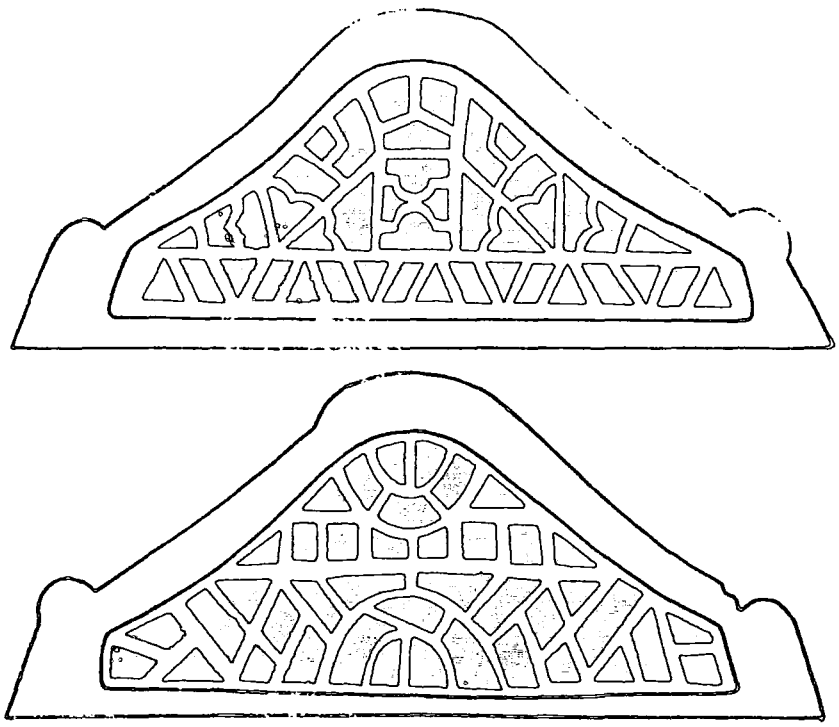


fig.33 Cloisonné pattern on the sword-pommel from Valsgärde, grave 7; from Arrhenius 1985, fig.231a-b.

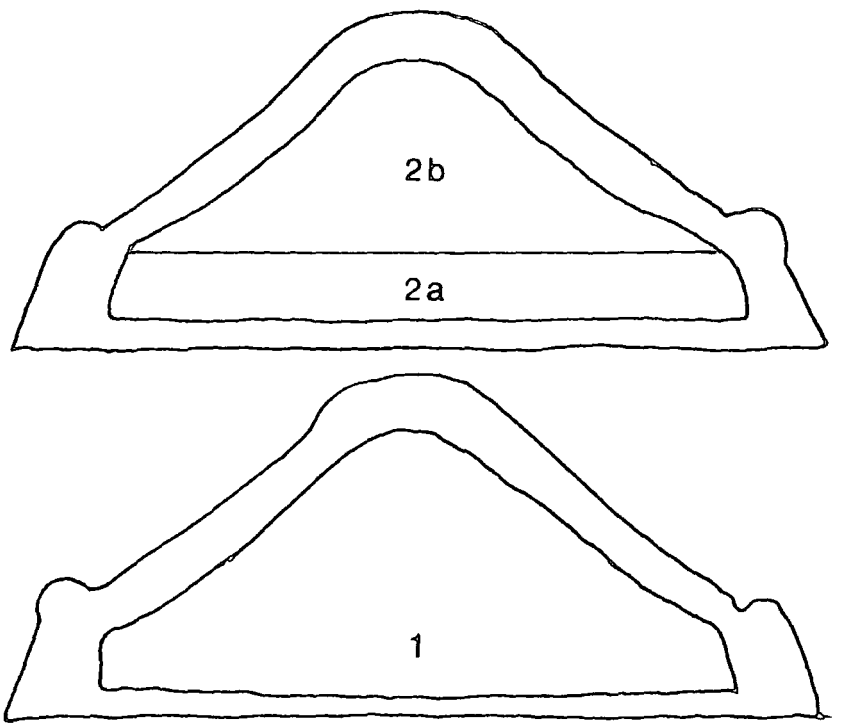
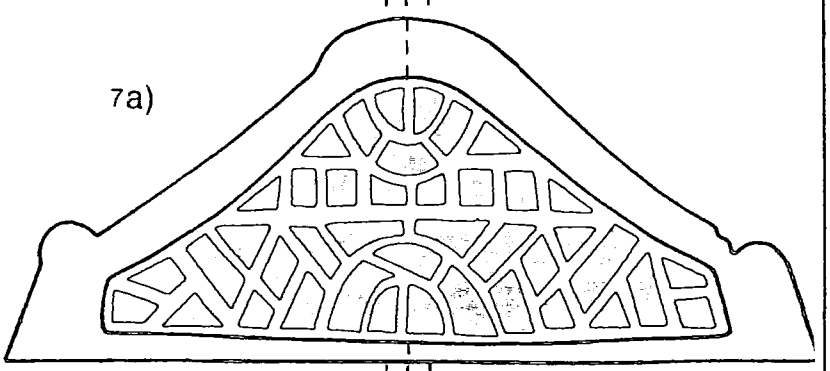
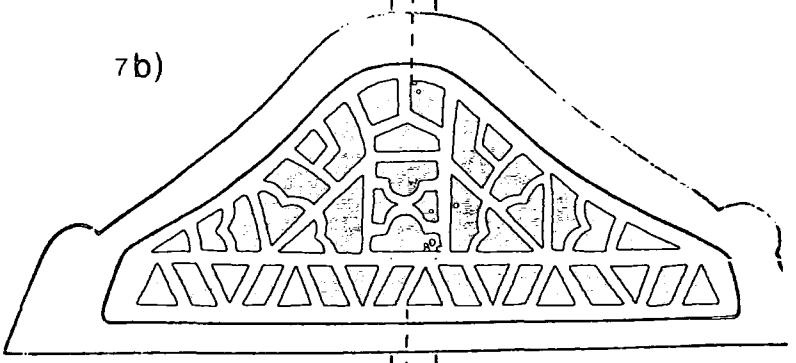
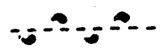
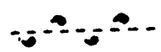


fig.34 Sketch drawing: sword-pommel from Valsgärde 7 with key sections for analysis.
Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1-2
ARTEFACT:	Sword-pommel
CONTEXT:	Valsgärde 7 / Skandinavian workshop

KEY FIG.	DESIGN STRUCTURE	DESIGN
1	7a) 	
2	7b) 	
2		
a		
b		

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Mirror Reflection		Finite				101	
2	Mirror Reflection		Finite				101	
2a	Slide Reflection							1-100x[1]
2b	Slide Reflection							1-100x[1]

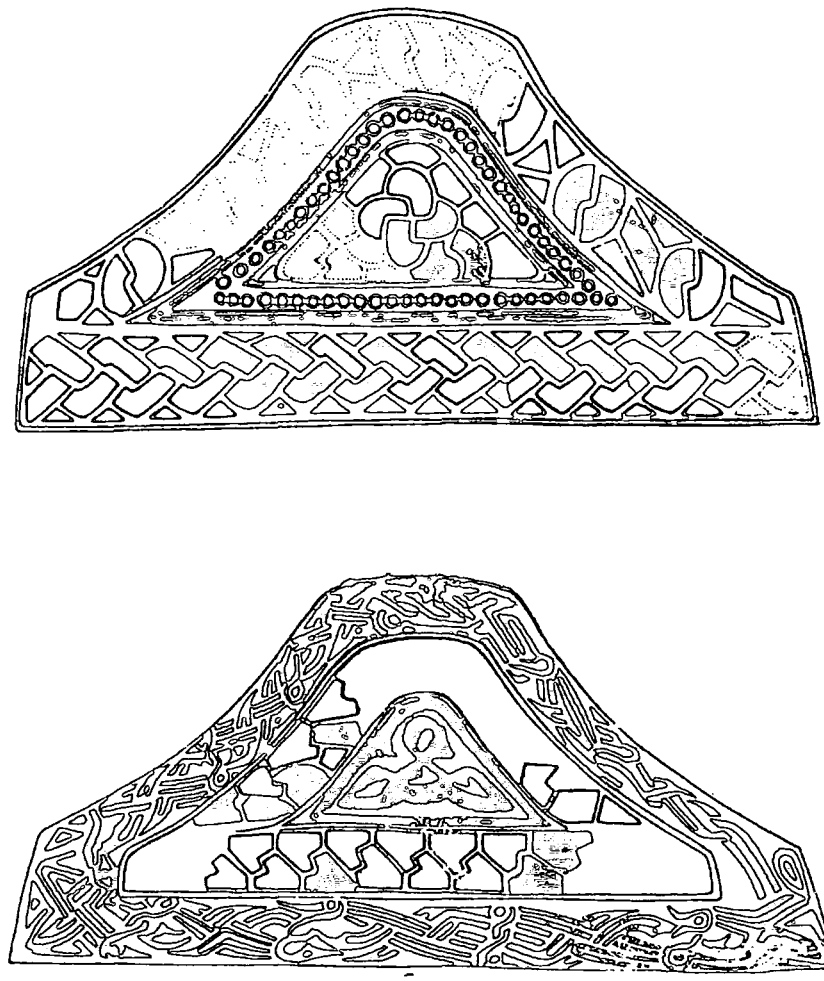


fig.35 Cloisonné patterns on the sword-pommel from Valsgärde, grave 5; from Arrhenius 1985, fig. 232a-b.

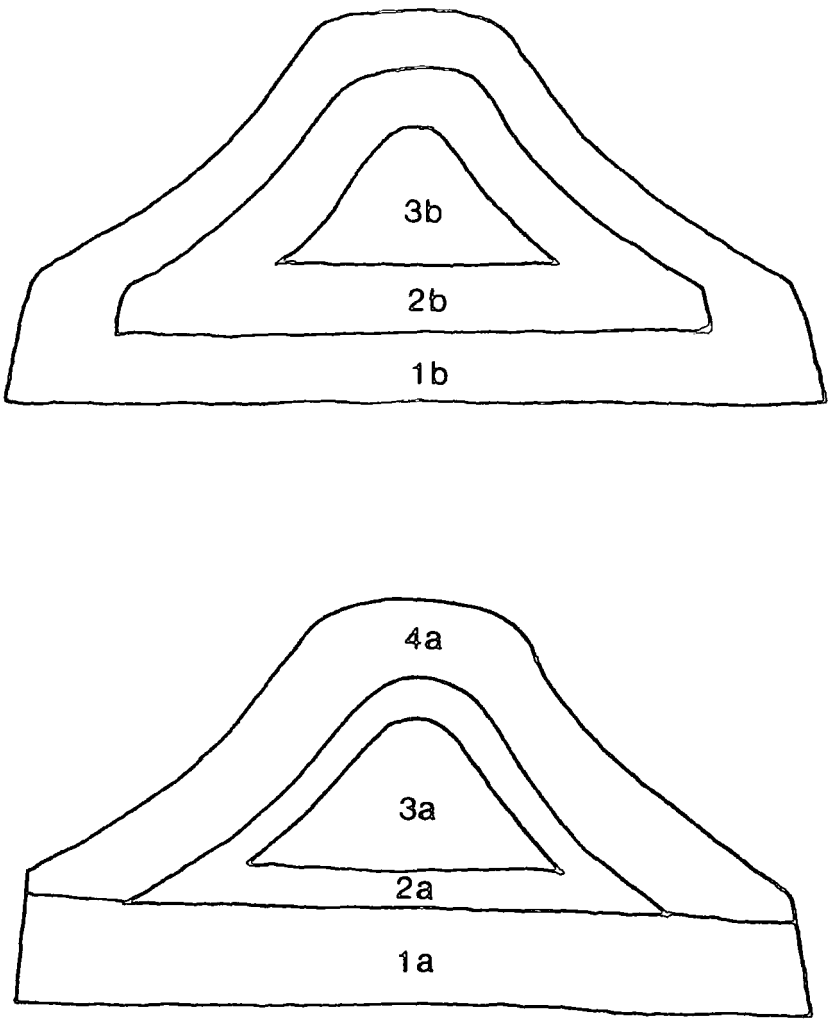
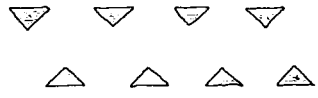
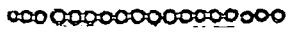
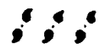
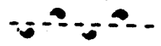
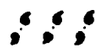


fig.36 Sketch drawing: sword-pommel from Valsgärde 5 with key sections for analysis. Scale 2:1.

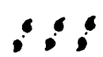
ANALYSIS - PAPER:	Sect.nos. 1a-4a
ARTEFACT:	Sword-pommel
CONTEXT:	Valsgärde 5 / Skandinavian workshop

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1a	
		1a	
		2a	
		3a	
		4a	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1a	Twofold Rotation							1-200
1a	Slide Reflection							1-100x[1]
2a	Translation							1-100
3a	Fourfold Rotation			Finite				400
4a	Twofold Rotation							1-200

ANALYSIS - PAPER:	Sect.nos. 1b-3b
ARTEFACT:	Sword-pommel
CONTEXT:	Valsgärde 5 / Skandinavian workshop

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1 b	
		2 b	
		3 b	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1b	Twofold Rotation							1-200
2b	Twofold Rotation							1-200
3b	Threefold Rotation			Finite				300

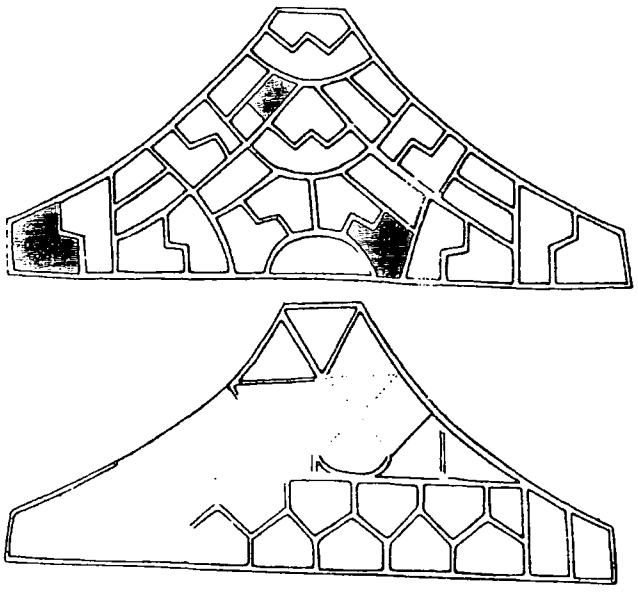


fig.37 Cloisonné pattern on the sword-pommel from Vendel I; from Arrhenius 1985, fig.230a-b.

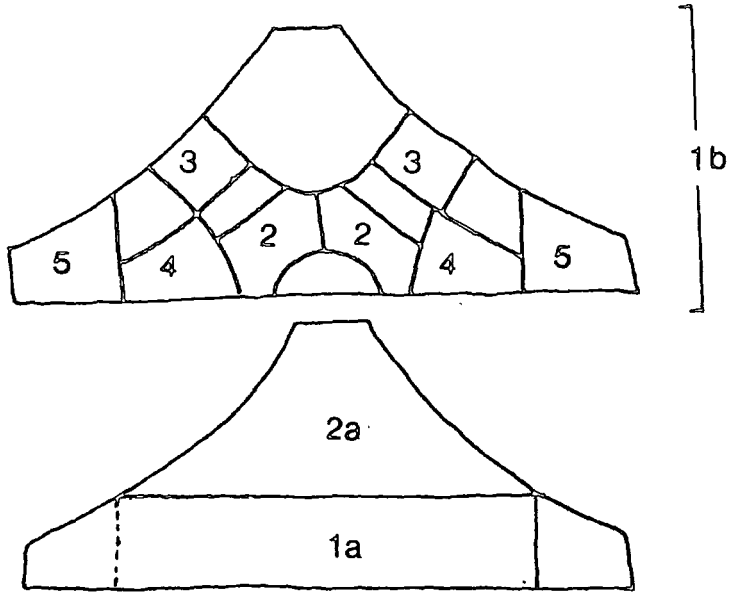
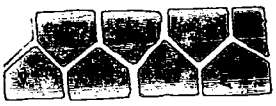
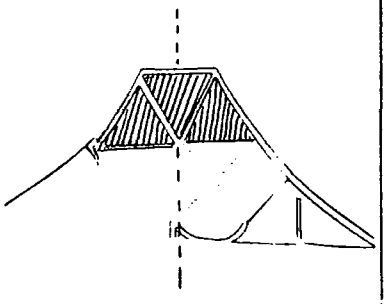
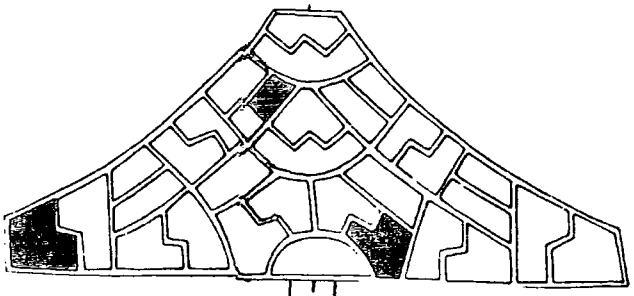
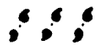


fig.38 Sketch drawing: sword-pommel from Vendel I with key sections for analysis. Scale 2:1.

ANALYSIS - PAPER:	Sect.nos. 1a-2a and 1b-3b
ARTEFACT:	Sword-pommel
CONTEXT:	Vendel I / Skandinavian workshop

KEY FIG.	DESIGN STRUCTURE		DESIGN
		1 a	
		2 a	
1		2 3 4 5	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATUR STR.	NOMENCLATUR DES.
1	Twofold Rotation							1 - 100x[1]
2	Mirror Reflection		Finite				101	
1	Mirror Reflection		Finite				101	
2 3 4 5	Twofold Rotation			Finite				200

Chapter four

Analysis Tables

Sutton Hoo jewellery

a) Purse-lid

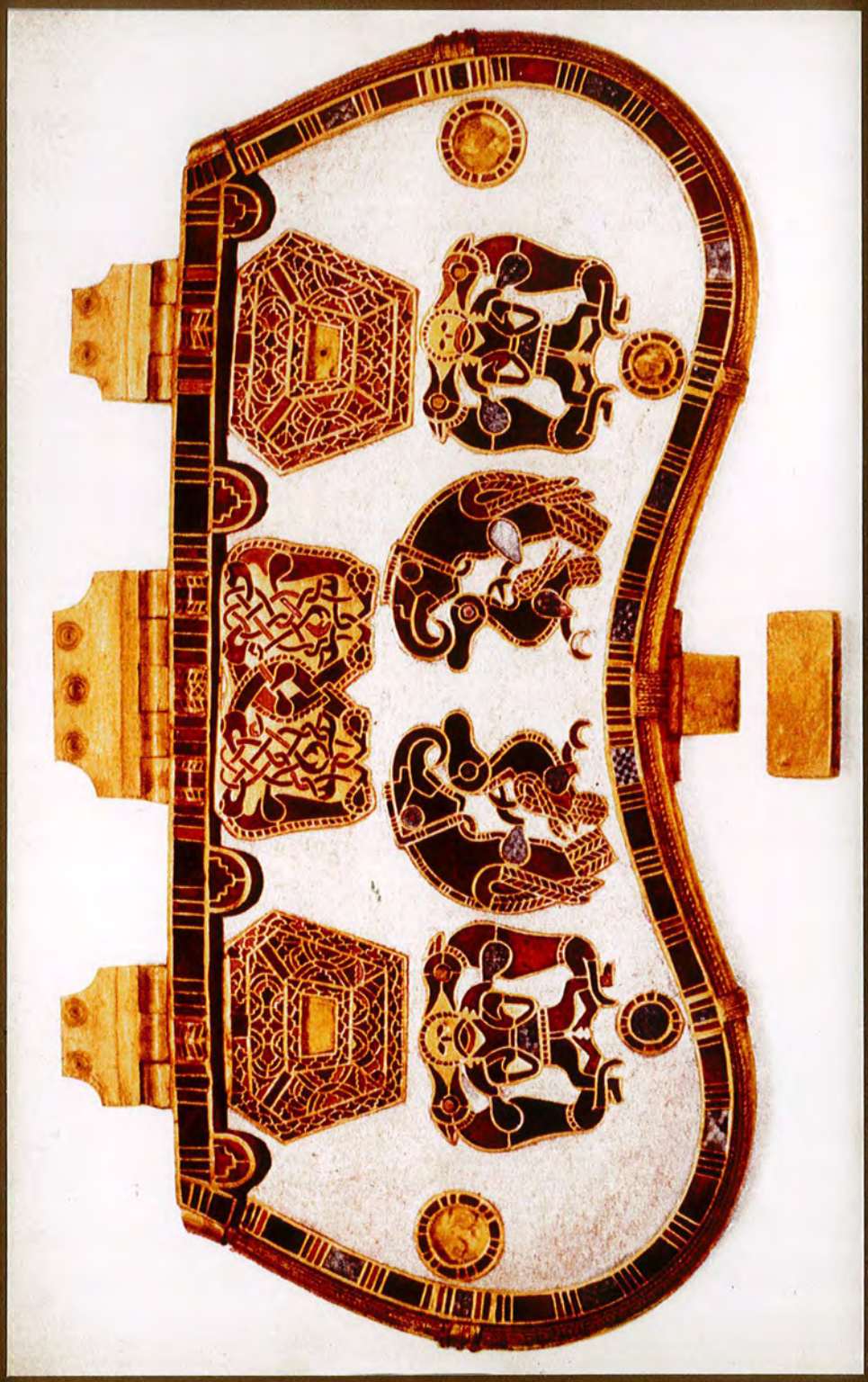
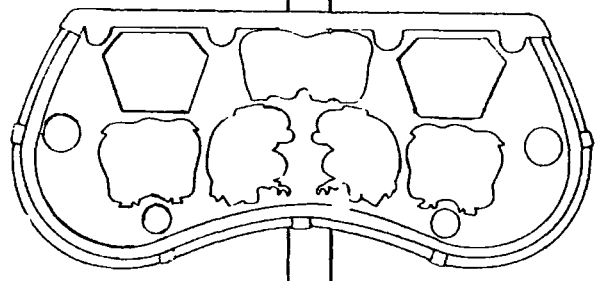
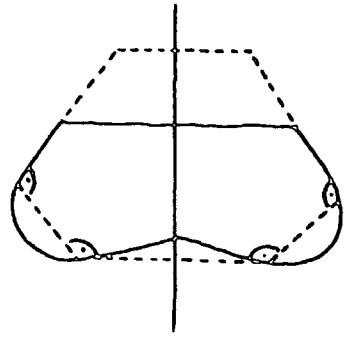
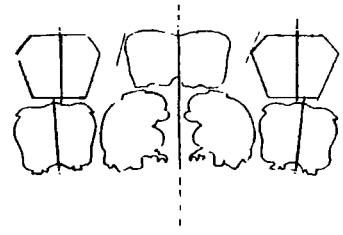


Plate 2

ANALYSIS - PAPER:	No. 1 Sect.nos. 1 (a - c) and 2a
ARTEFACT:	Purse - Lid
CONTEXT:	Sutton Hoo Jewellery

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
1a.			
1b.		1c.	
		E. F.	
2.		a.	
		A.	

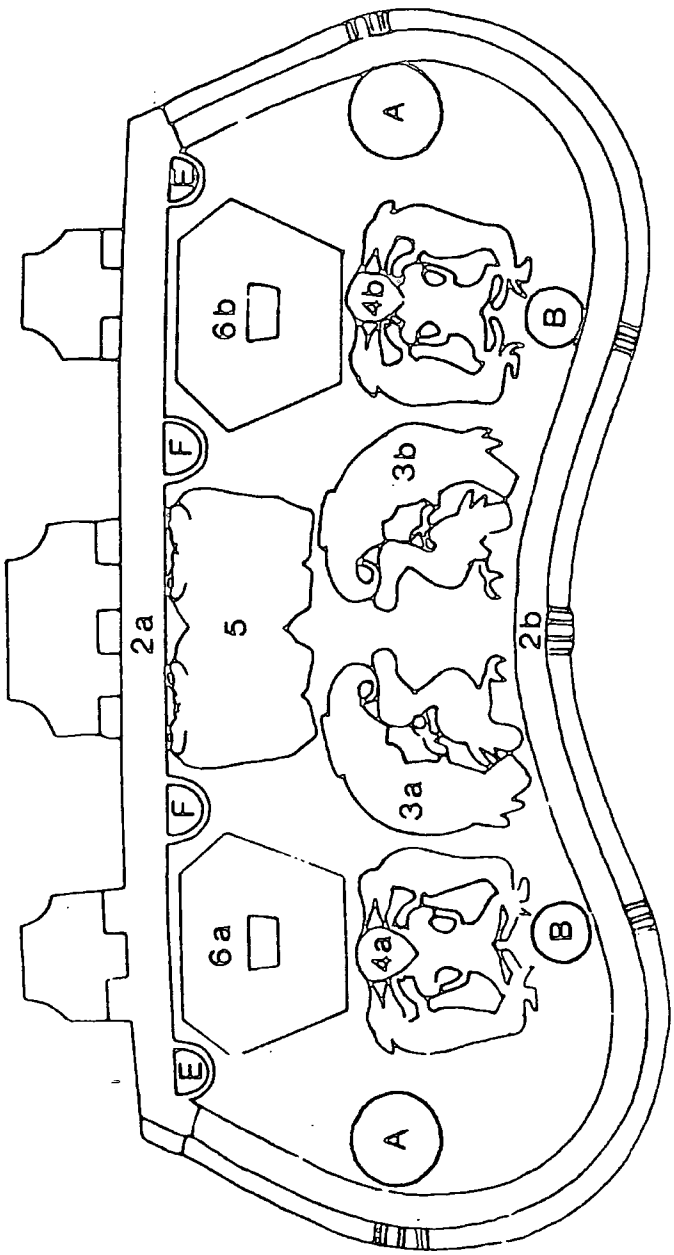
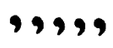
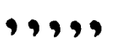
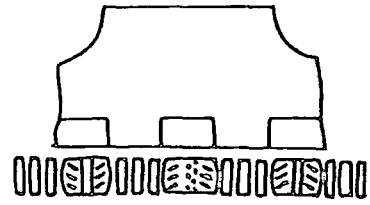
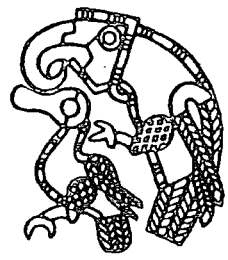
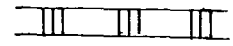
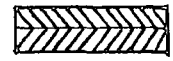
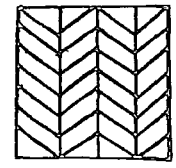
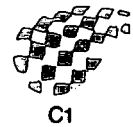


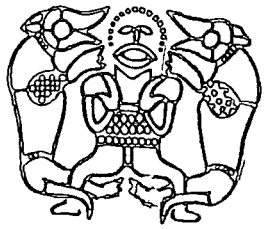
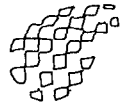
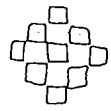
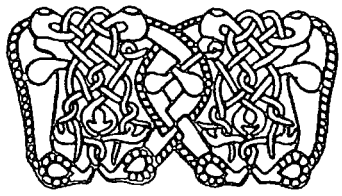
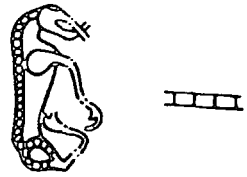
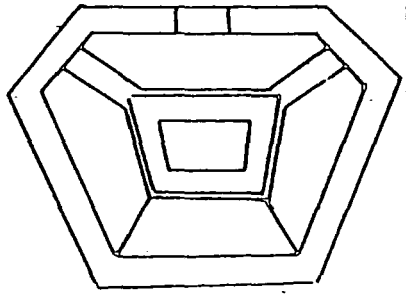
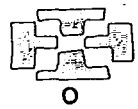
fig.39 Sketch drawing: purse-lid from Sutton Hoo with key sections for analysis

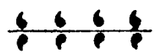
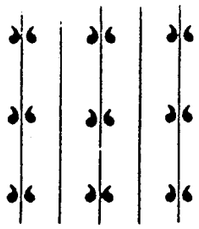
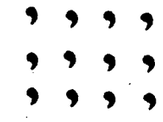
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					1a. *Symmetry:* While the vertical axes of the hexagons (key sect.no. 6a/b) run parallel to the central axis of the lid's surface, both central axes of the man-between-beast plaques (key sect.no. 4a/b) meet the main axis at a slight angle (north-west/south-east alignment) if projected far enough. Thus the axial properties of the artefact's surface have been taken into consideration by the craftsman in the layout of the plaques, and aligned, according to these properties with their own axis.			
					1b. *Symmetry:* The convex nature of the curved shape of the lid can be shown as lying within the design-field of a hexagon. This geometrical 'superstructure', as one may call it, is reflected or repeated in a smaller version in a reversed mode in the two hexagonal plaques (key-fig. no. 6a/b).			
4.- 6.	Vertical Mirror Reflection		Finite	Finite	1c. *Symmetry:* All plaques follow, as individual finite structures (except for the two bird plaques), the main scheme of vertical mirror-reflection which divides the lid's surface into two equal halves.		101	101
E.- F.	Vertical Mirror Reflection			Finite	• *Juxtaposition:* As seen from the distribution of the plaques there is also a horizontal division, the more abstract motifs (hexagons and the double-plaque) within the upper zone of the purse-lid being juxtaposed the the figural motifs in the lower horizontal motifs within the purse's lower zone.			101
2a.	Translation			One	2a. *Symmetry:* The assymetric cell-units (see this chapter, figs. 2a-b) are repeated in an alternating 'A-B-A-B' sequence. Cell-units 'a' appear in clusters of three, which is to be considered here as making up a design-unit.			1 – 100
A.	Translation			One	• *Variation:* This theme of translation is varied in the way the three differently ornamented barrel-shaped design-units (see this chapter, fig. 2 m, n and o) are substituted for the larger rectangular cell-units.			1 – 100

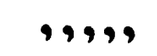
ANALYSIS - PAPER:	No. II Sect.nos. 2b and 3
ARTEFACT:	Purse - Lid
CONTEXT:	Sutton Hoo Jewellery

KEY FIG.	DESIGN STRUCTURE		DESIGN
2a.		a.	
2b.		b.	
3.		/1	
		/2	
		/3	
		/4	 C1  K

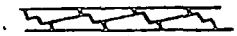
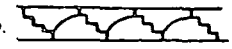
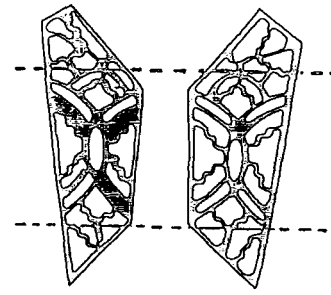
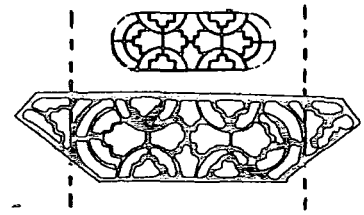
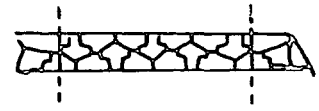
ANALYSIS - PAPER :	No. III Sect.nos. 4 - 6
ARTEFACT:	Purse - Lid
CONTEXT:	Sutton Hoo Jewellery

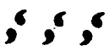
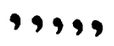
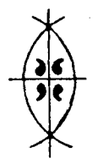
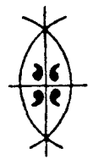
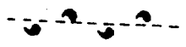
KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
4.		C1.	
		C.	
5.			
6.		O.	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					• *Juxtaposition:* In the case of the two outer hinges, the single barrel-like projections coincide with and emphasize the tubular portion of the mechanism, which is cast in one piece with the strap-terminator; but in the central hinge, the barrel-shaped projections coincide with the three tubular portions of the hinge mechanism which are attached to the purse-bar (Bruce-Mitford 1978,p.492). Thus we can observe here the juxtaposition of functional parts and ornamental design-units on the purse.			
2a.	Translation	,,,,,		One	• *Artistic effect:* The design is geometric in character. The straight bar is the only part of the frame to have features in relief (barrel-shaped projections), according to Bruce-Mitford (ibid.).			1 - 100
2b.	Translation	,,,,,		One	2b. Type of design, and the basic alternating sequence of cell-units as recorded above (Key-sec. 2a).			1 - 100
					• *Variation:* The particular theme of translation is varied in the way millefiori inlays replace at regular intervals the rectangular garnet cell-units, except in one case (see this chapter. fig.12 cell-unit no.9), where this sequence becomes irregular.			
P/1	Translation	,,,,,		One				1 - 100
P/2	Horizontal Mirror Reflection			One	• *Artistic effect:* The alternating sequence of repeated rectangular and clustered cell-units reflects the position of the four circular studs (sects. A-D) within the design-field of the lid.			1 - 110
P/3	Vertical Mirror Reflection			Two	3. *Variation:* Due to technical reasons, minor variations occur in the case of the main shapes of the two plaques. The ornamentation of the panels is analysed according to the following sections: P/1. bordering panels (bird's bodies) P/2. bird's wings P/3. bird's tails P/4. bird's legs (millefiori designs).			2 - 101
P/4	Translation			Two		2 - $1_3$00		2 - 100

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
C1.	Translation			Two	4. *Interlinking:* The motif consists of three individual figures, whose lower extremities are interlinked: the animals' tails overlying the men's legs, while these in return overly parts of the animals' legs. The other plaque's motif is similar in shape and coloured layout (key sect. no. 4b). • *Technique:* Combination of openwork/cloisonné and the 'lidded cell'. • *Art history:* The figural motif-elements show strong affinities to Vendel-period East Scandinavian themes embossed on helmets.	$2-1_3 00$		2 - 100
C.	Translation			Two	5. *Interlinking / Ambiguity:* The plaque comprises two design-units, which are interlinked through one of their fundamental parts in the middle. The fact that the backs of both of these interlinked animals are bent, unlike their opposites, adds to the ambiguity of this design. • *Variation:* The minute parallelogram cell-panels forming the bordering panels vary in size and shape to fit the animals' bodies anatomy.	$2-1_3 00$		2 - 100
	Translation			One	• *Art history:* The design comprises the theme of the 'interlaced' or 'biting' animal, well known on the pictorial background of Anglo-Saxon 'Style II' animal art.			1 - 100
O.	Fourfold Rotation			Finite	6. *Symmetry analysis:* The panels are analysed according to the following marked sections: P/1. Border around trapezoidal cell (step-pattern). P/2. Right and left assymmetrical middle panels (step-pattern with semicircles). P/3. Upper and lower assymetrical middle panels (step-pattern). P/4. Outer border (mushroom cells). P/5. Central trapezoidal cell (millefiori design). • *Variation / Symmetry:* Both plaques are similar in size and cell-layout, but some variations occur within the confines of their panels:			400

ANALYSIS - PAPER :	No. IV Sect.no. 6 (P/1 - P/4)
ARTEFACT:	Purse - Lid
CONTEXT:	Sutton Hoo Jewellery

KEY FIG.	DESIGN STRUCTURE		DESIGN
6.		/1	a.  b. 
		/2	
		/3	
		/3	
		/4	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
a. P/1	Twofold Rotation			One	P/1. The cell-shapes vary on the corners of the panel. P/1. *Ambiguity:* Here two different types of individual cells (fundamental parts of the design) are translated. Due to their particular, shapes they are fitted together like a jig-saw comparable to some of M.C. Escher's symmetrical drawings. P/2. The individual cells in the upper corners of the panels vary in size and shape (see this chapter, fig.4h-k). Thus the interior layout of cells is only symmetric within the design-field marked by the dotted lines. This applies also to the internal (class 211) symmetry of the individual panels. P/3. The above mentioned aspects of variation also apply here. P/4. The mushroom-cells vary in shape and size on each corner of the border panel. The residual cell-shapes are not considered in the symmetry analysis.			1 - 200
b.	Translation			One				1 - 100
P/2	Combined Horizontal/Vertical Mirror Reflection			Finite				211
P/3	Combined Horizontal/Vertical Mirror Reflection			Finite	• *Colour variation Artistic effect:* Some of the garnet inlay within the panels has a much darker red colour, and a punctuating effect is therefore achieved (Bruce-Mitford 1978:506). On the whole, the colour characterizing these plaques is more of a brick-red and less dark plum-colour than that of the rest of the work on the purse (ibid.,p.508). • *Technique:* The whole surface of the plaques is executed in openwork-cloisonné. • *Art history:* Bruce-Mitford maintains that one aspect of the compositional style of the plaques, i.e. their complete garnet encrustation, with little or no filigree work. and preserving many distinctive looking technical devices, is widespread. both geographically and in time (1974:36).			211
P/3	Vertical Mirror Reflection			Finite				101
P/4	Slide Reflection			One				1 - 100x[1]

Analysis Tables

Sutton Hoo jewellery

b) Shoulder-clasp

Plate 3

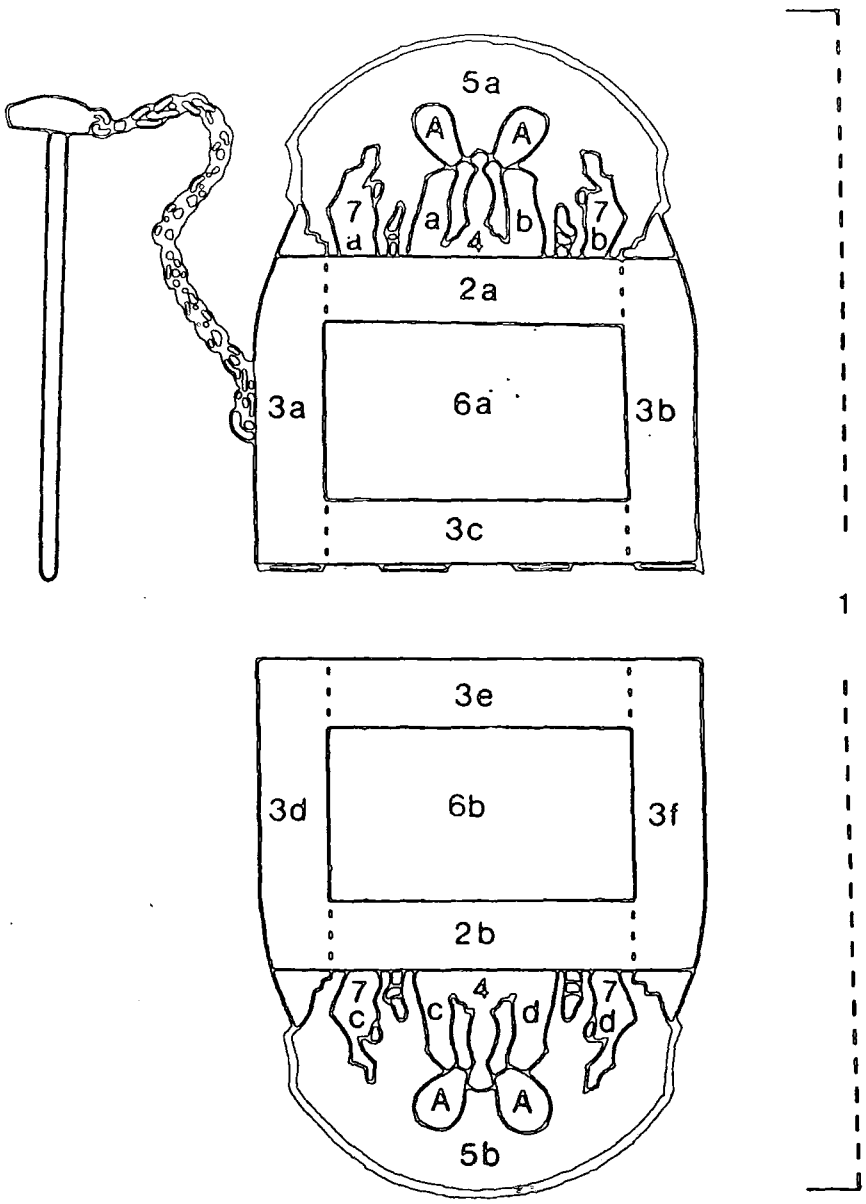
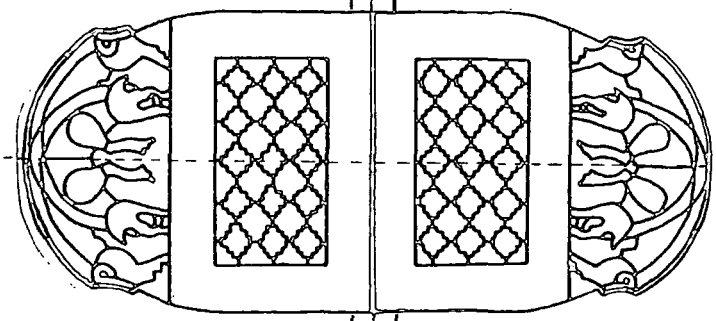


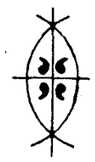
fig.40 Sketch drawing: shoulder-clasp from Sutton Hoo with key sections for analysis

ANALYSIS - PAPER : No. 1 Sect.nos. 1, 2 (a, b) and 3 (a - f)

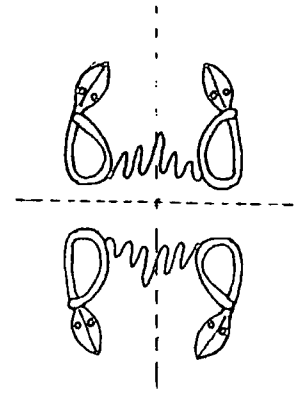
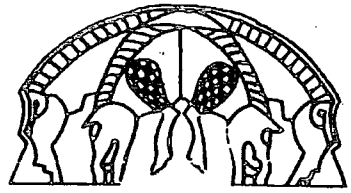
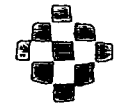
ARTEFACT: Shoulder - Clasp

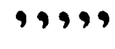
CONTEXT: Sutton Hoo Jewellery

KEY FIG.	DESIGN STRUCTURE		DESIGN
1.			
2.		a.	
3.		a.	
		c.	
		e.	

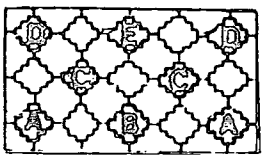
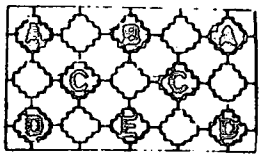
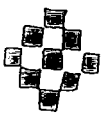
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
3 (a - f) 5. (a, b) 6 (a, b) 7 (a - d)	Combined Horizontal/Vertical Mirror Reflection			Finite	1. *Symmetry:* The two identical halves of the clasp are regarded as providing one continuous design-field. Its contained ornamentation is analysed accordingly. Thus it is characterized both through vertical and horizontal mirror-reflection symmetry. 1. *Symmetry:* According to the symmetry of the design-field (class 211), all the designs exept for sect.no. 3c/e follow this symmetry in their movement. The latter is accounted for in the motion model on the left exept for sect.no. 4a-d. • *Juxtaposition / Art history:* The figural design of the boars and interlaced filigree animals appears to be juxtaposed with the purely geometric design of the rectangular design fields (see same phenomenon on purse-lid). This is a characteristic described by Bruce-Mitford as typical for the Sutton Hoo craftsman (1978:584).			211
2a.	Twofold Rotation			Finite	2a. *Continuity:* The design-unit consists of two interlaced fundamental parts. • *Technique:* Use of the 'lidded cell'. • *Art history:* Style II animal interlacing similar to the double plaque on the purse-lid (key sect.no. 5). 2b. See section 2a.			200
3a. 3c. 3e.	Translation Twofold Rotation	 		One One	3a. *Continuity:* The three individual animals are interlaced with each other. 3b/d/f. See section 3a. 3e/c. *Symmetry:* The motifs of this particular design are found on two separate panels, which lie opposite each other on the clasp.			1 - 100 1 - 200

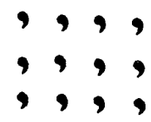
ANALYSIS - PAPER :	No. II Sect.nos. 4 (a -d) and 5 (a, b)
ARTEFACT:	Shoulder - Clasp
CONTEXT:	Sutton Hoo Jewellery

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
4.		a. b. c. d.	
5a.			
			
		C.	

KEY	MODE OF	MOTION	DIMENSION		COMMENTS	COLOUR	NOMENCLATURE	
FIG.	SYMMETRY	MODEL	STR.	DES.	ARTISTIC & OTHERS	VARIATION	STR.	DES.
4 (a -d)	Combined Horizontal/Vertical Mirror Reflection			Finite	4a/b. *Continuity / Symmetry:* The two motifs of the snakes are connected with each other while the two design units are related symmetrically over a distance to each other as is also the case with the boar design. • *Variation / Technique:* Due to their execution in filigree, the snake-motifs vary in shape and size. • *Artistic effect / Technique:* The snakes' bodies are 'contoured', a thick inner beaded wire being flanked by beaded wires of a smaller gauge (Bruce-Mitford 1978:609). The snakes fill the spaces between the design of the boars. Their smaller size and their colour, which is that of the background, transform them into subsidiary filling ornamentation. 4c/d. See section 4a/b. • *Art history:* Filigree work within the context of the Sutton Hoo jewellery is compared by Bruce-Mitford with a small number of other leading Anglo-Saxon pieces mostly from Kent (1978:611).			211
	Translation			One	5a. *Ambiguity:* The two boar figures appear, in effect, as one motif, with their bodies cutting through each other. • *Technique:* Use of the openwork-cloisonné, involving relatively large pieces of cut garnet. • *Colour variation:* There is much colour variation in the garnet inlays of the backbones of the boars. While the inner elements of the boars' backbones are uniformely a bright red, the outer lines of the cells are all orange (Bruce-Mitford 1978:525). 5b. See section 5a.			1 - 100
C.	Translation			Two	• All millefiori patterns are designated by capital letters which refer to colour plate five (according to Bruce-Mitford 1978, Pl.24).	2 - $1_3$00		2 - 100

ANALYSIS - PAPER :	No. III Sect.nos. 6a and 7a - d
ARTEFACT:	Shoulder - Clasp
CONTEXT:	Sutton Hoo Jewellery

KEY FIG.	DESIGN STRUCTURE		DESIGN
6a.			
6b.			
		A.	
		B.	
		C.	
		D.	
		E.	

KEY	MODE OF	MOTION	DIMENSION		COMMENTS	COLOUR	NOMENCLATURE	
FIG.	SYMMETRY	MODEL	STR.	DES.	ARTISTIC & OTHERS	VARIATION	STR.	DES.
6a.	Translation			Two	6a. *Symmetry / Colour counterchange:* The smaller, stilted cells, which carry the millefiori insets or garnets, are considered here to be the fundamental parts of the main design (see also Bruce-Mitford 1978:525). The translation of these design elements occurs in a counterchanged 'A - B - A - B' fashion. This is also the case with the different inlay material of the cells (see nomenclature on the right). • *Ambiguity / Artistic effect:* The large type of step-pattern cells can be considered to be secondary in importance. But as perfect cells of orthodox shape, and dovetailed regularly with the smaller stilted cells, they can be considered as leading cell types in their own right (Bruce-Mitford 1978:525). However, the polychrome and red smaller cells are suspended on four short straight ligatures or stems, giving them an isolation which serves to accentuate their form.			2 - 100
A.	Fourfold Rotation			Finite				400
B.	Translation			Two	• *Symmetry:* The stems are not only straight, but are set in perfectly straight alignment across the panels in whichever direction they are read. • *Art history:* The organisation of design-elements in a carpet-like arrangement is thus far considered to be a prototype for the later embellishment of the decorated pages of the Lindisfarne Gospels and the Book of Kells (Bruce-Mitford 1968:64).	2 - $1_3$00		2 - 100
C.	Translation			Two				2 - 100
D.	Translation			Two	7a-d. *Variation / Technique:* Due to their execution in filigree the animals vary in shape and size. The animal bodies are contoured with a thick inner beaded wire. • *Artistic effect / Symmetry:* The design-units are set inbetween these animals, they act as asort of 'bracket' containing all the designs which lie in the middle of the design-field (see the same phenomenon on the purse-lid; hexagons and man-between-beasts plaques).			2 - 100
E.	Fourfold Rotation			Finite				400

Analysis Tables

Chi-Rho painting

Lindisfarne Gospels

Plate 4

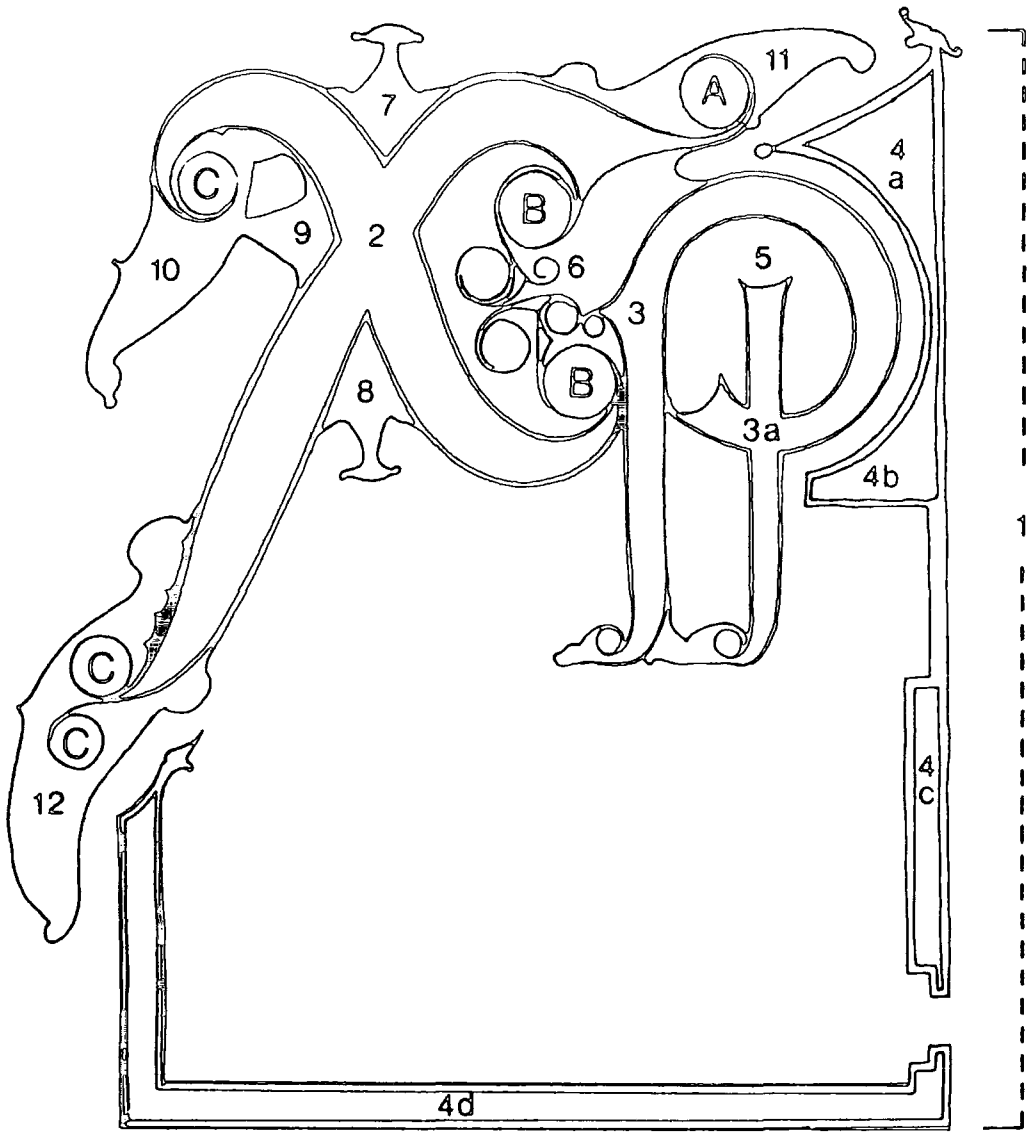
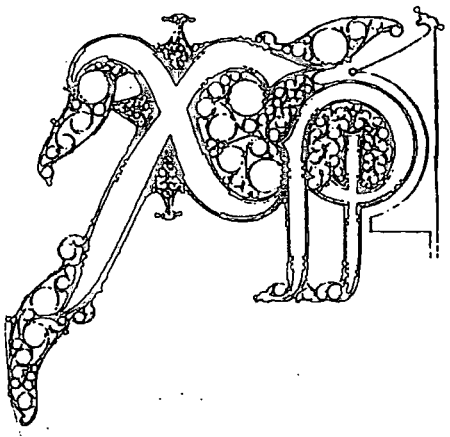
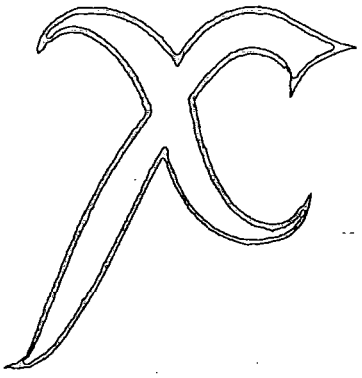
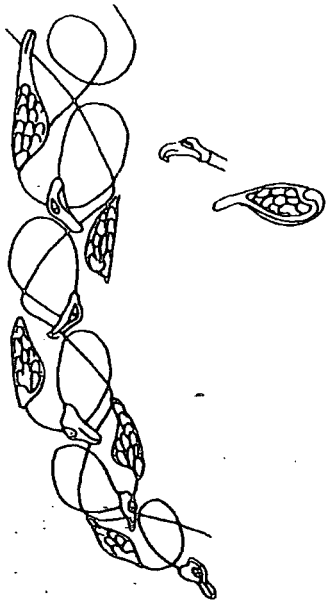


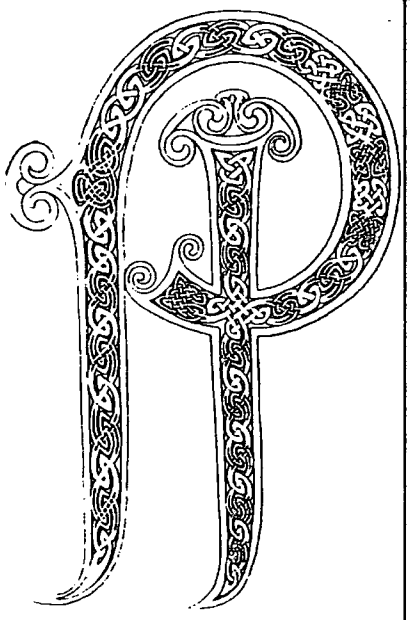
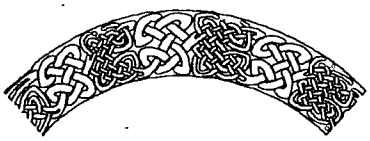
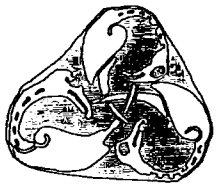
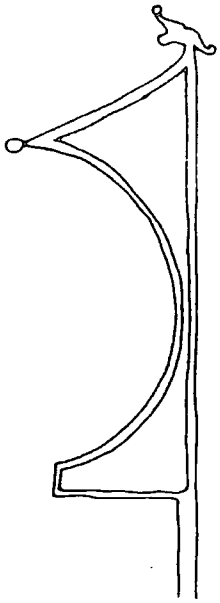
fig.41 Sketch drawing: Chi-Rho initial of the Lindisfarne Gospels with key sections for analysis

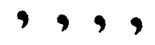
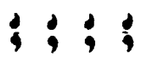
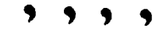
ANALYSIS - PAPER:	No. 1 Sect.nos. 1 and 2
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Lindisfarne Gospels

KEY FIG.	DESIGN STRUCTURE	DESIGN
1.		
2.		
2.		

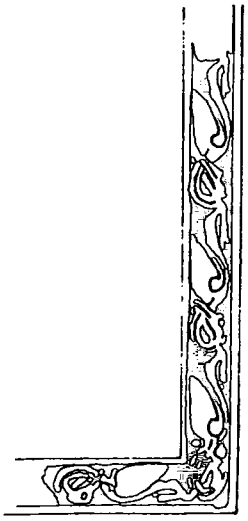
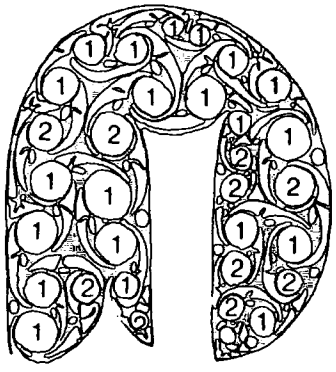
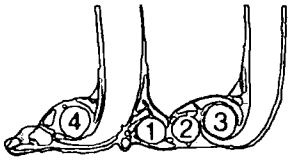
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					1 . *Symmetry analysis / Artistic effect:* The overall structure of the greek letter 'chi' (=χ) is dynamic in character and therefore on the whole asymetric. However, the cross-section of the letter can be defined by vertical as well as horizontal mirror-reflection. The open-space panels with key sect.nos. 6, 7, 8 and 9, although slightly shifted away, follow this axial arrangement of the letters' cross-section. 1 . *Symmety / Artisic effect:* The shape of the greek letter 'rho' (=ρ) is asymmetric. On the bottom of its stems the letter merges into animal heads. 2. *Variation:* The birds' bodies which constitute the fundamental parts of this design vary in size and shape, and according to the diminuition of the cross-arm panels towards their end. • *Colour counterchange:* The colours of the birds' bodies appear counterchanged in the colours pale blue and pink. • *Continuity / Interlacing:* The birds which constitute the fundamental parts of the design are interlaced with each other by means of their elongated throats, claws and tails. • *Variation / Symmetry:* Within the design-field area of the central cross-section of the letter 'chi', the former symmetry of slide-reflection apparent in all four crossarms is transformed into bifold-rotational symmetry.			
2.	Slide Reflection			One		1 - 100x^2		1 - 100x^1
2.	Twofold Rotation			Finite				200

ANALYSIS - PAPER :	No. II Sect.nos. 3, 3a and 4 (a - c)
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Lindisfarne Gospels

KEY FIG.	DESIGN STRUCTURE		DESIGN
3.			
			
		a.	
		a.	
4.			
		c.	

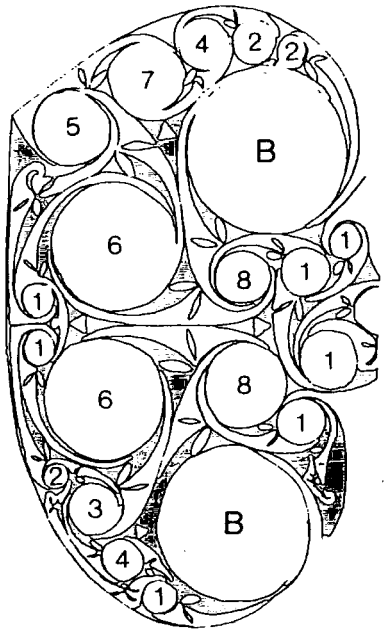
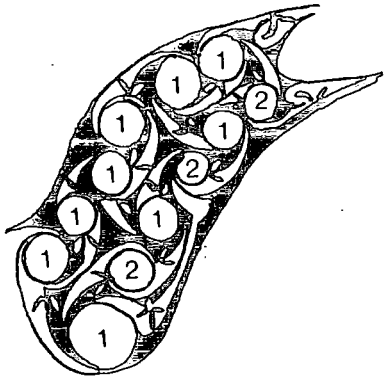
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					3. *Continuity / Interlacing:* The interlace pattern is to be considered as the continuous repetition of knots which constitute the fundamental parts of the design.			
	Translation			One	• *Variation / Symmetry:* The continuous translation of knots has been transformed into a design of knots defined by one-dimensional mirror-reflection. This is in accordance with the widening of the panel on the right hand side of the loop.	$1-1_200$		1 - 100
	Horizontal Mirror Reflection			One	• *Colour counterchange:* The individual knots are counterchanged in colour. The counterchanged colours are red and green.	$1-11^20$		1 - 110
3a.	Fourfold Rotation			Finite	3a. *Continuity / Interlacing:* As section 3 above. • *Variation / Symmetry:* Here within a cross-shaped section of the panel, the continuously translated design of knots has been transformed into a fourfold rotational design.			400
4a.	Threefold Rotation			Finite	4a. *Continuity / Interlacing:* The rotational design is to be considered as continuous, as its fundamental parts (birds) are interlaced by means of their throats and tails. • *Variation:* The shape and size of the birds' bodies vary. This is in relation to the varying space left within the design-field of the panel. • *Artistic effect:* The panel of this section of the frame merges into the head of an animal.			300
4c.	Translation			One	4b. *Symmety:* The design of interlaced animals has to be considered as asymmetrical and serves to fill an irregular space in the frame panel. 4c. *Continuity / Interlacing:* The translated design is to be considered as continuous, as its fundamental parts are interlaced by means of their throats and tails.			1 - 100

ANALYSIS - PAPER:	No. III Sect.nos. 4d and 5
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Lindisfarne Gospels

KEY FIG.	DESIGN STRUCTURE		DESIGN
4.		d.	
5.		/2	
		/4	
		/1	
		/3	

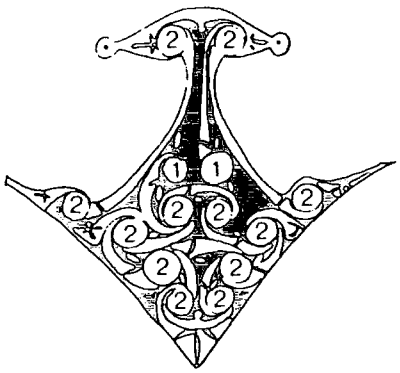
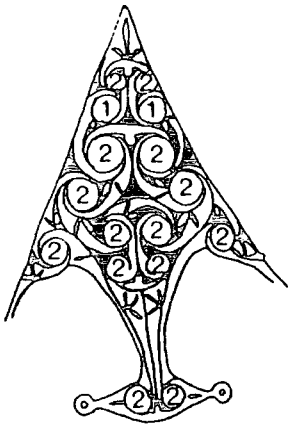
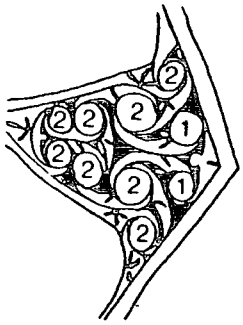
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
4d.	Translation			One	4d. *Continuity:* As in section 4c. • *Artistic effect:* As is the case with the frame section 4a, the panel of this section of the frame merges into the head of an animal. 5. *Symmetry analysis / Continuity:* The so-called 'spiral' design, analysed here, consists of small black whirls, which have been coloured in between the remaining gaps of their circular design-field. They also consist of three black and white spirals, which have been embedded in a circular design-field with a black background. The circular design-fields of these spiral patterns are interlinked by means of the so-called 'trumpet design'. Altogether the designs have thus a organic, continuous and carpet-like appearance.			1 – 100
/2	Twofold Rotation			Finite				200
/4	Twofold Rotation			Finite				200
/1	Threefold Rotation			Finite				300
/3	Threefold Rotation			Finite				300

ANALYSIS - PAPER:	No. IV Sect.no. 6
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Lindisfarne Gospels

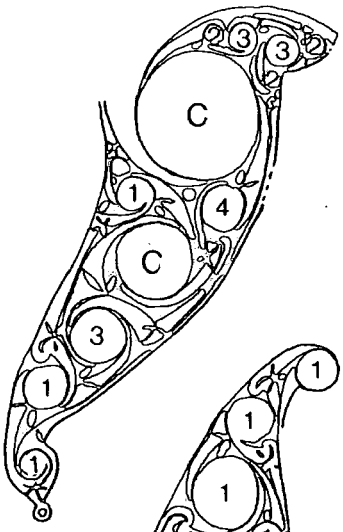
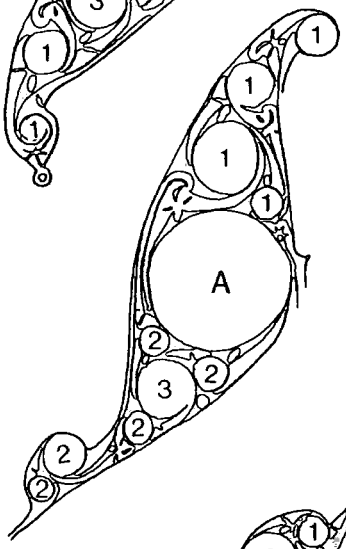
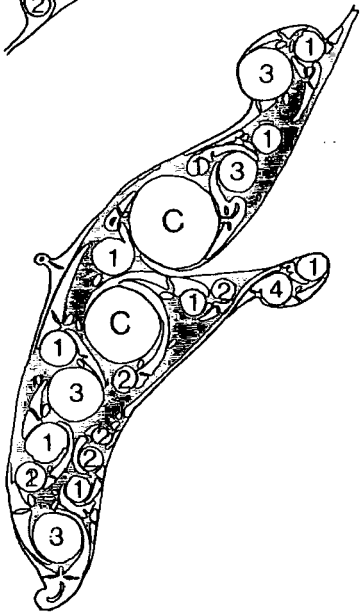
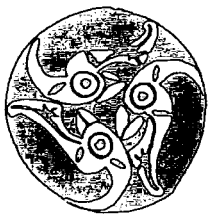
KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
6.		/1	
		/2	
		/3	
		/4	
		/5	
6.		/6	
		/7	
		/8	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					6. *Symmetry analysis / Continuity:* As described in section 5. The various themes of rotational designs here and in sections 7., 8. and 9. are analysed according to the following sections: /1. pelta design (three black whirl motifs) /2. pelta design (two black whirl motifs) /3. pelta design(three spiral motifs) /4. two round spiral motifs /5. roundels (three whirls) /6. roundels (three bird's heads) /7. roundels (two whirls) /8. roundels (degenerate bird's heads).			
/1	Threefold Rotation			Finite				300
/2	Twofold Rotation			Finite				200
/3	Threefold Rotation			Finite				300
/4	Twofold Rotation			Finite				200
/5	Threefold Rotation			Finite				300
/6	Threefold Rotation			Finite				300
/7	Twofold Rotation			Finite				200
/8	Threefold Rotation			Finite				300

ANALYSIS - PAPER :	No. V Sect.nos. 7 - 9
ARTEFACT :	Chi - Rho Initial
CONTEXT :	Lindisfarne Gospels

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
7.			
8.		/2	
		/1	
9.			

ANALYSIS - PAPER:	No. VI Sect.nos. 10 - 12 and Sect. A - C
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Lindisfarne Gospels

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
10.		C.	
		/1	
		/2	
11.		A.	
		/3	
		/4	
12.		C.	
		B.	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					10. As above.			
C.	Threefold Rotation			Finite	11. As above.			300
/1	Threefold Rotation			Finite	12. As above. A. *Symmetry analysis:* The design constitutes the abstract features of a birds' head, with each of the heads bearing a different colour.			300
/2	Twofold Rotation			Finite	B. As above. C. *Symmetry analysis:* The fundamental parts of this so-called 'pelta' design consist of organically shaped motifs which have a close resemblance with the birds' heads seen in the pelta designs of key section A.			200
A.	Threefold Rotation			Finite				300
/3	Threefold Rotation			Finite				300
/4	Twofold Rotation			Finite				200
C.	Threefold Rotation			Finite				300
B.	Threefold Rotation			Finite				300

Analysis Tables

Chi-Rho painting

Book of Kells

Plate 5

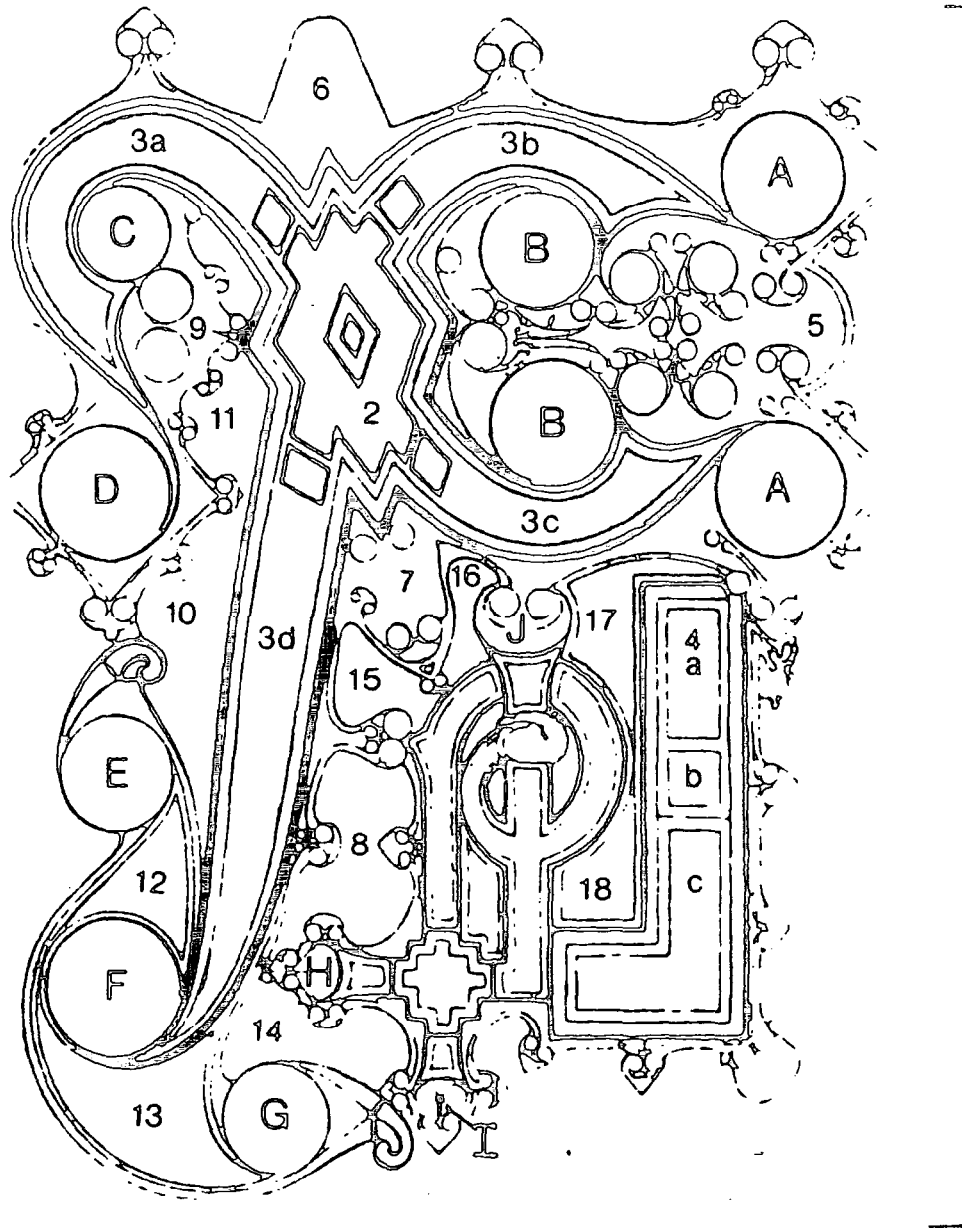
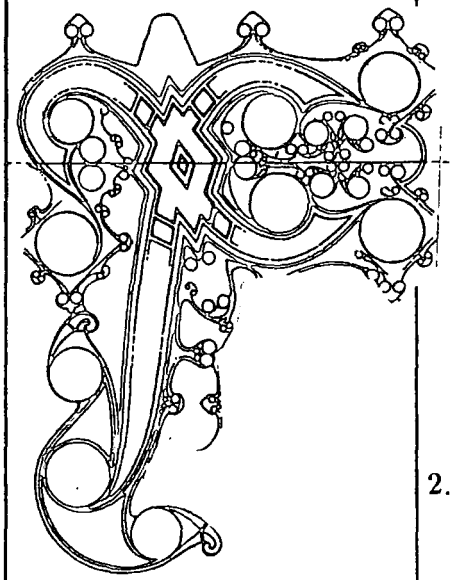
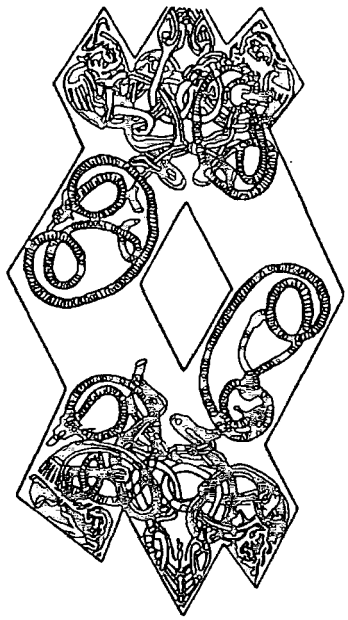
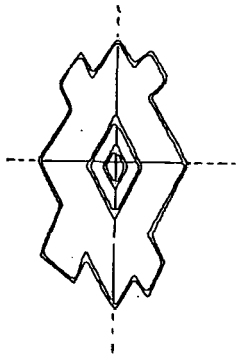
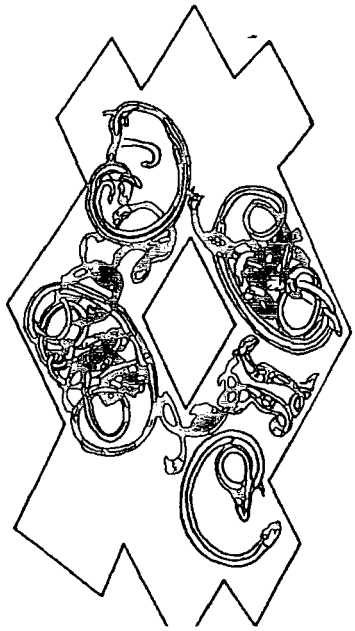


fig.43 Sketch drawing: Chi-Rho initial of the Book of Kells with key sections for analysis

ANALYSIS - PAPER :	No. 0 Sect.nos. 1a and 2
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

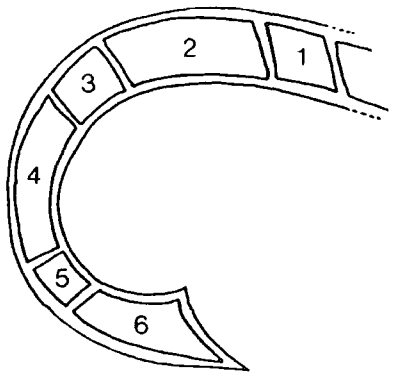
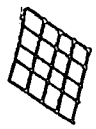
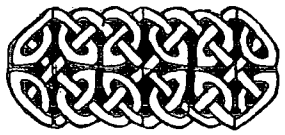
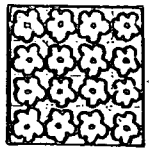
KEY FIG.	DESIGN STRUCTURE		DESIGN
1a.		2.	
2.		2.	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					1b. *Symmetry analysis:* The greek letter 'rho' = ρ is asymmetrical in shape. The only symmetrical features are a stepped rhomboid panel which interlinks both of the stems of the letter and three rectilinear terminals projecting from the stems of the Rho. The panels are analysed according to the following sections: P/1. rectilinear terminal (interlace); the scetch is drawn according to Bains 1951:49, Pl.9 P/2. rectilinear terminal (interlace; P/3. rectilinear terminal (knotwork); P/4. rhomboid panel (pattern not identified); P/5. one-dimensional panel (heartshapes and interlace); the scetch-drawing opposite is found closest to the original pattern. See Bains 1951:111, Pl.5.			
P/1	Vertical Mirror Reflection			Finite				101
P/2	Horizontal Mirror Reflection			Finite	P/5. *Symmetry / Variation:* Within the area of the cross-section where the one-dimensional panels of the loop and the stem meet the interlace forms a knot-pattern with class 400 symmetry.			110
P/3	Vertical Mirror Reflection			Finite				101
P/5	Vertical Mirror Reflection			One				1 - 101
P/5				Finite				400

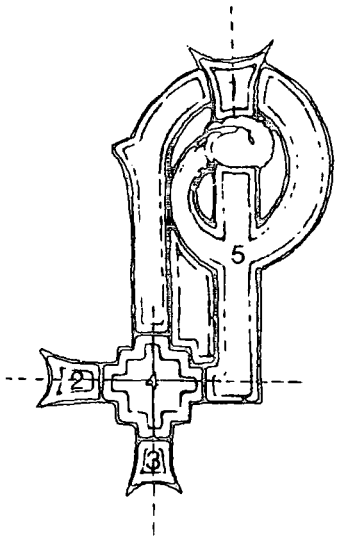
ANALYSIS - PAPER : No. II Sect.no. 3a (P.1 - P.4)

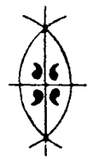
ARTEFACT: Chi - Rho Initial

CONTEXT: Book of Kells

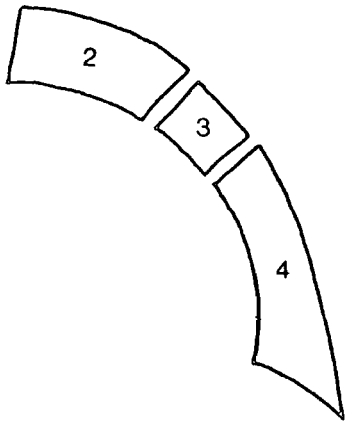
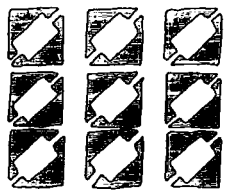
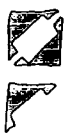
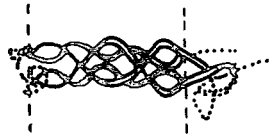
KEY FIG.	DESIGN STRUCTURE		DESIGN
3a.		/1	
		/2	
		/3	
		/4	

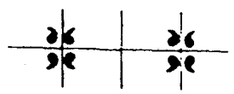
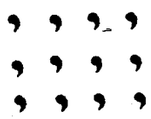
ANALYSIS - PAPER :	No. I Sect.no. 1b (P/1 - P/5)
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
1b.		/1	
		/2	
		/3	
		/5	

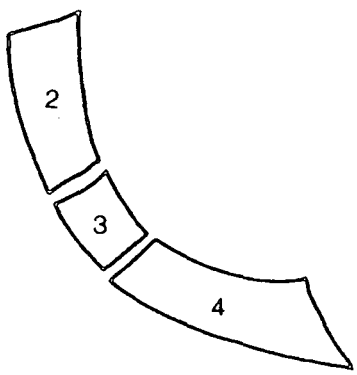
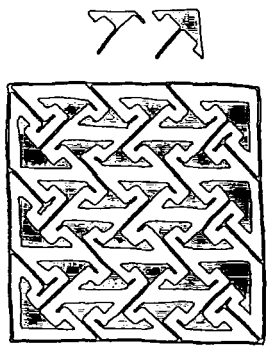
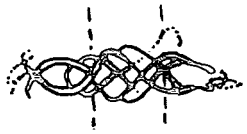
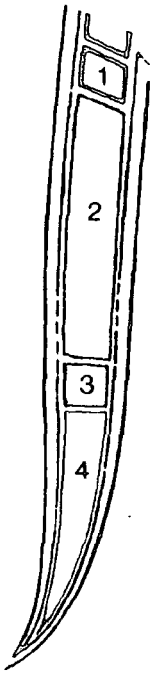
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					1a. *Symmetry analysis:* The structure of the greek letter chi (=χ) is dynamic in character. However, the upper proportions of the letter (key sect.no. 1a) are layed out symmetrically on a horizontal axis. The open-space panels marked as key sects. 5 and 9 are both aligned according to this symmetry axis.			
1a.	Horizontal Mirror Reflection			Finite	2. *Symmetry analysis:* The panel-structure of the rhombus which has been inserted into the cross-section of the letter 'chi' is symmetrical in character and mirror-reflected on the letters' horizontal axis (key sect.no. 1a). It also has vertical mirror-reflection symmetry. The open-space designs of key sect.nos. 6 and 7 appear to be aligned according to this axial arrangement. The fundamental parts analysed here consist of: a. four human figures b. four birds, and four reptiles c. strands of interlace.			110
2.	Combined Horizontal/Vertical Mirror Reflection			Finite	• *Variation:* The individual figural motifs vary in size and shape, dictated by the design field.			211
	Combined Horizontal/Vertical Mirror Reflection			Finite	• *Continuity / Interlacing:* The figural motifs and the strands of interlace, marked out here as the fundamental parts of the design, project from a dense carpet of fine interlace which fills the entire design-field of the rhombus panel and which is also interlaced with the figural motifs.			211
2.	Fourfold Rotation			Finite				400

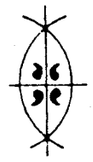
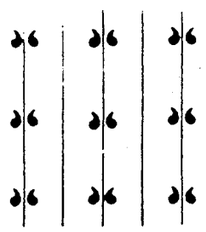
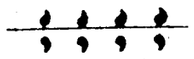
ANALYSIS - PAPER :	No. III Sect.nos. 3a (P/6) and 3b (P/1 - P/4)
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
3a.		/6	
3b.		/3	 
		/4	

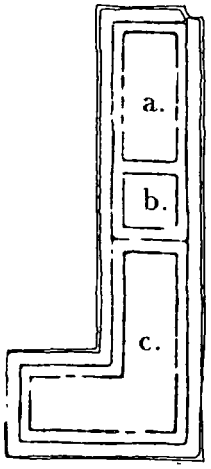
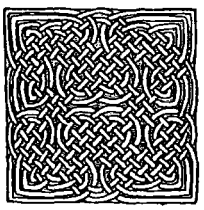
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					3a. *Symmetry analysis:* The design-field of the cross-arm structure is divided up into smaller rectilinear panels with mostly irregular shape. The panels are marked according to the following sections: P/1. square panel close to the cross-section (chequer-pattern); P/2. large rectangular panel (interlace pattern); P/3. square panel (marigold design); P/4. irregular panel (bird interlace); P/5. irregular panel (design not analysed); and P/6. irregular panel (interlace).			
P/1	Translation			Two	P/1. *Variation:* The square blank fundamental parts vary in shape, which is a result of the irregular shape of the design-field.			2 - 100
P/2	Combined Horizontal/Vertical Mirror Reflection			One	P/2. *Symmetry analysis:* This interlace design consists of four strands based on a distinctive element: the assymmetrical loop, of which the 'carved' side is extended (according to Adcock 1974, pattern C/fig.2.1.). These loops also comprise the fundamental parts of the design. • *Variation:* The interlacing appears to fill the panel completely and follows its curved outline.			1 - 211
P/3	Translation			Two	P/3. *Variation:* The fundamental parts vary in size and shape according to the irregular design-field of the panel.			2 - 100
P/4	Twofold Rotation			Finite	P/4. *Continuity / Interlacing:* The birds' bodies merged with the strands of interlace comprise the fundamental parts of this design. The interlacing fills the entire panel. • *Variation:* The birds' tails and bodies vary according to the irregular shape of the panel.			200

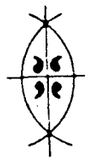
ANALYSIS - PAPER :	No. IV Sect.nos. 3c (P/1 -P/4) and 3d (P/1, P/2)
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
3c.		/3	
		/4	
3d.		/2	

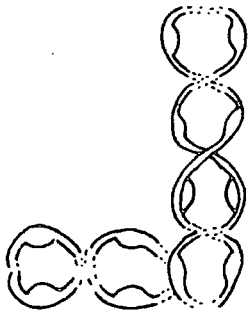
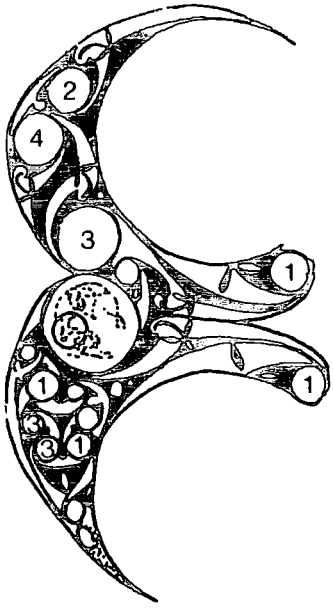
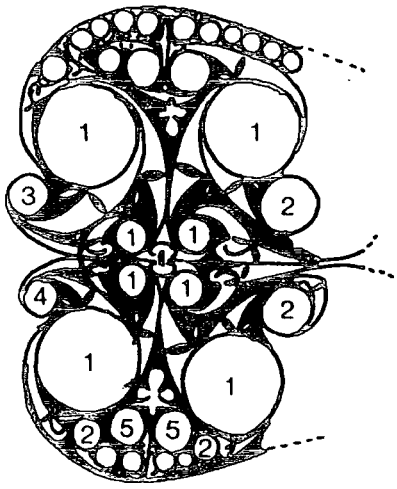
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
P/6	Combined Horizontal Vertical Mirror Reflection			Finite	P/6. *Symmetry analysis:* This interlace design comprises the features of the so-called 'stafford-knot' and can be classified according to Adcock as a 'simple pattern E' (1978,fig. 2.9). The fundamental part consists of the individual stafford-knot motif. • *Variation:* The interlace as well as the knots have been distorted in order to cover the entire design-field. • *Continuity / Interlinking:* The design appears on a background of fine interlacing which fills the entire panel and which is interlinked with the stafford knot. 3b. *Symmetry analysis:* The panels contained within this cross-arm section are analysed according to the following marked sections: P/1. as seen in key sect.no. 3a; P/2. as seen in key sect.no. 3a; P/3. square panel (key pattern); and P/4. irregular panel (animal interlace).			211
P/3	Vertical Mirror Reflection			Two	P/3. *Symmetry analysis:* The design consists of twelve pairs of mirror-reflected key-pattern motifs as fundamental parts. As far as the mirror-reflection symmetry of these fundamental parts is concerned, the the individual key-motifs have to be considered as the fundamental parts. P/4. *Symmetry analysis:* The interlace is slightly irregular in shape and becomes asymmetric on both ends. The symmetry analysis concerns only the middle section marked out by the dotted lines.			2 - 101
P/4	Horizontal Mirror Reflection			One				1 - 110

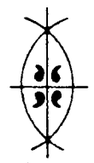
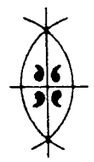
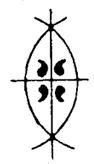
ANALYSIS - PAPER :	No. V Sect.nos. 3d (P/3, P/4), 4a and 4b
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
3d.		/4	
		/4	
4.		a.	
		b.	

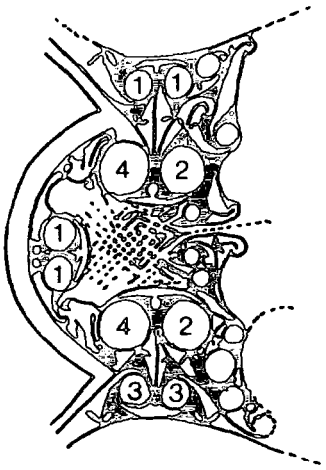
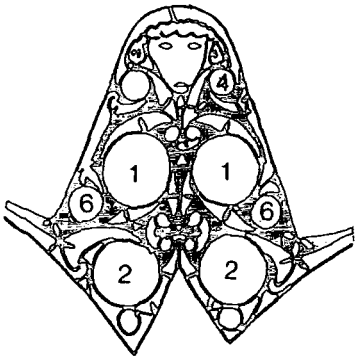
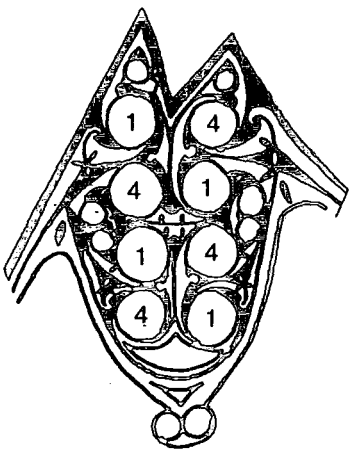
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					3c. *Symmetry analysis:* The panels contained within this cross-arm section are analysed according to the following marked sections: P/1. as seen in sect. 3a; P/2. as seen in sect. 3b; P/3. square panel (key pattern); and P/4. animal interlace.			
P/3	Twofold Rotation			Two	P/3. *Symmetry analysis:* In effect, the fundamental parts of the design consist of key motifs cut into halves. with a tail-like feature added on to them. The complete version of the key motif appears only along the two opposite margins of the panel (sketch taken from G.Bains 1951:81,'key-patterns'). • *Continuity / Interlinking:* The fundamental parts are interlinked in pairs.			2 - 200
P/4	Combined Horizontal/Vertical Mirror Reflection			Finite	• *Ambiguity / Symmetry:* The fundamental parts which appear to be interlinked are defined by the symmetry of bifold rotation, while the half-key motifs which lie directly opposite each other are defined by one-dimensional slide-reflection symmetry. P/4. *Symmetry analysis:* The panel is asymmetric in shape and only symmetric in its upper portions. The design is slightly irregular is shape. The rest of the panel is filled with strands of interlace.			211
P/2	Vertical Mirror Reflection			One	3d. *Symmetry analysis:* The panels of this elongated cross-arm are analysed according to the following marked sections: P/1. as seen in sect. 3a; P/2. large rectangular panel (loop medallions); P/3. square panel (marigold design); and P/4. irregular panel (various designs). P/2. The fundamental parts defined by one-dimensional translational symmetry consist of loop medallions. Each of these five medallions is defined by vertical mirror-reflection.			1 - 101

ANALYSIS - PAPER:	No. VI Sect.nos. 4c and 5
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
4.		c.	
5.		/1	
		/2	
5.		/3	
		/4	
		/5	

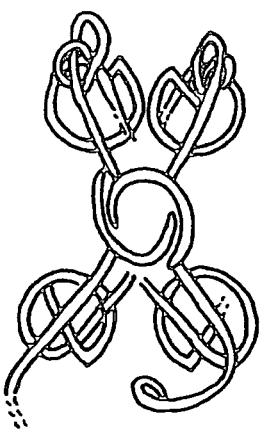
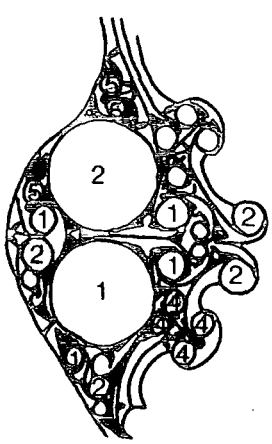
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					• *Artistic effect / Interlinking:* A complex animal interlace is interlinked with the medallion design and provides a vivid and multicoloured background which fills the entire panel.			
P/4	Vertical Mirror Reflection			Finite	4a. *Continuity / Interlacing:* Four human figures, whose limbs and hair are interlaced with each other, comprise the fundamental parts of this design. The hair appears also to be interlaced, with the fine strands of interlace filling the design-field of the panel in the background.			101
P/4	Combined Horizontal/Vertical Mirror Reflection			Finite	• *Colour counterchange:* The counterchange occurs amongst the pairs of human figures on both sides of their horizontal mirror-reflection axis.			211
					4b. *Continuity / Interlacing:* The design's only motif consists of knotwork which is build up from fine double strands of interlace (sketch drawing taken from G. Bains 1950:46, plate 3).			
4a.	Combined Horizontal/Vertical Mirror Reflection			Finite		$2^2{}_1 2_1$		211
4b.	Combined Horizontal/Vertical Mirror Reflection			Finite				211

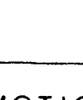
ANALYSIS - PAPER:	No. VII Sect.nos. 5, 6 and 7
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
5.		/1	
		/4	
6.		/3	
		/2	
7.		/6	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
4c.	Translation			One	4c. *Continuity / Twisting:* The main motif of this panel is built up from regularly twisted broad strands. The design-field of the angular panel is otherwise completely filled with fine strands of interlace, which are also interlinked with the main motif. • *Variation:* The motif and the interlace design change direction according to the angular layout of the panel. 5. *Symmetry analysis:* The structure of the open-space panel is irregular in shape. The fundamental parts of the design consist of the so-called 'spiral pattern' (F. Henry 1974:205). The various spirals are contained within circular design-fields. The spirals themselves are built up from: /1. three black whirl motifs, /2. two black whirl motifs, /3. three circle motifs, and /4. three club motifs /5. two club motifs.	$1 - 1_2 00$		1 - 100
/1	Threefold Rotation			Finite				300
/2	Twofold Rotation			Finite				200
/3	Threefold Rotation			Finite				300
/4	Threefold Rotation			Finite				300
/5	Twofold Rotation			Finite				200

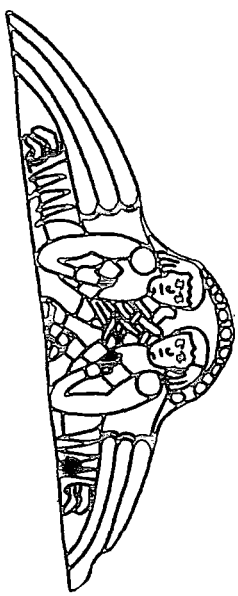
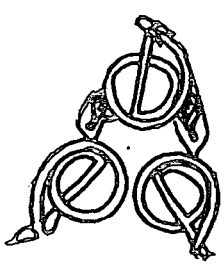
ANALYSIS - PAPER:	No. VIII Sect.nos 8 and 9
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
8.			
9.		/1	
		/2	
		/4	
		/5	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					6. *Symmetry / Variation:* This open-space panel comprises a slightly irregular but symmetrical design-field. It contains a design that is orientated along the symmetry axis of the panel. The design is analysed according to the following sections: /1. two large spiral designs (threefold rotational whirl motifs); /2. two spiral designs (twofold rotational whirl motifs); and /6. two circuar design-fields (twofold rotational circle motifs).			
/1	Threefold Rotation			Finite				300
/4	Threefold Rotation			Finite	The designs, listed in sections a, b, and c, comprise the fundamental parts of the panels' design field while the motifs, mentioned in brackets, are the fundamental parts which are contained within the design-fields of the formerly mentioned fundamental parts.			300
6.	Vertical Mirror Reflection			Finite	• *Continuity / Artistic effect:* All circular panels, contained as fundamental parts within the main design-field, are interlinked by means of 'trumpet' motifs. Artistically, this gives the impression of a complex human body, filling the entire design-field with its limbs and head.		101	
/3	Threefold Rotation			Finite				300
/2	Twofold Rotation			Finite	7. *Symmety / Variation:* This open-space panel, although slightly irregular in shape, comprises, as does the panel of key sect.no. 6, vertical mirror-reflection symmetry. The design, contained within, is orientated along this mirror-reflection axis. It is analysed symmetrically according to the following sections: a. two sets of four spiral designs (threefold whirl and club-shaped motifs); b. two pairs of circular designs (unidentifiable motifs); and c. two circle motifs within each corner of the adjacent letter 'chi' structure.			200
/6.	Twofold Rotation			Finite				200
7.	Vertical Mirror Reflection			Finite		101^2	101	

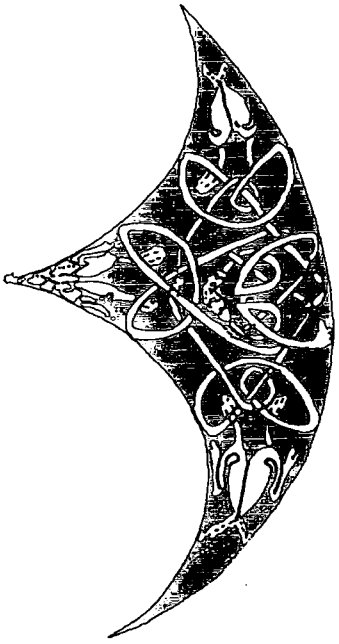
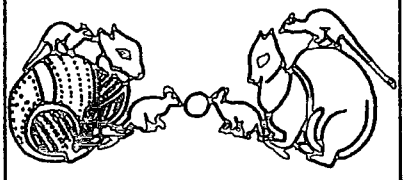
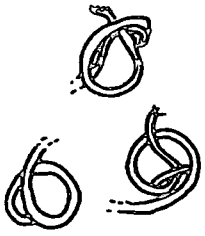
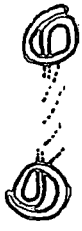
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					The designs, listed in sects. a, b and c, form the fundamental parts of the panels' structure, functioning as a design-field. The motifs, mentioned in brackets, comprise the fundamental parts which are embedded in the designs' design-field.			
8.	Fourfold Rotation			Finite	• *Continuity / Artistic effect:* The trumpet motifs, contained within the design-field of the panel, interlink all circular design panels and thus provide a carpet-like ornamentation which fills the entire open-space panel.			400
8.	Twofold Rotation			Finite	8. *Symmetry / Variation:* The design-field of the panel is irregular in shape, but shares together with the the design, contained within it, the same rotational point-axis.			200
					• *Continuity / Interlinking:* The fundamental parts of the design consist of individual knots and a bifold rotational strand motif, eans both of which are interlinked by means of two differently coloured strands of interlace whose cross-section coincides roughly with the point axis of the design.			
9.	Horizontal Mirror Reflection			Finite	9. Symmetry / Variation: The design-field is slightly irregular in its proportions. However, the horizontal axis is beeing emphasized by the interior design of this panel. The fundamental parts of the design are analysed symmetrically according to the following sections: a. One pair of large counterchanged spiral designs (threefold and twofold rotational whirl motifs) and b.four pairs of small spiral designs (threefold rotational whirl motifs).		110	
/1	Threefold Rotation			Finite				300
/2	Twofold Rotation			Finite	The fundamental parts of sect.a appear counterchanged as they house motifs with different design symmetries.			200
/4	Threefold Rotation			Finite				300
/5	Twofold Rotation			Finite				200

ANALYSIS - PAPER:	No. IX Sect.nos. 10, 11 and 12
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
10.			
11.		/1	
		/4	
12.			

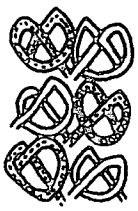
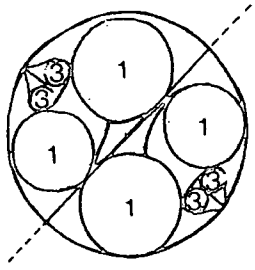
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
10.	Horizontal Mirror Reflection			Finite	10. *Symmetry / Variation:* As in key sect.no.9, the design-field of this open-space panel is slightly irregular in shape. However,its horizontal mirror-reflection axis is also emphasized by the design, contained within it. • *Continuity / Interlinking:* The main fundamental parts of the design consist of two winged human figures (angels ?), the arm of one of the figues overlying the other figures' arm. The narrow panel, surrounding the heads of the figures, emphasize the unity of the two angel figures. It contains circles as fundamental parts.			110
11.	Horizontal Mirror Reflection			Finite	11. *Symmetry / Variation:* Here the panels' shape has obviously been determined by the design of the angel-like figure which fills the whole panel. Both, panel and design, are irregular in shape but its proportions are, ideally, mirror-reflected along a horizontal axis as indicated in the sketch drawing.			110
/1	Threefold Rotation			Finite	12. *Symmetry / Variation:* The design-field of the panel is asymmetric in shape. • *Continuity / Interlinking:* The fundamental parts of the design consist of individual knots which are embedded in a carpet of fine interlacing, interlinked with the knots.			300
/4	Twofold Rotation			Finite				200
12.	Threefold Rotation			Finite				300

ANALYSIS - PAPER:	No. X Sect.nos. 13 - 16
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
13.			
14.			
15.			
16.			

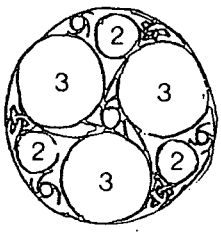
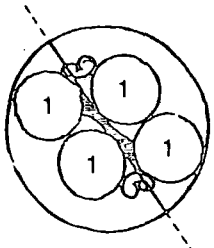
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
13.	Vertical Mirror Reflection		Finite		13. *Symmetry / Variation:* The design-field of this panel is, similar to all the open-space panels, described above, irregular in shape. However, a symmetry axis, ideally, also exists. This is apparent in most of the proportions of the panel as well as in the design. • *Continuity / Interlacing:* The fundamental parts of this design consist of the so-called 'stafford knot' which appears four times and with slight variations. . The knots are interlaced with each other. They are embedded in a carpet of fine interlacing strands, which provide the background for the design and which fill the entire panel.	101^2		101
14.	Vertical Mirror Reflection			Finite	14. *Variation:* The fundamental parts of the design consist of a compound of three animal figures. These figures vary in outline and size. The design field is irregular in shape, but reflects in its proportions the symmetry of the figures. • *Colour counterchange:* The colour counterchange occurs amongst the two groups of animal figures on each side of the vertical mirror-reflection axis.	101^2		101
15.	Threefold Rotation			Finite	15. *Symmetry analysis:* This open-space panel is asymmetric, as is also the design contained within. It consists of loops and fine interlacing, and fills the entire panel.			300
16.	Twofold Rotation			Finite	16. *Continuity / Interlinking / Twisting:* The design consists of a compound of two loops, twisted strands of interlace and a background filling of fine interlacing strands. All these are interlinked and fill the whole asymentric panel.			200

ANALYSIS - PAPER:	No. XI Sect.nos. 17, 18 and Sect. A
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
17.			
18.			
A.			
		/1	
		/2	
		/3	

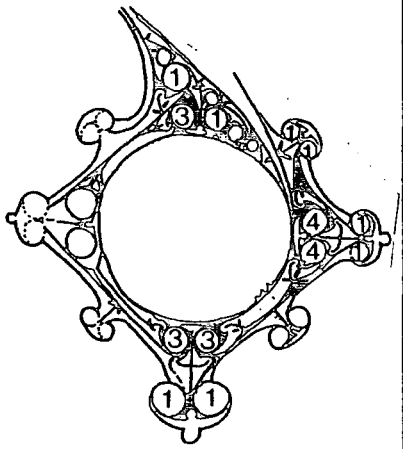
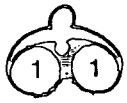
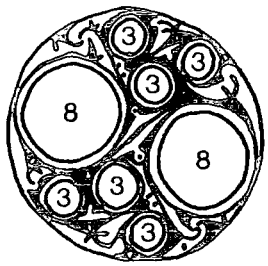
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					17. *Continuity / Interlacing / Interlinking:* The design consists of knots as fundamental parts which are interlaced with each other. The fine interlace strands are interlinked with the knots and fill the whole design-field of this asymmetric panel.			
17.	Vertical Mirror Reflection			One	• *Colour counterchange:* The counterchange occurs amongst the pairs of mirror-reflected knots along the mirror-reflection axis.	$1-101^{2}_{2}$		1 - 101
					18. *Continuity / Interlinking:* The fundamental parts of the design consist of three loops. They are embedded in a thick carpet of fine interlacing strands, which are interlinked with the design and fill the whole asymmetric open-space panel.			
18.	Threefold Rotation			Finite	A. *Symmetry analysis:* A symmetry analysis of this so-called 'pelta' design has to proceed on different levels as the main circular design-field contains smaller circular design-fields which in turn house a design. Thus the fundamental parts of the 'pelta' design are analysed according to the following sections : /1. two large 'pelta' designs (threefold rotational 'pelta' designs, interlinked by 'trumpet' motifs); /2. two small 'pelta' designs (threefold rotational whirl motifs); and /3. two pairs of spiral designs (threefold rotational whirl motifs).			300
A.	Twofold Rotation			Finite		200		
/1	Threefold Rotation			Finite	The designs listed in the sections a, b and c comprise the fundamental parts of the large 'pelta' (key sect. A.). The designs and motifs mentioned in brackets comprise the fundamental parts of the formerly listed designs. This proceedure of analysis applies to all 'pelta' designs analysed symmetrically in the following key sections B - G.			300
/2	Vertical Mirror Reflection			Finite				101
/3	Threefold Rotation			Finite	• *Continuity / Interlinking:* The fundamental parts listed in sections a and b are interlinked by 'trumpet' motifs.			300

ANALYSIS - PAPER:	No. XII Sect. B and C
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
B.		/3	
		/2	
		/7	
		/8	
C.		/1	
		/6	

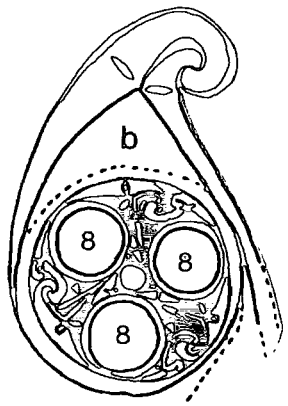
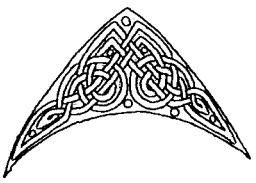
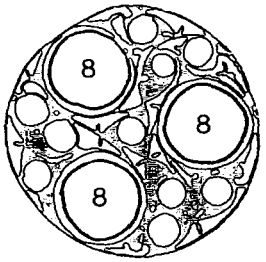
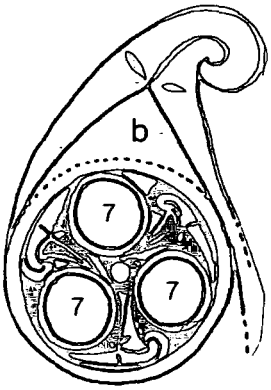
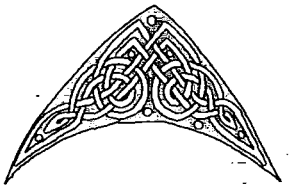
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					B. *Symmetry analysis:* The fundamental parts of this 'pelta' design are analysed llowing according to the following sections: /8. three small peltas (spiral designs, interlinked with 'trumpet' motifs); /2. three spiral designs (twofold rotational whirl motifs); and /7. three threefold rotational knot motifs.)			
B.	Threefold Rotation		Finite		C. *Symmetry analysis:* The 'pelta' design is analysed according to the following sections: /1. four 'pelta' designs (threefold rotational whirl motifs), and /6. two pairs of circular designs).		300	
/3	Threefold Rotation			Finite				300
/2	Twofold Rotation			Finite	• *Continuity / Interlinking:* The four 'pelta' designs of section a are interlinked by trumpet motifs.			200
/7	Threefold Rotation			Finite	• *Ambiguity:* The peltas and the circle designs are aligned on a linear symmetry axis. But there is no real mirror-reflection symmetry amongst all the listed fundamental parts along this axis.			300
/8	Threefold Rotation			Finite				300
C.	Twofold Rotation		Finite				200	
/1	Threefold Rotation			Finite				300
/6	Vertical Mirror Reflection			Finite				101

ANALYSIS - PAPER:	No. XIII Sect. D
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
D.		/1	
		/4	
		/3	
D.		/6	
		/8	
		/3	

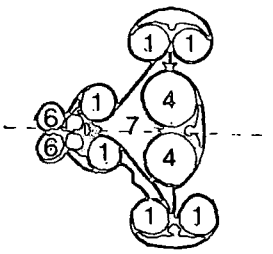
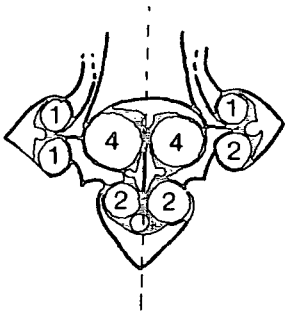
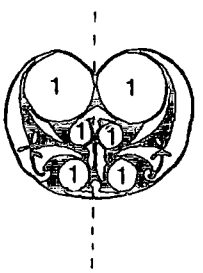
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					D. *Symmetry analysis:* Similar to the arrangement of the 'pelta' designs in key section A, the 'pelta' design is embedded in a square-shaped design-field. The latter appears only distorted on one corner, where it merges into the panel structure of the letter 'chi'. The axes which mirror-reflect the fundamental parts of the 'double spiral' and 'club' designs, and project from the three corners of the square design-field, coincide with the point axis of the 'pelta' design of section D. The ornament of the square shaped design-field surrounding the pelta-roundels of section A. are analysed accordingly.			
	Vertical Mirror Reflection			Finite				101
/1	Threefold Rotation			Finite				300
/4	Threefold Rotation			Finite	• *Symmetry analysis:* The design of this pelta is analysed according to the sections earlier defined under section 5. The remaining ornaments are defined as follows: 3. two sets of three roundels (circle motifs). 8. two roundels (threefold rotational design). • *Continuity / Interlinking:* The fundamental parts of sections /3 and /8 are interlinked by 'trumpet-motifs'.			300
/3	Threefold Rotation			Finite				300
/6	Twofold Rotation		Finite				200	
/8	Threefold Rotation			Finite				300
/3	Threefold Rotation			Finite				300

ANALYSIS - PAPER:	No. XIV Sect. E - G
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
E.		b.	
		/8	
F.		/8	
G.		b.	
		/7	

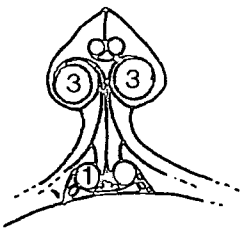
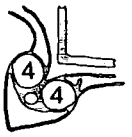
KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					E. *Symmetry analysis:* The design panel, analysed here, consists of three different design-fields. The latter and the fundamental parts of the designs are marked out acccording to the following sections: a. symmetric trumpet shaped design-field; b. vertically mirror-reflected design-field (interlace pattern); and c. 'pelta' design .			
b.	Veritcal Mirror Reflection			Finite	• *Continuity / Interlacing:* The fundamental parts of the animal interlace, contained within section b, comprise a continuous design.			101
E.	Threefold Rotation		Finite				300	
					F. *Symmetry analysis:* This 'pelta' design is analysed according to the following sections: a. three 'pelta' designs (three circle motifs) and b. three clusters of circle motifs.			
/8	Threefold Rotation			Finite				300
					• *Continuity / Interlinking:* The thee fundamental parts, marked out in section a, are joined together by 'spiral' motifs. The three clusters of circle motifs are joined together by 'trumpet' motifs.			
F.	Threefold Rotation		Finite				300	
					G. *Symmetry analysis:* Similar to key sect.E, the panel structure is divided up into three different compartments (see under that section for details). The vertical mirror-reflection axis of the middle panel (section b) coincides with the point axis of the 'pelta' design panel. This is also the case in key sect.E. The fundamental parts of the 'pelta' design have been analysed as in key sect.E.			
/8	Threefold Rotation			Finite				300
b.	Vertical Mirror Reflection			Finite				101
G.	Threefold Rotation		Fintie				300	
/7	Threefold Rotation			Finite				300

ANALYSIS - PAPER:	No. XV Sect. H - J
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
H.		d.	
		/7	
I.		/1	
		/2	
J.		/4	
		/6	
		/5	

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
H.	Horizontal Mirror Reflection		Finite		H. *Symmetry analysis:* The open-space panel, analysed here, is an elaboration of the letter 'rho' panel. Its' horizontal mirror-reflection axis coincides with this open-space panel. The design of its' design-field is analysed according to the following sections: a. three pairs of spiral design (threefold rotational whirl motif): /7. knot motif ; /6. one pair of circular designs (threefold rotational core-like motifs; and d. one pair of 'pelta' designs(threefold rotational circle motifs.		110	
d.	Vertical Mirror Reflection			Finite	• *Continuity / Interlacing:* The strands of the knot motifs merge into the background of the panel' design-field.			101
/7	Horizontal Mirror Reflection			Finite				110
I.	Vertical Mirror Reflection		Finite		I. *Symmetry analysis:* The design-field of this open-space panel conforms to the vertical mirror-reflection symmetry of the letter 'rho' panel, of which it is an elaboration. The design of the panel is analysed acording to the following two sections: a. three pairs of small spiral designs (threefold rotational whirl motifs) and b. one pair of larger spiral designs (threefold rotational whirl motifs).		101	
/1	Threefold Rotation			Finite				300
/2	Twofold Rotation			Finite	J. *Symmetry / Variation:* The design-field of this panel is, like the panels in key section H and I, an elaboration of one of the stems of the letter 'rho'. However, its vertical mirror-reflection axis is slightly shifted away from the axis of the stems' panel. The fundamental parts of the design consist of: a. a pair of spiral designs (threefold rotational whirl motifs) and b. a pair of pelta designs (threefold rotational circle motifs)			200
J.	Vertical Mirror Reflection		Finite			101		
/4	Threefold Rotation			Finite				300
/6	Twofold Rotation			Finite	• *Continuity / Interlinking:* The designs, defined in section a and b, are, as fundamental parts, interlinked with 'trumpet' motifs.			200
/5	Twofold Rotation			Finite				200

ANALYSIS - PAPER:	No. XVI Miscellaneous frame designs
ARTEFACT:	Chi - Rho Initial
CONTEXT:	Book of Kells

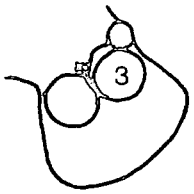
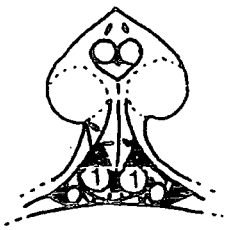
KEY	DESIGN		DESIGN
FIG.	STRUCTURE		
			
		/3	
		/1	
			
		/4	
			

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
					• *Symmetry analysis:* The ornamentation of the miscellaneous frame designs are analysed according to the sections defined under section 5.			
	Vertical Mirror Reflection		Finite				101	
/3	Threefold Rotation			Finite				300
	Horizontal Mirror Reflection		Finite				110	
/1	Threefold Rotation			Finite				300
	Vertical Mirror Reflection		Finite				101	
/4	Threefold Rotation			Finite				300
	Vertical Mirror Reflection		Finite				101	

ANALYSIS - PAPER : No. XVII Miscellaneous frame designs and ornamentation

ARTEFACT: Chi - Rho Initial

CONTEXT: Book of Kells

KEY FIG.	DESIGN STRUCTURE		DESIGN
		/3	
		/1	
			
			
			

KEY FIG.	MODE OF SYMMETRY	MOTION MODEL	DIMENSION STR.	DIMENSION DES.	COMMENTS ARTISTIC & OTHERS	COLOUR VARIATION	NOMENCLATURE STR.	NOMENCLATURE DES.
	Vertical Mirror Reflection		Finite				101	
/3				Finite				300
	Horizontal Mirror Reflection		Finite				110	
/1	Threefold Rotation			Finite				300
	Horizontal Mirror Reflection		Finite				110	
	Vertical Mirror Reflection		Finite				101	
	Vertical Mirror Reflection						101	

Chapter Five

Statistical Analysis

1. *Introduction*

According to Washburn's methodology, introduced in chapter two, a *design-unit* is defined as consisting of at least two fundamental parts, so that, for example, two commas in bifold rotation constitute a design-unit. The statistical analysis proposed in this chapter is designed to account for the number of repetitions of symmetrical movements that occur between each repetition of the fundamental parts. The total amount of repetition is listed for every mode of symmetry, i.e. for translation, reflection and rotation, and according to the three plane-pattern categories. In this way each artefact is treated individually. The results are then compared between the different groups of artefacts as well as between the two different types of artefacts.

1.1. *Procedure of analysis and its interpretation*

The interpretation of the statistical analysis proposed here is on two levels: a) according to the amount of repetition of design-units and the particular symmetry class into which they fall according to all three plane-pattern categories and b) the repertoire, i.e. the presence, or absence, of motions in a particular symmetry class. The particular sub-classes of colour counterchange are not taken into account within this investigation. The result of the statistical analysis and the procedure become clearer when the example shown in figure one on the following page is considered.

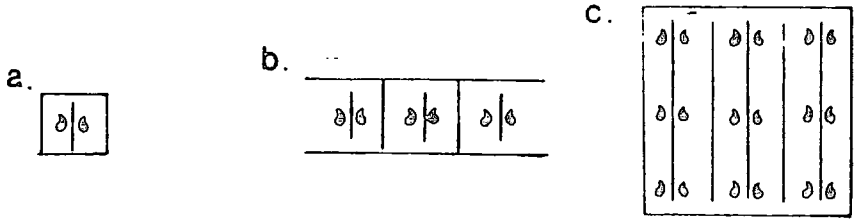


fig.1

Figure 1(a) shows a design-unit, whose two fundamental parts are repeated by *one* movement of vertical mirror-reflection. This particular symmetry movement belongs, as an individual design, to the *finite* category of plane-patterns. It can serve here as an example to show that, in statistical terms, designs from the *finite* category always account for *one case* of a particular symmetry motion.

In the case of design-units, which belong to the one-dimensional and two-dimensional plane-pattern categories, however, the particular mode of symmetry which repeats its fundamental parts, appears more than one time. Thus, in figure 1(b) the design-units which each comprise one movement of vertical mirror-reflection (class 1-101) are repeated along a linear axis. In the statistical sense we can therefore speak of *one case* of one-dimensional vertical mirror-reflection. In figure 1(c), the design-units which again each comprise one movement of vertical mirror-reflection, are repeated along two line axes. One runs horizontally, and the other, vertically. This design is an example of the two-dimensional plane-pattern category (class 2-101), and we can therefore speak of *one case* of two-dimensional vertical mirror-reflection. The fact that the design-units can also be mirror-reflected along the central vertical axis, as in figs. 1(b) and 1(c), is not relevant to the statistical analysis at this stage, as only the symmetry of the design-units is considered here, rather than that of the design-field. In the latter case, the design-field reduces the more complex symmetry of the design to its own finite, and therefore more simple, symmetrical mode. However, the latter does not exclude that there are finite or one-dimensional designs which match the symmetry of the design-field. This makes for the symmetrical homogeneity of the design and the structure of the surface or panel. This is apparent, for instance, in the decoration of one-dimensional panel-structures. These border-like panels often contain a one-dimensional translation (class 1-100) pattern which provides the most simple alternative of ornamentation for such a design-field.

In this way the bar-graphs, which show the repetitions for each symmetry class in percentage, contain the sum of the design-symmetries in all three plane-pattern categories, irrespective of the symmetries of the design-field. An exception, however, is made in cases where the design-fields themselves could be regarded as designs following a particular symmetrical mode within the design-field of the main structure.

1.2. *The statistical result in graphs*

It has to be noted that the analysis of the designs in chapter four is exemplary in that only one example of a number of designs similar with regard to their motifs and symmetry is shown and analysed from the particular context of a design-field. Naturally, all the other similar designs have been taken into account for the final result. In order to compare the results, the number of repetition of symmetry

movements has been calculated in relation to the decorated surface area of each artefact. The size of the decorated surface itself has been calculated in square centimetres. In order to simplify the reading of the bar-graphs, the calculated numbers have been multiplied by an index of 200. The absolute figures gained from the previous calculations have been calculated in percentage form. The result is presented in the tables of figures 2 and 5.

2. *Comparison and interpretation of the statistical results from the Merovingian garnet jewellery material*

2.1. *The North Sea Group*

Using the data in the table and the graphs (figs.2a and 3), certain characteristic distributions of design-symmetries in relation to the artefacts can be identified. Except for the disc-brooch from the Rhineland, and the disc-brooch from Köln-Müngersdorf, all the disc-brooches associated with the North Sea area contain fourfold rotational design-symmetries (class 400), and a combination of fourfold rotational and vertical mirror-reflection symmetries (class 411). The relative frequency of these symmetry classes within the total symmetry movements on the artefact in question varies from 12.4% to 40.1% in the case of fourfold rotational symmetries (class 400), and from 13.3% to 37.5% among the artefacts with design-symmetries of class 411. Within the context of ornamentation of the sword-pommels and the purse-handle from Köln-Müngersdorf, the design-symmetry of vertical mirror-reflection (class 101) is very dominant. This type of design-symmetry comprises from 25% to up to 100% of the decoration of these artefacts.

A third significant distribution pattern of design-symmetries can be identified among the disc-brooches. Thus, four out of six disc-brooches contain one-dimensional translational symmetries (class 1-100). The relative frequency of this type of design-symmetry ranges from 25% to 100% within the ornamental context of the brooches. This distribution pattern of dominant design-symmetries, described so far, is significant in the way it reflects the characteristic shape and symmetry of the surface area of the artefacts. Thus the rotational symmetries (classes 400 and 411) appear nearly exclusively within the ornamental context of the disc-shaped brooches. In the case of the purse-handle from Köln-Müngersdorf, the rotational design-symmetries are contained within its disc-shaped terminals (see fig.12, chapter 4). We also find that the design symmetry of one-dimensional translation (class 1-100) appears nearly exclusively within the ornamental context of the disc-brooches. Both types of symmetry, i.e. the fourfold rotational symmetry of classes 400 and 411 and one-dimensional translation (class 1-100), are well suited for the decoration of round surfaces. In the case of the triangular-shaped sword-pommels and the purse-handle, a similar relationship between structure of

design and structure of design-field applies. Thus, the design-symmetry of vertical mirror-reflection (class 101) perfectly matches the design-field symmetry of the triangular-shaped artefacts. All three types of artefact, i.e. the disc-brooches, the sword-pommels and the purse-handle, were designed in order to perform a particular function. The shape of the sword-pommel, for instance, is particularly suited to hold the blade of the sword on one end, but also to link it to the sword-handle on the opposite end. The metalworker evidently respected the symmetric triangularity of the pommel when he decorated its surface with garnets, and respected therefore indirectly also the function of the sword-pommel. The same principle of decoration could be said to apply to the disc-shaped brooches. Their function to hold two pieces of the same garment together allows, however, for a larger scope of forms and shapes for this type of artefact. It can be concluded that the most dominant of the pattern-structures found on the two main types of artefact, i.e. the brooches and the sword-pommels, seem to reflect the shape, and indirectly, the function of these artefacts. Analysing the tables and the graphs, it also appears, however, that a number of design-symmetries, which would be equally suited for the decoration of the rounded and triangular design-fields, do not appear at all within the ornamental context of the two main types of artefacts analysed. Thus, a design-symmetry such as threefold rotation (class 300), which would provide an alternative to the fourfold rotational designs for decorating the disc-brooches, does not appear at all within the design-repetoire of the brooch material associated with the North Sea area.

The exclusion of threefold-rotational design-symmetries from the pattern-repertoire of the brooches indicates that some sort of culturally or socially based selection has set in in the process of decoration in favour of the fourfold rotational design-symmetries of classes 400 and 411. The visual effect, partly created and partly stressed by the appearance of these fourfold rotational designs, is an equal-armed cross structure (on the brooches, dominated by these designs). It is possible that the Christian symbol of the Cross has been used as a model for the ornamental layout of the brooches, in order to symbolize the Christian faith of the owner. Arrhenius has established that some of the Frankish cloisonné production was probably controlled by the Church (1985:197). There is also archaeological evidence that the distribution of female jewellery during the Merovingian period may reflect missionary activity of the Catholic Church (ibid.).

The graphical display (see fig.3) shows that one-dimensional translation symmetries occur most frequently among the three most dominant design-symmetries appearing on the disc-brooches. One-dimensional designs provide the most simple and most unassuming means of decoration of surfaces of all forms and shapes. In the case of the brooches, the characteristic visual effect is a border-like pattern which emphasizes and complements the round shape of the artefacts. This type of ornamentation is more decorational in function and unassuming visually than the fourfold rotational design symmetries, which were more likely to lend extra symbolic significance to the brooches at the time. The latter hypothesis

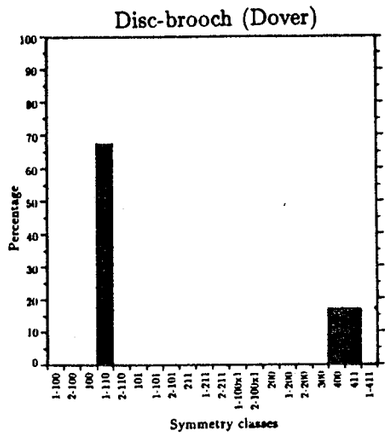
a)

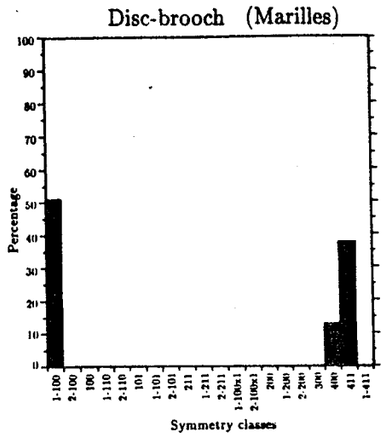
No.	Symmetry Classes	Disc-brooch (Dover)	Disc-brooch (Marilles)	Disc-brooch (St. Denis)	Disc-brooch (Faversham)	Disc-brooch (Rhineland)	Disc-brooch (Köln-M)	Purse-handel (Köln-M)	Sword-pommel (Sutton-Hoo)	Sword-pommel (Väsby)	Sword-pommel (Hög-Edsten)	Sword-pommel (Vallestarum)	
1	1-100	0	50.1	25	0	100	50	0	0	50	0	0	100
2	2-100	0	0	0	0	0	0	0	0	0	0	0	100
3	100	0	0	0	0	0	0	0	0	0	0	0	100
4	1-110	67	0	0	0	0	0	0	0	0	0	0	100
5	2-110	0	0	0	0	0	0	0	0	0	0	0	100
6	101	0	0	0	0	0	50	25	100	50	100	100	100
7	1-101	0	0	0	0	0	0	0	0	0	0	0	100
8	2-101	0	0	0	0	0	0	0	0	0	0	0	100
9	211	0	0	0	0	0	0	0	0	0	0	0	100
10	1-211	0	0	0	0	0	0	0	0	0	0	0	100
11	2-211	0	0	0	0	0	0	0	0	0	0	0	100
12	1-100x1	0	0	0	33.3	0	0	25	0	0	0	0	100
13	2-100x1	0	0	0	0	0	0	0	0	0	0	0	100
14	200	0	0	0	0	0	0	0	0	0	0	0	100
15	1-200	0	0	25	13.3	0	0	0	0	0	0	0	100
16	2-200	0	0	0	0	0	0	0	0	0	0	0	100
17	300	0	0	0	0	0	0	0	0	0	0	0	100
18	400	16.5	12.4	25	40.1	0	0	50	0	0	0	0	100
19	411	16.5	37.5	25	13.3	0	0	0	0	0	0	0	100

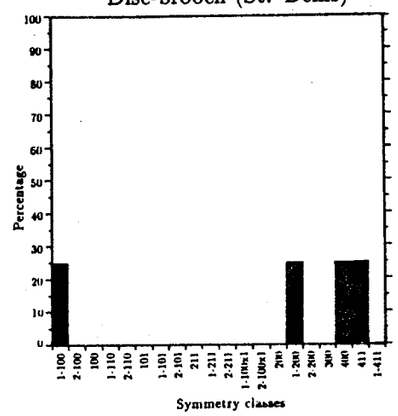
b)

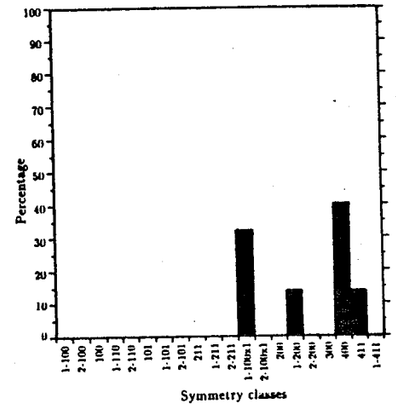
No.	Symmetry Classes	Plaque (Trier)	Disc-brooch (Schretzheim)	Disc-brooch (Soest)	Belt-buckle (Tongeren)	Sword-pommel (Skrävsta)	Sword-pommel (Valsgärde/7A)	Sword-pommel (Valsgärde/7B)	Sword-pommel (Valsgärde/5A)	Sword-pommel (Valsgärde/5B)	Sword-pommel (Vendel I/A)	Sword-pommel (Vendel I/B)	
1	1-100	50.4	0	37.5	25.5	0	0	0	0	42.8	0	0	100
2	2-100	0	0	0	0	0	0	0	0	0	0	0	100
3	100	0	0	0	12.5	0	0	0	0	0	0	0	100
4	1-110	0	0	0	0	0	0	0	0	0	0	0	100
5	2-110	0	0	0	0	0	0	0	0	0	0	0	100
6	101	0	0	0	0	33.4	100	33.3	0	0	33.3	11	100
7	1-101	0	0	0	25	0	0	0	0	0	0	0	100
8	2-101	0	0	0	0	0	0	0	0	0	0	0	100
9	211	0	0	0	25	0	0	0	0	0	0	0	100
10	1-211	25.0	0	0	0	0	0	0	0	0	0	0	100
11	2-211	0	0	0	0	0	0	0	0	0	0	0	100
12	1-100x1	12.4	0	0	12.5	33.3	0	67.7	0	14	66.7	0	100
13	2-100x1	0	0	0	0	0	0	0	0	0	0	0	100
14	200	0	0	0	0	0	0	0	0	0	0	89	100
15	1-200	0	0	37.5	0	0	0	0	67.7	28.5	0	0	100
16	2-200	0	0	0	0	0	0	0	0	0	0	0	100
17	300	0	0	25	0	0	0	0	33.3	0	0	0	100
18	400	0	100	0	0	33.3	0	0	0	14	0	0	100
19	411	6.2	0	0	0	0	0	0	0	0	0	0	100

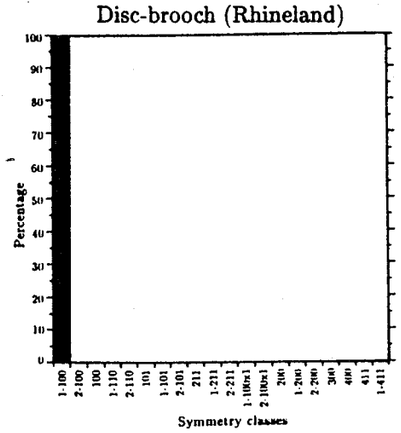
fig.2 Symmetry class data in percentages from: a) Merovingian garnet objects associated with a workshop in the North Sea area and b) Merovingian garnet objects associated with a workshop in Trier and sword-pommels from Skandinavia

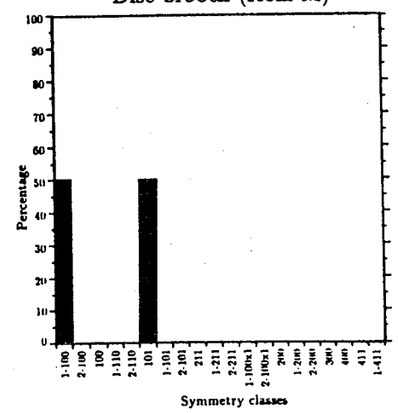


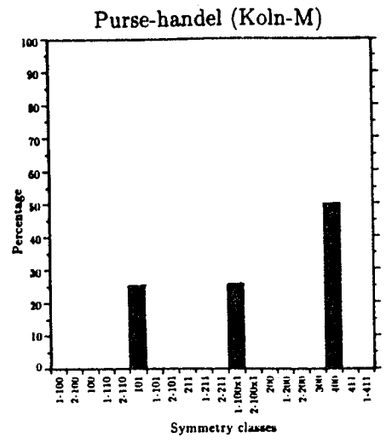


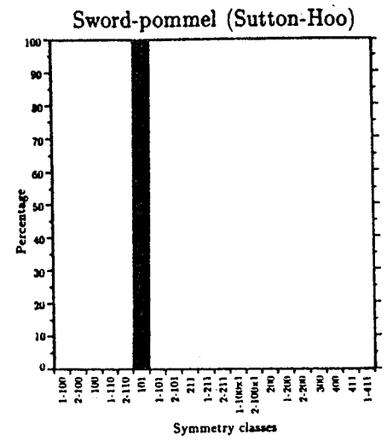


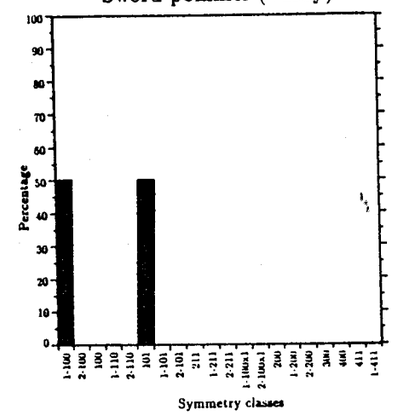


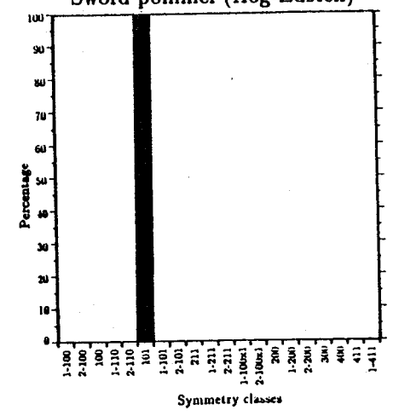












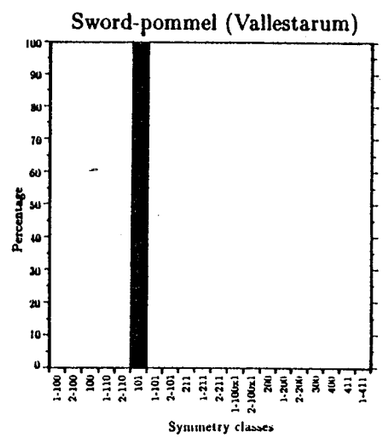


fig.3 Graphical display of the symmetry class frequencies in percentages of Merovingian garnet objects from the North Sea area

is supported by the fact that the disc-brooches from Dover, Marilles, St. Denis and Faversham are larger in size than the other two disc-brooches from the Rhineland and Köln-Müngersdorf. This would have made them more suitable for representational purposes, i.e. to convey (symbolic) messages to a particular audience. Besides the main distribution pattern of design-symmetries, analysed above, there are more individual characteristic groupings observable amongst the disc-brooches.

A relatively great homogeneity can be found between the disc-brooch of Marilles and the disc-brooch of St Denis. The latter has three out of a total of four design-symmetries in common with the three design-symmetries comprising the pattern-structure of the disc-brooch from Marilles. These are one-dimensional translation (class 1-100), fourfold rotation (class 400) and the combination of fourfold rotation and vertical mirror-reflection (class 411). The only design-symmetry which does not appear within the repetoire of Marilles is one-dimensional twofold rotation (class 1-200). In relation to all other brooches, this represents one of the closest relationships as far as the similarity of the design-symmetry repertoire is concerned. Arrhenius has proposed the hypothesis that the disc-brooches from St Denis and Marilles were, together with the sword-pommel of Sutton-Hoo and Vallestarum, produced within the same workshop (p.33). All four objects contain similar setting pastes, similar garnet shapes and similar motifs, such as the opposed boar's heads. The great similarity of the symmetry repertoire of both disc-brooches may therefore be explained by their production within the same workshop. However, while each type of the four design-symmetries within the repertoire of the brooch from St Denis is represented by a relative frequency of 25%, the relative frequency of the design-symmetries of Marilles appears to be more varied, with one-dimensional translation (class 1-100) representing about 50% of the entire pattern structure of the brooch.

A homogeneity in the repertoire of the design-symmetries can also be found between the disc-brooch of St Denis and the disc-brooch of Faversham. Again, both disc-brooches have three out of a total of four design-symmetries in common. These are: one-dimensional twofold rotation (class 1-200), fourfold rotation (class 400) and the combination of fourfold-rotation and vertical mirror-reflection. However, the fourth design-symmetry of one-dimensional slide-reflection (1-100x1), which also belongs to the pattern repertoire of the Faversham brooch, finds no correspondence amongst all the other brooches analysed from the North Sea group.

A smaller deviation in design-symmetry repertoire and frequency is represented by the disc-brooch from Dover. It contains the two typical fourfold rotational design-symmetries of classes 400 and 411, but the remaining 67% of its decoration is comprised of one-dimensional horizontal mirror-reflection symmetries (class 1-110). This high frequency finds no correspondence with any of the other brooches analysed. Visually, the effect of this type of ornamentation is very striking, and

lends extra individuality to the overall design-structure of this disc-brooch. The effect is also enhanced by the filigree wire which has been used in order to render this particular pattern-structure (see figure 1).

It has been mentioned above that there is no similarity in the design-repertoire between the two types of artefact, i.e. the disc-brooches and the sword-pommels. An exception is the disc-brooch from Köln-Müngersdorf, which also contains vertical mirror-reflection symmetry (class 101), like all of the sword-pommels believed to relate to the North Sea Group. A second exception from this general distribution-pattern is the sword-pommel from Väsby, which contains one-dimensional translation symmetry (class 1-100) in its repertoire of design-structures. Nevertheless, the sword-pommels represent a very homogeneous group; a) according to the similarity of their design-structures, and b) according to the similarity of the frequencies of these design-structures. The graph (see fig.3) shows that from the total of all design-symmetries among the sword-pommels, vertical mirror-reflection (class 101) is represented in 73.8%, while the remaining 26.4% is represented by the only other design-symmetry, which is one-dimensional translation (Class 1-100).

2.2. *Artefacts associated with an ecclesiastical and secular workshop in Trier and comparative material*

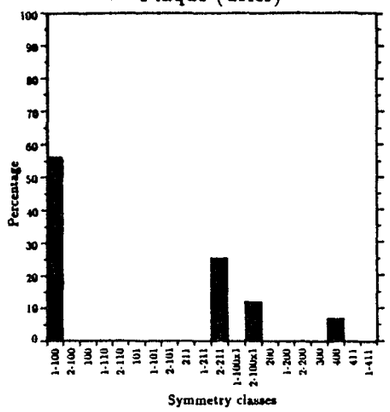
The overall distribution pattern of design-symmetries in the context of the artefacts associated with the workshop in Trier appears to be more diverse. Among the artefacts which have been directly associated with the ecclesiastical and secular workshop in Trier, that is, the three disc-brooches, the mount and the sword-pommel from Skrävsta, the design-symmetry of one-dimensional translation (class 1-100) is the most dominant. The disc-brooch from Schretzheim is the only exception from this pattern of distribution. The relative frequency of this design-symmetry varies from 25.5% to 56.4% amongst each of the individual objects. The highest frequency is found within the ornamentation of the plaque, while the lowest frequency occurs on the sword-pommel from Valsgärde.

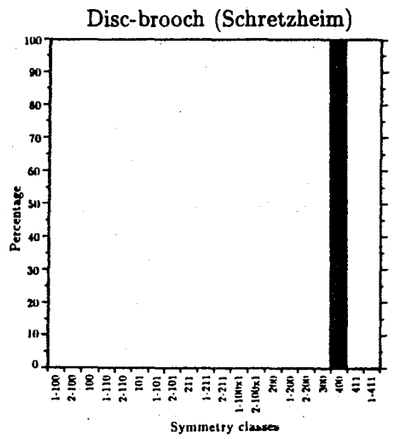
As with the objects associated with the North Sea area, this high frequency can be explained by the fact that one-dimensional translation symmetry provides the most simple decorational device. Fourfold rotation (class 400) is the second most frequent design-symmetry among the objects associated with the Trier-workshops. The objects containing this pattern-structure are the plaque, the disc-brooch from Schretzheim, and the sword-pommel from Skrävsta. The disc-brooch from Schretzheim is again exceptional, in that fourfold rotation represents 100% of its pattern-structure, while the plaque contains only 6.1%, and the sword-pommel of Skrävsta 33.3% of fourfold rotational designs. It is significant that also the sword-pommel of Skrävsta also contains fourfold rotational pattern-structures. These cannot be explained by the character and symmetry

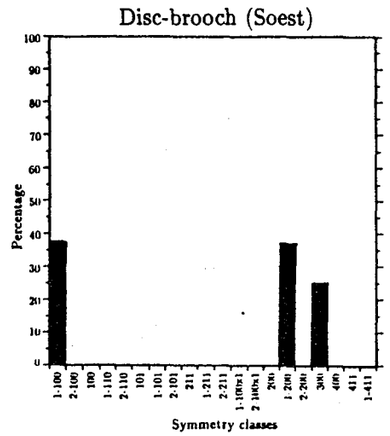
of the design-field of the sword-pommel. Arrhenius has suggested that a secular workshop, operating in close connection with an ecclesiastical workshop in Trier, was responsible for the ornamentation of the sword-pommel. Another possibility would be that this sword-pommel was directly ornamented under the supervision of the ecclesiastical workshop. As has been suggested before in the context of the disc-brooches from the North Sea area, fourfold rotational design-patterns and the cross-like visual effect they produce might have had a representational function on the sword-pommel relating to Christian faith.

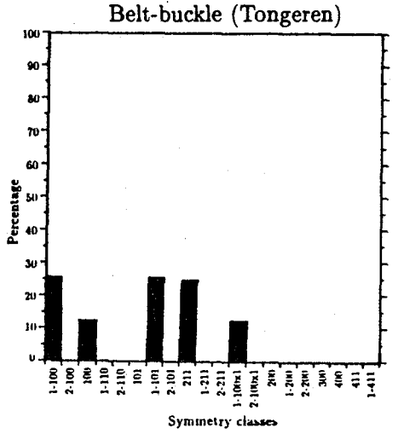
It is clear from the graphical display (see fig.4) that the three other sword-pommels of Valsgärde 5, Valsgärde 7 and Vendel I, which have been assigned to a Scandinavian workshop, are homogeneous in their repertoire of one-dimensional slide-reflection symmetries (class 1-100x1). The relative frequency of this design-symmetry varies among these objects, between 66.7% and 14%. It is significant that all of the three sword-pommels have different pattern structures on the two design-fields on the two sides of the pommel. In all cases, the design symmetry of one-dimensional slide-reflection is present on only one of the the two similar design-fields of the sword-pommels. In relation to the symmetry repertoire- and frequency of pattern-structures a close correspondence is found between the sword-pommels of Valsgärde 7 and Vendel I. One side of each pommel contains a similar repertoire and frequency of vertical mirror-reflection (class 101=33.3%) and one-dimensional slide-reflection (class 1-100x1). The data in the table (see fig.2) shows that both pommels have an similar high frequency of class 1-100x1 patterns, which is 66.7% in one case and 67.7% in the other. The frequencies of vertical mirror-reflection, which can be found on both sides of the two sword-pommels vary, however, between 11% and 100%. Altogether the similarity of the patterns and their relative frequency among the three sword-pommels is not very great. This is mainly due to the rotational patterns contained within the ornamental context of Valsgärde 5 and Vendel I. Thus the sword-pommel from Vendel I differs from the two others in that it contains a high percentage of twofold rotational designs (class 200=89%). The sword-pommel from Valsgärde 5 is different in that it contains a relatively high percentage of one-dimensional translation design (class 1-100=42%) and a high frequency of one-dimensional twofold rotation designs (class 1-200=67.7% and 28.5%). Valsgärde 7 is dissimilar from the other two sword-pommels in that it contains a fourfold rotational pattern (class 400) within its ornamental context.

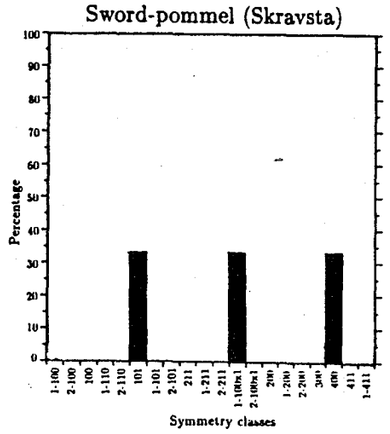
The sword-pommel of Skrävsta contains a design-symmetry repertoire which is similar in several instances to the repertoire of the other three sword-pommels. However, there is no homogeneous distribution pattern observable. An exception is vertical mirror-reflection. The instance of similarity among the sword-pommels can again, however, be explained by the general decorational function of this type of design, as it is similar to the design-field structure of the sword-pommels. A further difference between the Skrävsta pommel and the other pommels can be found in the way nearly all design-structures appearing in the ornamentation of

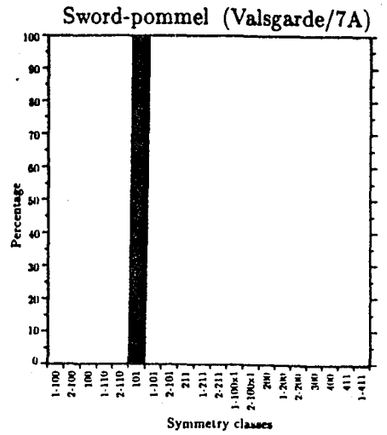


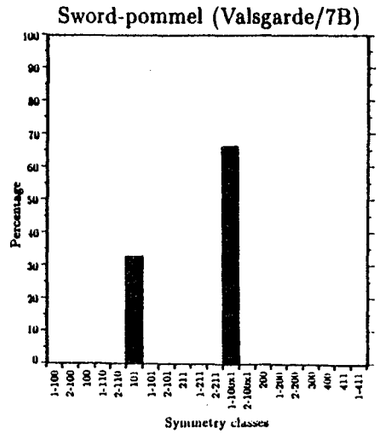


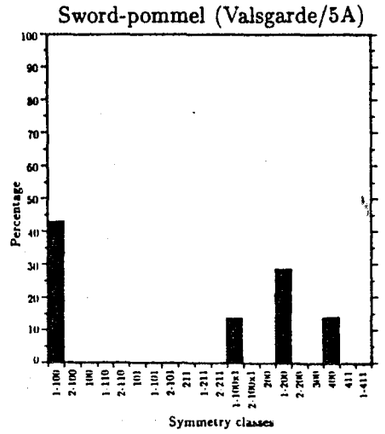


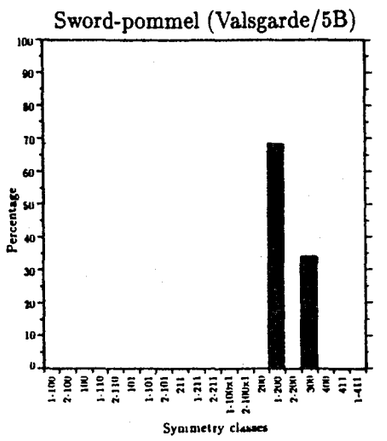


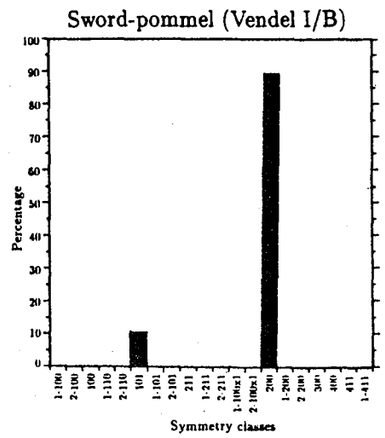












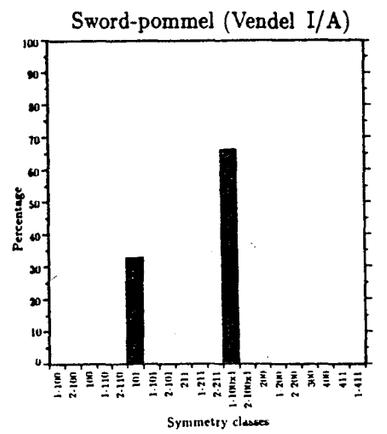


fig.4 Graphical display of the symmetry class frquencies in percentages of Merovingian garnet objects associated with a workshop in Trier and sword-pommels from Skandinavia

the former have a balanced frequency of 33.3% (33.4%). The relative frequency among the pattern structures of the other pommels varies considerably. The apparent dissimilarity in the repertoire and frequency of pattern-structures between Skrävsta and the sword-pommels from Valsgärde 5, Valsgärde 7 and Vendel I reflects the archaeological evidence that the first mentioned sword-pommel was produced later and in a different (possibly ecclesiastical) environment than that of other sword-pommels, which derive most probably from a Scandinavian workshop.

2.3. *Comparison of the material from the North Sea area and the material associated with Trier*

Comparing the distribution-pattern of design-symmetries from both groups of artefacts, certain similarities can be noted. In both groups, the most dominant design-symmetry appears to be one-dimensional translation (class 1-100). Another incidence of homogeneity between both groups is found in the relatively high frequency of vertical mirror-reflection within the ornamental context of the sword-pommels. It has been pointed out earlier that the dominance of these patterns can be related back to their decorational function on the sword-pommels, i.e. by the fact that the design-structure has been favoured due to the shape of the design-area to be decorated. The similarity of the dominance of the patterns of class 1-100 and class 101 symmetries on the objects of the North Sea group and on the objects associated with the workshop in Trier is therefore likely to have no significance in terms of the local or social background of the artefacts' production. More interesting and significant, therefore, are the dissimilarities between the two groups of artefacts, which can be discerned very clearly from the data presented in the tables and in the graphs presented.

Comparison of the brooches alone reveals a clear dissimilarity in the repertoire of both groups. Thus, while the brooches of the North Sea group display a characteristic combination of class 400 and class 411 symmetries, the brooches associated with Trier are characterised by class 400 patterns. In relation to this type of design-symmetry, another instance of dissimilarity can be picked out amongst the sword-pommels. The sword-pommels of Skävsta and Valsgärde 5 have a characteristic display of class 400 designs within their decorated surface. However, no such pattern-structure is found within the decorational context of the sword-pommels of the North Sea group.

Amongst the sword-pommels other instances of dissimilarity can be found. All the Skandinavian sword-pommels analysed in relation to the Trier workshop contain one-dimensional slide-reflection symmetries, whereas no sword-pommel of the North Sea group is characterised by this particular pattern-structure. The distribution-pattern of design-symmetries in general shows that the homogeneity

of the pattern structures found on the sword-pommels of the North Sea group is in clear contrast to the diversity of symmetrical repertoire of the same type of artefact from the other group. This difference between homogeneity on the one hand and variety on the other, is also complemented by the fact that all the sword-pommels from the North Sea group have matching ornamental pattern structures and motifs on both sides of the pommel. The other group of sword-pommels is, in contrast, characterised by a display of decorations different in their design-structure on both sides of the pommel. Harmony and balance in relation to the sword-pommels of the North Sea group is opposed by ambiguity and imbalance in relation to the other sword-pommels from Skandinavia. It is not clear whether the sword-pommel from Skrävsta had a similar decoration on both sides, as only one side was available for analysis. A similar relationship seems to emerge from the comparison of the brooches amongst both groups of material. The disc-brooches from the North Sea group reveal a clear cut pattern of similar design-symmetries. This may be explained by the fact that they were produced within a similar local and social context, as Arrhenius has suggested. The homogeneity of the latter group of brooches contrasts with the other group of disc-brooches associated with Trier, where the distribution pattern is more diverse. The reason for this diversity may, however, be the small size of the sample of brooch material analysed.

3. *Comparison and interpretation of the statistical results from the garnet jewellery of Sutton Hoo, and the Chi-Rho manuscript paintings from the Gospel-books of Lindisfarne and Kells*

3.1 *Sutton Hoo purse-lid and shoulder-clasp*

The comparison of the repertoire of design symmetries between the two Sutton Hoo artefacts shows that almost all symmetry classes which define the ornamentation of the shoulder-clasp are also present within the decoration of the purse-lid. The only exception is bifold rotational symmetry (class 200), which appears within the decorational context of the clasp only. The symmetry repertoire of the purse-lid's decoration is more complex, in that it also contains the three plane-pattern categories of vertical mirror-reflection (classes 101, 1-101, 2-101), as well as one-dimensional slide-reflection (class 1-100 x1). Among the symmetries which occur in the repertoires of both Sutton Hoo artefacts, the translational symmetries of class 1-100 and class 2-100 are clearly dominant. While designs with one-dimensional translation symmetry are the most frequent within the context of the purse (class 1-100=28.1% and class 2-100=18%), the ratio between these frequencies appears to be reversed on the clasp. Here the two-dimensional category of translation symmetry appears as the most dominant in relation to all other symmetries found on this artefact (class 2-100=37.3% and class 1-100=28%) (see figs. 5 and 6).

No.	Artefacts / Symmetry Classes	SH Purse Lid	SH Clasp	Lindisfarne	Kells
1	1-100	28.1	28.0	2.8	0.3
2	2-100	18.8	37.3	0.0	2.3
3	110	0.0	0.0	1.4	1.7
4	1-110	4.2	0.0	0.0	0.3
5	2-110	0.0	0.0	0.0	0.0
6	101	11.3	0.0	1.4	6.8
7	1-101	4.2	0.0	0.7	1.0
8	2-101	4.2	0.0	0.0	0.3
9	211	6.3	9.3	0.0	2.0
10	1-211	0.0	0.0	0.0	0.3
11	2-211	0.0	0.0	0.0	0.0
12	1-100x1	8.3	0.0	2.8	0.0
13	2-100x1	0.0	0.0	0.0	0.0
14	200	0.0	4.6	27	13.9
15	1-200	8.3	2.3	0.0	0.0
16	2-200	0.0	0.0	0.0	0.3
17	300	0.0	0.0	63.2	70.5
18	400	6.3	18.5	0.7	0.3
		100	100	100	100

fig.5 Symmetry class data in percentages from the garnet objects from Sutton Hoo and the Chi-Rho illuminated pages from the Lindisfarne Gospels and the Book of Kells

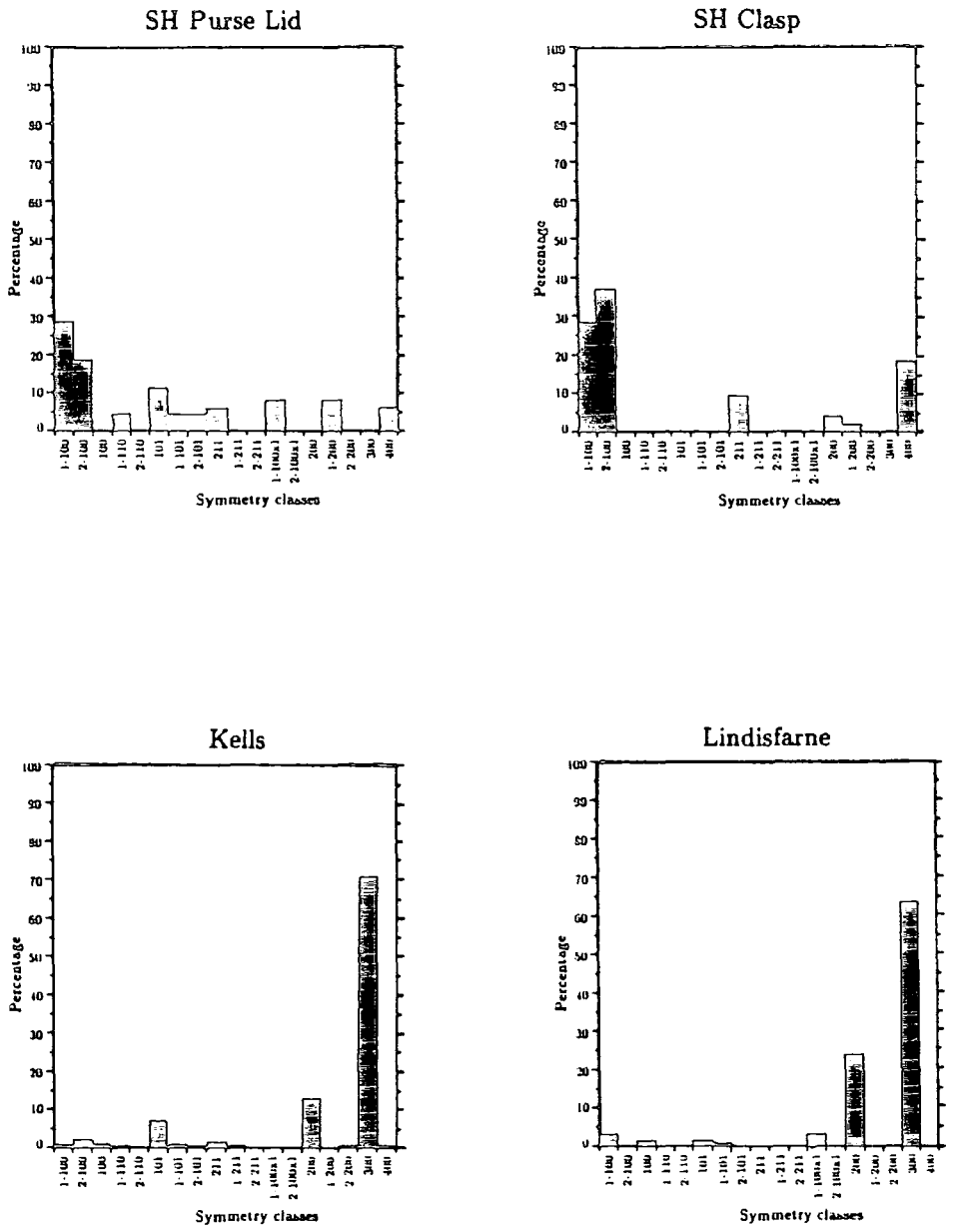


fig.6 Graphical display of symmetry class frequencies in percentages from the Sutton Hoo-purse and shoulder clasp and the two Chi-Rho illuminated pages from Lindisfarne and Kells

The relatively high frequency of one-dimensional translation symmetry (class 1-100), in the case of both Sutton Hoo artefacts, arises from the characteristic layout of motifs in the narrow bordering panels. One-dimensional translational patterns on the purse are made up exclusively of rectilinear geometric cell motifs which are used as bordering devices around the design-field of the lid's surface, and, in a much smaller proportion they also appear very frequently as borders around the various plaques. The translational (class 1-100) patterns contained within the decoration of the clasp are also extended to the abstract figural motifs of Style II animal interlace, seen as a dominant feature along the two short sides of the pair of rectangular design-fields. A one-dimensional translation pattern provides one of the most simple devices for the purpose of decorating an artefact. In the case of the purse-lid and the shoulder-clasp, it emphasizes the shape of the artefact and the figural motifs as well as the one-dimensionality of some of the major panels on the two artefacts. The relatively high frequency of two-dimensional translation symmetry (class 2-100=37%) on the shoulder-clasp is again the result of the particular function of this design-symmetry to simply decorate this artefact. It is symmetrically complementary to the characteristic square-shape of the two rectangular design-fields of the clasp. Here, not only the step-patterned cells follow this symmetrical motion, but also the inherent millefiori designs, which appear at regular intervals as a filling ornament. However, a certain amount of these millefiori fillings, although still rectilinear in appearance, contain star-like fourfold rotational patterns (class 400=18.5%). This explains the large amount of fourfold rotational symmetry in the statistical score, where it appears as the third most frequent design-symmetry. Fourfold rotational symmetries also occur on the purse, but are much less frequent, as one can see from the graphical display. They derive in fact from the arrangement of T-shaped millefiori motifs. They occupy the trapezoidal cells of the two hexagonal plaques, and also appear as a filling device in certain cells within the border frame of the purse-lid. The two-dimensional translational patterns are more than half as frequent in the decorational context of the purse than on the clasp (purse=18.8%; clasp=37.3%). That the chequer-patterned millefiori designs are more restricted in their use may not be obvious at first. They appear only in certain places in the figural plaques, and at regular intervals within cells of the main frame, and are thus used as a regular filling device within the overall ornamentation, as with the clasps. The difference is rather to be found in the condensed nature of the all-over chequer-patterned decoration on the side of the shoulder clasp, while the surface of the purse is more loosely decorated with individual plaques.

The design-symmetry of one-dimensional horizontal mirror-reflection (class 1-110) found in the context of the purse is a result of the minute cell-motifs decorating some of the larger design-fields of the two hexagonal plaques. The symmetries of vertical mirror-reflection (classes 101, 1-101 and 2-101) are the result of the ornamental details required for the decoration of the panels on the various other plaques. The latter group of design-symmetries appears nicely balanced in

its amount of repetition, each symmetry-class representing a relative frequency of 4.2%. Together with the symmetry motion of one-dimensional slide-reflection (class 1-100x1), which appears in the border panels of the hexagonal plaques, none of the last mentioned design-symmetries occurs within the context of the clasp. It is thus the plaques which provide the background for the greater complexity of design-symmetries on the purse. The individual character of the shape of the panels within the hexagonal plaques, and the bird motifs, may be referred to as the main reason for the occurence of these less frequent design-symmetries. It is again argued that these design symmetries mainly serve as decoration, as they complement the symmetry of their design-field. In the case of the bird-motifs, the occurence of the design-symmetry of two-dimensional vertical mirror-reflection (class 2-101) can be related to the attempt to render the bird's wings and feathers as naturalistic as possible. Some of the design-symmetries such as the combination of horizontal and vertical mirror-reflection (class 211), and one-dimensional bifold rotation, which are contained in the hexagonal plaques (class 1-200), also appear within the decorational scheme of the shoulder-clasp. In this context, it is also interesting to note that a perfect balance is maintained between the relative frequencies of the last-mentioned design symmetries used for the plaques. Thus, fourfold rotational designs are balanced with class 211 designs, with a relative frequency of 6.3%, while class 1-100 x1 symmetries appear as frequently as designs moved by class 1-200 symmetries, with 8.3%.

The symmetry motion of vertical mirror-reflection (class 101) comprises the third most frequent design-symmetry within the ornamental context of the purse-lid, with a relative frequency of 11.4%, yet it does not occur in the shoulder-clasp's symmetry repertoire. However, this relative frequency is comparable to that of combined vertical and horizontal mirror-reflection (class 211) in the clasp, which represents 9.3% of the whole repertoire of design-symmetries . Both modes of symmetry reflect the finite symmetrical character of the artefact's surface as a design-field. It is clear from here that the difference in frequency and design-symmetry repertoire between the two artefacts derives in this case from the different shape of the surface area of the two artefacts. All the larger design-fields on the purse and the clasp tend to follow this overall design-field symmetry with their own symmetrical layout. Thus all the plaques and studs, as individual designs, follow the main scheme of vertical mirror-reflection of the purse, while most of the designs of the clasp follow the movement of class 211 symmetry.

It can be concluded that most of the design-symmetries within the repertoire of both Sutton Hoo artefacts represent patterns which match the symmetries of the design-fields of these artefacts. This can be distinguished as the main reason for the dissimilarity in repertoire and relative frequency of pattern-structures found among both Sutton Hoo artefacts. The purse-lid and the shoulder-clasp are homogeneous in relation to their decoration with, class 1-100 and class 2-100 design-symmetries. The former type of design-symmetry has been described as a very common decorative device, which was also often found within the context

of the garnet jewellery material analysed before. However, this design-symmetry appears in such high frequencies within the context of both Sutton Hoo artefacts that it is a possible significant indicator for the stylistic relation of these two artefacts.

The two-dimensional translation patterns are represented by the millefiori glass, which fills certain cells within the cell decoration of the purse and the shoulder-clasp. There is evidence that millefiori designs were originally, and more easily, produced in a round shape, which resulted in a flower-like rotational design. This is also suggested by the latin name 'mille fiori', meaning 'a thousand flowers', which was chosen for this multi-coloured product of probably originally Roman glass-melting technique. For the decoration of the two artefacts with these chequer-patterned millefiori, the craftsman has evidently respected the rectilinear character of the cells' design-field (the boar's hips are the only exception). The most obvious reason for the choice of class 2-100 designs was therefore not to introduce distracting and discordant symmetrical elements into the decoration of both artefacts, but to match the millefiori designs to the symmetry of the design-field of the cell-panels. The high frequency of two-dimensional translation can therefore be considered significant and typical as a design-symmetry within the repertoire of both Sutton-Hoo artefacts.

3.2. *The 'Chi-Rho' pages of the Lindisfarne Gospels and the Book of Kells*

With regard to symmetry motions, the design-symmetries of Kell's Chi-Rho are more extensive than those within the decorational context of the Lindisfarne Chi-Rho. Altogether there occur six more design symmetries in Kells, namely the classes 2-110, 1-110, 2-101, 211, 1-211 and 2-200. On the other hand, only one of the Lindisfarne Chi-Rho design-symmetries, class 1-100x1, is not contained within the repertoire of Kell's Chi-Rho ornamentation. Altogether there are six out of fourteen design-symmetries present in the repertoire of both Chi-Rho illuminated pages. Among these six design-symmetries, threefold rotation (class 300) is the most dominant. Kell's decoration contains the highest amount of repetitions, with a relative frequency of 70.5%, as compared to Lindisfarne, which has a relative frequency of 63.2% (see table fig.5). This high frequency of threefold rotational symmetries coincides with a relatively high amount of twofold rotational design-symmetries (class 200) on both illuminated pages. The relative frequency of 27% within the decorational context of Lindisfarne is superseded by a relative frequency of 13.9% within the context of Kell's 'Chi-Rho' decoration. The latter frequency in Kells comprises only about half of the relative frequency found in Lindisfarne. The high amount of class 300 and class 200 symmetries reflects the characteristic decoration of the Chi-Rho pages with the so-called 'spiral' and 'pelta' designs. They are used exclusively for the decoration of the irregular open-space design-fields outside the letter-panels. They are contained in roundels of

varying size, and also within the curvilinear terminals at each end of the four cross-arms of the letter 'Chi'. The larger roundels mostly contain the threefold rotational spiral and pelta designs, while the smaller roundels contain mostly twofold rotational symmetries. In comparison to the Lindisfarne 'Chi-Rho', there is not much variation and fluctuation in the size of roundels in the context of Kell's Chi-Rho page. Rather, these threefold rotational designs are here contained within a more homogeneous construction of roundels. These roundels together comprise the fundamental elements within a symmetric design, or else one roundel is contained within another, as in the case of the pelta-terminals on each end of the four cross-arms in Kells.

It has been argued by Meyer, for instance, that the spiral-motif has been used in the Lindisfarne Gospels and the Book of Kells as a subordinate filling ornament (1960:108). Bruce-Mitford also maintains that these designs provided the most suitable filling ornament in the task of decorating the open-space between the letter-shapes. In the case of the Lindisfarne paintings, he could demonstrate that in drawing the designs of terminals within coils on roundels, Eadfrith used an elaborate and rigid compass and ruler technique, which incorporates the smallest detail. The construction of symmetrically accurate designs, down to the very small scale of the roundels, could allow for the high frequency of identical threefold and twofold rotational pelta and spiral designs. The same technical advantages may have led the artist of the Book of Kells to draw pelta and spiral designs in such a great number, and for the decoration of the open spaces between the letters. However, there is also evidence that the spirals and peltas were of important symbolic significance in the background of monastic learning. It has been suggested that the spiral-design found within the repertoire of Celtic ornamentation represented one form of the religious symbol of the 'Wheel of life' (Purse, 1974). This can not be proved, but nevertheless, there is archaeological evidence that this symbol was amalgamated and associated later within the Irish Christian tradition, with the symbol of the Cross. In sculpture, one of the finest examples is seen in the so-called 'Cross of the Scriptures' at Clonmacnoise (Co. Offaly), from the 9th/10th century A.D. The wheel-cross, which surmounts this tall stone, has for its central figure the form of a man, who may be taken to be Christ. On the wheel itself, there are four roundels terminating on all four crossarms of the central cross. One of the roundels (the lower) resembles very closely the threefold pelta-designs found as terminals on the four cross-arms of the Lindisfarne 'Chi-Rho'. Within the medium of metalwork, an earlier example of the association of spiral-design with the Cross symbolism is the gilt bronze 'pax' from St. John's Athlone (fig.7). The plaque is considered to be one of the earliest surviving representations of the crucifixion in Ireland, and ascribed to the latter 7th, or the 8th century A.D. (Ryan 1983:120). From the period of Constantine onwards the 'Chi-Rho' symbol stood in close association with the Cross, and acted as its substitute at the time Christianity was adopted as the religion of the Roman state. Within the context of the two Gospel-books, the 'Chi-Rho' can

fig.7 Gilt bronze 'pax' from St Johns Athlone, from Luce 1960, Plate IV, fig.1

also be understood as a substitute for the cross or Christ crucified (Werkmeister 1964:702). In relation to the cross symbolism of the 'Chi-Rho', and its association with pelta and spiral designs, descriptions in the Old English poems of 'Elene' and the 'Dream of the Rood', contained in the Vercelli codex, are also significant. The first sections of 'Elene' describe the process of decorating crosses as a part of Constantine's revelatory experience. The poet tells us that Constantine had seen the Cross in his dream, 'fraetum beorht...golde geglenged grimmas lixtan' ("bright in trappings...decked with gold, gems shining", McEntire 1986:346). The 'Dream of the Rood' also recalls the decorated and bejewelled Cross in the dream-version of the narrator: "I beheld, borne up on high, methought a wondrous rood, bewound with light, the brightest of beams. That beacon was all overlaid with gold; lovely stood the gems at the ends of the earth, and up on the crossing were five gems more..." (Swanton 1970:89). In this case the ends of the earth are symbolized by the four crossarms, while the five gems symbolize the five wounds of Christ. If we regard the letter 'Chi' on the illuminated pages as a substitute for the cross, the threefold rotational pelta designs terminating on each of the four crossarms of the Lindisfarne Chi-Rho and the other pink-coloured peltas in the centre of the open space created by these letters can be directly associated with the gem-symbolism alluded to in the poems. This symbolic association of the Cross with gems is also imitated in the medium of metalwork in the later medieval period. An example is the 'Cross of Cong' from the early 12th century. Here large jewels were set at intervals on the arms and shaft of the cross, as well as on the ends of the crossarms.

The occurence of vertical and horizontal mirror-reflection symmetry (classes 101 and 110), reflects the symmetrical layout of all open-space panels in the context of both illuminated Chi-Rho pages. In the Lindisfarne ornamental page the amount of class 101 and class 110 motions appears to be exactly balanced with a relative frequency of 1.4%. This balance between vertical and horizontal mirror-reflection has been abandoned in Kells in favour of the vertical mirror-reflection designs, which have a relative frequency of 6.8%. The latter are contained within the many open-space panels. They contain a variety of geometrical and figurative designs. Together with the club-shaped framing devices, they are most frequently laid out according to the vertical axes of the whole illuminated page. For the decorational context of the Chi-Rho page in Lindisfarne, the mirror-reflection symmetries are altogether less developed. In fact, there are only four open-space panels, each pair following the horizontal and vertical axes of the letter 'Chi'.

The symmetries which are unique to either Lindisfarne's or Kell's style of decoration are mostly to be found among the designs decorating the 'Chi-Rho' letter panels and the panels of the frame. The repertoire of Lindisfarne's panel decorations appears far more restricted in comparision to Kell's decorational scheme. Thus only three different modes of symmetries have been used, ie. one-dimensional mirror-reflection and one-dimensional translation (classes 1-101 and 1-100) for the letter 'Rho' and the two frames, and slide-reflection symmetry

(class 1-100 x1) for the letter 'Chi'. Both types of design symmetries fill out the available space of the panels. It is also interesting that both modes of symmetries yield the same frequencies in relation to the other patterns found within the decoration which is 2.8%. In Kells, the greater repertoire of design-symmetries can be seen as a result of the divisions of the letter's design-field into smaller panels of varying size and shape, which are fitted with the geometric and figurative motifs, devices characteristic for Kell's book illumination. The symmetries according to which these designs are laid out involve two-dimensional translation (class 2-100), two-dimensional combined horizontal and vertical mirror-reflection (class 211), one-dimensional combined horizontal and vertical mirror-reflection (class 1-211), and two-dimensional bifold rotation symmetry (class 2-200). The design symmetries contained within the frame are one-dimensional translation (class 1-100), fourfold rotation (class 400) and combined horizontal and vertical mirror-reflection (class 211). The relative frequency of all these designs, listed above, varies between 2.3% amd 0.3%. A number of these above listed symmetries appear only once, which is indicated by the relative frequency of 0.3%.

Many of the motifs and symmetrical designs used for the decoration of the illuminated pages of Insular manuscripts bear a close resemblance in their form and layout to the chronologically preceeding native metal style of the British Isles. It is therefore assumed that a lot of the Celtic metalwork, such as the escutcheons of hanging-bowls, latchets, hand-pins, penannular brooches and other ornamental trinkets, deriving from the sixth and seventh centuries, has been the source of inspiration for the monastic scribe and artist. Also the organisation of ornamentation in panels within manuscript pages clearly reflects the layout of celtic ornamental metalwork. An example from the 8th/9th century is the (pseudo-penannular) 'Tara Brooch'. This brooch consists of an elaborate ring divided on the front into numerous panels by cast mouldings. All the surfaces of the brooch, including the inner and outer edges, carry ornamentation (Ryan 1983:121). Much of the metalwork was made in the service of the Church, and there are strong literary hints that some craftsmen were clerics and that a great deal of this work may have been accomplished in monastic ateliers (Ryan 1983:40). It it therefore possible that such stylistic features as the use of different symmetrical devices and the overall decoration using panels within the medium of metalwork had a direct influence on the illumination of the letter-shapes of the manuscripts within the monastic background of production. In comparison with the ornamentation of the 'Chi-Rho' in Lindisfarne the overall decoration of the Chi-Rho letters in Kells and its various panels seems to reflect this celtic metalwork tradition much more. It has also to be considered that the letter-shapes and open spaces on the rest of the page of especially Kell's 'Chi-Rho' were divided into panels *in order* to accommodate more designs. This could be taken as evidence for the ambition of the artist of Kells to *illuminate* the whole page and the Chi-Rho letters in a more pronounced spiritual and symbolic dimension. The possible symbolic content of some of the figural motifs arranged in symmetric designs like, for instance, the

cat and mice, the four human figures etc., may support this idea. However the symbolic content of these depictions might be interpreted, there is archaeological evidence that seemingly secular motifs were combined with Christian symbols. This can be seen, for instance, in the carvings of high stone crosses in Ireland from the eighth, ninth and tenth centuries. An example again is the High Cross from Clonmacnoise, where biblical iconography is deliberately juxtaposed with secular figural carvings. The archaeological evidence of these juxtapositions on engraved stones and also jewelled caskets supports the general idea that the whole of the Celtic Church was more concerned with celebrating life than recording death. The variety of figural motifs, and the resulting variety of the symmetries used in the designs within both 'Chi-Rho' illuminated pages could be understood as a consequence of this particularly Irish/Celtic monastic spirituality and learning.

Altogether, the decoration of the Lindisfarne's 'Chi-Rho' page appears to be more restricted in its repertoire of design-symmetries. They were chosen to match the original one-dimensional design-field character of both letter-and frame panels, - note the domination of one-dimensional design-symmetries (classes 1-100, 1-100x1 and 1-110). Moreover, all design symmetries occuring in Lindisfarne's decorational scheme, except for the two-and threefold rotational symmetries, appear in very regular and even frequencies. None of this applies to the underlying concept of symmetrical layout in Kell's 'Chi-Rho' decoration. All symmetries appear to be more varied in their repertoire and frequency. Both 'Chi-Rho' illuminated pages appear most homogeneous in the way threefold and twofold rotational symmetries dominate over all other design symmetries used for the ornamentation. But in the case of Lindisfarne, deviations from the above frequency, discovered upon closer examination here, show once more the restriction of this artist's motif and design repertoire.

3.3. *Comparison of the repertoire and frequency of design-symmetries of all artefacts (Sutton Hoo, the Lindisfarne Gospels and the Book of Kells)*

The interpretation and comparison of the repertoire and frequencies of design-symmetries has revealed certain characteristics which are typical for the ornamental scheme of decoration on each artefact and illuminated page. The highest relative frequencies that could be discerned from among all four artefacts are one-dimensional translation (class 1-100), two-dimensional translation (class 2-100), twofold rotation (class 200) and threefold rotation (class 300). These four highest frequencies of design-symmetries indicate the major dissimilarity in the ornamental structure of the two groups of artefacts, namely the Sutton Hoo artefacts on the one hand, and the two Chi-Rho manuscript paintings on the other. The two Sutton Hoo artefacts are characterized by one-dimensional and two-dimensional translation patterns, manifest in the framing devices and the millefiori patterns; and the 'Chi-Rho' paintings are characterized by twofold and

threefold rotational designs, manifest in the pelta and spiral-designs contained in the open space panels. The explanations found for these high frequencies could support the hypothesis that the difference in design-symmetry repertoire reflects the difference between the secular and the ecclesiastical milieu in which the four artefacts have been produced. This evidence comes from the particular function of the designs identified within the decorational context of each group of artefacts. Because the designs and the design-fields of the Sutton Hoo artefacts are complementary in their symmetrical structure, it has been concluded that the designs have mainly been used for decorational purposes. In merely decorating the artefacts, the craftsman mainly respected also the original function of the artefacts. The high frequency of class 1-100 and class 2-100 designs remains, among the other design-symmetries found, typical for the decoration of both artefacts. In the case of the two manuscript paintings, it has been found that the two- and threefold rotational pelta- and spiral designs provide ideal filling ornament for the irregular open-space panels between the frame and the letter panels. However, it could also be shown that these rotational designs have symbolic significance relating to the monastic background of learning. The greater variety and frequency of design structures in the Book of Kells could be used as an indicator of the closer cultural affinity of its paintings to the Irish/Celtic milieu. However, this evidence has to be tested on the background of a larger sample of analysed objects, which should ideally include a sample of material from the background of Celtic metalwork production. It is also generally suggested here that the analysis of a larger sample of material from both manuscript painting and metalwork is essential in order to confirm the validity of the conclusions made above about the function of the design-symmetries in relation to their secular and ecclesiastical milieus of production. This necessity arises all the more if hypotheses about the cultural or regional background of the manufacture of these artefacts have to be proved.

Conclusion

This thesis set out to test the validity of symmetry analysis as a systematic and objective method for the classification of Early Medieaval art styles as exemplified by selected items of metalwork and manuscripts. As a preamble to the tests, the current state of archaeological and art-historical classification was considered. As the first test material, a group of Merovingian garnet jewellery was chosen. It has been classified comparatively recently by Arrhenius according to the scientific understanding of the manufacturing processes involved in producing this material, and was therefore considered as most suitable for the test evaluation. The other group of objects chosen i.e. the Sutton Hoo purse and shoulder-clasp, and the two 'Chi-Rho' manuscript paintings from the Lindisfarne Gospels and the Book of Kells respectively are more complex in their composition and have attracted already a good deal of scholarly comment. They have also been compared with each other on art-historical grounds. The method of symmetry analysis is based on the scientific understanding of human behaviour with regard to the perception of visual imagery and the structural organisation of visual images in order to communicate ideas (see pp.19-21). It was therefore hypothesized that the method can also be used empirically to classify and compare art-styles decorating different types of media and different types of design-fields. It has been concluded that this could solve the dilemma of the art-historical comparison of art-styles decorating different media, which is not founded on formal evidence but liable to be influenced by subjective historical judgement as the examples of Henderson and Dodwell, for instance, show (see p.2).

In the case of the Merovingian garnet jewellery it can be concluded that the types of pattern structures emerging reflect the characteristic shape and symmetry of the two main types of artefacts investigated, i.e. the disc-brooches and the sword-pommels. Thus rotational and one-dimensional patterns are mostly found within the ornamental context of the disc-brooches, while vertical mirror-reflection symmetries are mainly found within the ornamental context of the triangular shaped sword-pommels (see pp.63-68). However, a comparison of the symmetry repertoire and frequencies of the garnet objects analysed also generally seems to support the grouping Arrhenius suggested according to her analysis of manufacturing techniques (p.68). It is therefore evident that symmetry analysis could be employed usefully as an indicator of the locally and culturally distinct production of the garnet material. In relation to the garnet objects, allocated by Arrhenius to a workshop in the North Sea area, it is also evident that the classification according to the repertoire of design symmetries could be used to identify stylistic continuity relating to a socially specific community. Thus the

clear-cut distribution pattern of design symmetries among the brooches could show that the patterns are not only determined by the type and shape of the brooches, but that the patterns have also been selected for other purposes than decoration. In the case of the brooches, it has been suggested that the patterns were made to express the identity of individuals of a Christian community who were possibly also engaged in missionary activities. It has been acknowledged, in relation to the grouping of the garnet objects according to different regions and workshops, that more material has to be analysed to confirm the classification results arrived at by the method of symmetry analysis. The symmetry analysis of the two Sutton Hoo artefacts confirmed their close relationship in design symmetry structure and frequency, and could therefore confirm also their provenance from the same workshop or individual craftsman. While differences in the distribution of design-symmetries occured, they could be related back to the individual shapes and symmetries of the artefacts' design-fields (see p.72). The analysis of the two 'Chi-Rho' illuminated paintings appear to show that the symmetry repertoire of the decorated page from the Book of Kells is more extensive as compared to Lindisfarne's 'Chi-Rho' page. In contrast, the decoration of the Lindisfarne Chi-Rho page has been found to be more restricted and balanced in its repertoire and frequency of pattern structures (pp.73-76). It can be concluded that these differences in the decorative scheme of both manuscript paintings are significant for the identification of different monastic backgrounds of production. In the case of Kells' illuminated page it has been suggested that a pronounced Irish/Celtic milieu of monastic spirituality and learning may have been the reason for its more extensive pattern structures in contrast to Lindisfarnes' 'Chi-Rho' painting, which could well represent an Anglo-Saxon aesthetic. Alternatively, it may be, since the Book of Kells is of later date, that it has augmented the symmetry repertoire through time. It is further suggested that the result of the symmetry analysis derived from the two manuscript paintings could also be important in further research for the identification of different 'hands'. The great homogeneity in the appearence of three-and twofold rotational pattern structures has been related to the use of pelta and spiral designs as an ideal decorational filling ornament. However, these designs could also be related to the fact that both manuscript paintings were produced within an ecclesiastical milieu in which they had significant symbolical value. It is considered that more material has to be analysed and compared in order to confirm the measurement of stylistic variation which distinguishes the ecclesiastical and the secular milieu of production. A preliminary conclusion in this respect could be that the pattern repertoire occuring in artefacts from the secular milieu, such as the Sutton Hoo artefacts (and also the Merovingian garnet jewellery), are mainly defined by the shape and symmetrical character of the artefacts, while pattern structures from ecclesiastical artefacts do not necessarily reflect the design-field structure of the artefact, but are mainly characterised by the symbolic value of religious motifs and designs. One must, however, also keep in mind that painting is a freer medium than the technically more demanding medium of garnet jewellery.

It is regretted that within the constraints of an M.A. thesis it was not possible to support the conclusions with a fuller archaeological evaluation of the results. Nevertheless it is clear that some useful conclusions have already emerged despite this very limited amount of research material. The test analyses therefore, demonstrate the high potential of symmetry analysis as a method of stylistic classification.

Bibliography

Adcock, G., 1974, 'A study of the types of interlace on Northumbrian stone sculpture', (Unpubl.M.Phil.thesis, University of Durham)

Adcock, G., 1978, 'The theory of interlace types in Anglian sculpture', in J. Lang, ed., *Anglo-Saxon and Viking Age Sculpture*, B.A.R. V, 33-35

Alexander., J.J.R., 1973, *Illuminated Manuscripts in the Bodleian Library 3. British, Irish and Icelandic Schools.* Oxford

Alexander, J.J.R., 1978, *The Decorated Letter.* (Thames and Hudson)

Alexander, J.J.R., 1978, 'Scribes and artists', in M.B. Parkes, ed., *Medieval Scribes*,87-109.

Almgren B., 1955, *Bronsnycklar og Dyreornamentik.* Uppsala

Alton, E.H., 1951, *The Book of Kells*, Vol.III. New York

Arrhenius, B., 1973, 'East Scandinavian Style I - a review', *Medieval Arch. xvii*, 26-42

Arrhenius, B., 1975, 'Die technischen Vorraussetzungen für die Entwicklung der germanischen Tierornamentik', in *Frühmittelalterliche Studien ix*, 93-109

Arrhenius, B., 1985, *Merovingian Garnet Jewellery - emergence and social implications.* Stockholm

Backhouse, J., 1981, *The Lindisfarne Gospels.* Oxford

Bain, G., 1951, *Methods of Construction of Celtic Art.* Glasgow

Bakka, E., 1968, 'Methodological Problems in the Study of Gold Brakteates', in *Norwegian Archaeological Review 1*, 5-35.

Barley, N., 1974, 'Anthropological Aspects of Anglo-Saxon Symbolism', (Unpubl.D.Phil.Thesis, Oxon.)

Beckwith, J., 1961, *The Art of Constantinople - An introduction to Byzantine Art.* London

Biebuyck, D., 1969, 'Introduction', in D. Biebuyck, ed., *Tradition and Creativity in Tribal Art.* Berkeley and Los Angeles

Bieler, L., 1976, 'Ireland's contribution to the culture of Northumbria', in G. Bonner, ed., *Famulus Christi.* London

Bimson, M. and Oddy, W.A., 1983, 'Aspects of the Technology of Glass and of Copper Alloys', in Bruce-Mitford, *The Sutton Hoo Ship-Burial,* Vol 3, A.C. Evans, ed., 924-959. British Museum Publications. London

Boas, F., 1955, *Primitive Art.* New York

Brown, P., 1985, *The Book of Kells.* Dublin

Brown, T.J., 1971, *Northumbria and the Book of Kells.* Jarrow Lecture

Brown, T.J., 1972, 'Northumbria and the Book of Kells', in *Anglo-Saxon England I,* P. Clemoes, ed., 219-246

Bruce-Mitford, R.L.S., 1950, 'The Sutton Hoo Ship-burial: recent theories and some comments on general interpretation', in *Proceedings of the Suffolk Institute of Archaeology, vol. XXV*

Bruce-Mitford, R.L.S., 1960, 'Decoration and Minitiatures', in T.D. Kendrick et al., *Evangeliorum Quattuor Codex Lindisfarnensis II, part IV.* Olten and Lausanne

Bruce-Mitford, R.L.S., 1968, *The Sutton Hoo Ship-Burial, A Handbook.* London

Bruce-Mitford, R.L.S. 1971, in R. Girvan, *Beowulf and the seventh century.* Methuen

Bruce-Mitford, R.L.S., 1974, *Aspects of Anglo-Saxon Archaeology.* London

Bruce-Mitford, R.L.S., 1978, *The Sutton Hoo Ship-Burial, Vol.2, Arms, Armour and Regalia,* (British Museum Publ. Ltd.). London

Bruce-Mitford, R.L.S. et al., 1983, *The Sutton Hoo Ship-Burial, Vol.3, Late Roman and Byzantine Silver, Hanging-Bowls Drinking Vessels, Cauldrons and other Containers, Textiles, The Lyre, Pottery Bottle and other Items.* London

Chadwick, H.M., 1940, 'Who was he?', in *Antiquity, vol.XIV,* 76-87

Chadwick-Hawkes, S., 1961, 'The Jutish Style A: a study in Germanic animal art in southern England in the fifth century A.D.', in *Archaeologica,* xcviii, 29-74.

Charbonnier, G., 1969, *Conversations with Claude Levi-Strauss.* London

Cherry, C., 1971, *On Human Communications, Signification and Significance - A study of the relations of signs and values.* Massachsetts

Clarke, D.L., 1978, *Analytical Archaeology,* (Second Edition). London

Clarke, K.M., 1956, 'A study of Art-History', in *Universities Quarterly*, Vol.x., No.3.

Conkey, M., 1980, 'The Identification of prehistoric hunter-gatherer aggregation sites', in *Current Anthropology* 21, 609-620.

Cramp, R., 1984, *Corpus of Anglo-Saxon Stone Sculpture in England. General Introduction.* Oxford University Press

Crawford, H.S., 1980, *Irish carved ornament.* Dublin and Cork

Davis, P., 1987, *God and the New Physics.* Pelican Books

Dickins, B. and Ross, A.S.C., 1963, *The Dream of the Rood.* London

Dodwell, C.R., 1982, *Anglo-Saxon Art - A new perspective.* (Manchester Univ. Press)

Dölger, F.J., 1957-8, 'Beiträge zur Geschichte des Kreuzzeichens', *Jahrbuch für Antike und Christentum, 1-10*

Elbern, V.H., 1955, 'Die Dreifaltigkeitsminiatur im Book of Durrow', *Wallraf-Richards Jahrbuch 17*, 7-42. Köln

Elbern, V.H., 1964, 'Die Bedeutung der Chi-Initialseite im Book of Kells',in V.H. Elbern, ed., *Das erste Jahrtausend*, 687-710. Köln

Elbern, V.H., 1971, 'Zierseiten in Handschriften des frühen Mittelalters als Zeichen sakraler Abgrenzung', in *Miscellana Medievalia 8*, 340-356

Era-Eskö, A., 1965, *Germanic Animal Art of Salin's Style I in Finnland.* Helsinki

Finlay, I., 1973, *Celtic Art.*London

France-Lanord A. and Fleury M., 1962, 'Das Grab der Arnegundis in St. Denis', *Germania 40*, 2. Halbband. Frankfurt

Franklin, N.R., 1986, 'Stochastic vs Emblemic: an archaeologically useful method for the analysis of style in Australian Rock Art',in *Rock Art Research; vol.3, no.2*

Fuglesang, S., 1978, 'Stylistic Groups in Late Viking Art',in J. Lang, ed., *Anglo-Saxon and Viking Age Sculpture*, in *BAR V*, 205-216

Fuglesang, S., 1978, 'The Ringerike Style', in *Medieval Scandinavia*,103-5. Odense

Gilson, E., 1961, *The Christian Philosophy of Saint Augustine.* London

Gombrich, E.H., 1979, *The Sense of Order: A study of the psychology of decorative art.* Oxford

Gombrich, E.H., 1979, *Art and Illusion: a study in the psychology of pictorial representation.* Oxford

Gough, M., 1973, *The Origins of Christian Art.* London

Grabar, A., 1969, *Christian Iconography, a study of its Origins.* London and Henley

Hackman, A., 1906, 'Ylistaro-spännet pa Historiska museet i Stockholm', in *Snomnen Museo.* Helsinki

Harden, D.B., 1965, *Dark Age Britain.* London

Haseloff, G., 1974, 'Salin's Style I', in *Medieval Archaeology 18*, 1-15

Haseloff, G., 1981, *Die Germanische Tierornamentik der Völkerwanderungszeit. Studien zu Salins Stil I.* Berlin/New York

Hawkes, S., 1961, 'The Jutish Style A. A study of Germanic animal art in southern England in the fifth century AD', in *Archaeologia*, 98, 29-74.

Henderson, G., 1972, *Style and Civilisation, Early Medieval.* (Penguin)

Henderson, G., 1987, *From Durrow to Kells. The Insular Gospel-books 650-800.* London

Henry, F., 1933, *La Sculpture Irlandaise....* Paris

Henry, F., 1940, *Irish Art in the Early Christian Period.* London

Henry, F., 1965, 'Irish Enamels of the Dark Ages and their relation to the cloisonné techniques', in D.B. Harden, ed., *Dark Age Britain*, 71-88. London

Henry, F., 1974, *The Book of Kells.* London

Hole, F., 1984, 'Analysis of structure and design in prehistoric ceramics', in *World Archaeology 15 No.3*, 326-347.

Holmquist, W., 1939, *Kunstprobleme der Merowingerzeit.* Stockholm

Hughes, K., 1966, *The Church in Early Irish Society.* London

Hunter-Blair, P., 1977, *An Introduction to Anglo-Saxon England.* (Second Edition). Cambridge University Press

Jacobsthal, H., 1944, *Early Celtic Art.* Oxford

Jantzen, H., 1940, *Das Wort im Bild in der frümittelalterlichen Buchmalerei*, Historisches Jahrbuch 60, 507-513.

Jessup, R., 1950, *Anglo-Saxon Jewellery.* London

Jung, C.G., 1964, *Man and his Symbols.* Aldus/Jupiter Books. London

Kendrick, T.D., 1938, *Anglo-Saxon art to AD 900.* London

Kitzinger, E., 1977, *Byzantine Art in the making.* London

Langer, S., 1953, *Feeling and Form.* London

Layton, R.G., 1977, 'Naturalism and cultural relativity in Art', in P.J. Ucko, ed., *Form in Indigeneous Art,* 33-43. Canberra

Layton, R.G., 1981, *The Anthropology of Art.* St. Albans

Leach, E.R., 1961, *Rethinking Anthropology.* New York

Leach, E.R., 1976, *Culture and Communication, The Logic by which symbols are connected,* (Cambridge University Press). London/Cambridge

Leeds, E.T., 1936, *Early Anglo-Saxon Art and Archaeology.* Oxford

Leigh, D., 1984, 'Ambiguity in Anglo Saxon Style I Art', in *Antiquaries Journal 64,* 34-42

Levison, W., 1966, *England and the Continent in the eighth century.* Oxford

Levi-Strauss, C., 1963, *Structural Anthropology.* Basic Books

Lewis-Williams, D., 1981, *Believing and Seeing. Symbolic meanings in Southern San rock paintings.* Academic Press

Luce, A., 1960, *The Book of Kells.* Dublin

Macgillavry, C.H., 1965, *Symmetry Aspects of M.C. Escher's Periodic Drawings.* Utrecht

Malmer, M.P., 1963, 'Methodproblem inom järnalderns Konsthistorica, in *Acta Achaeologica Lundensia,* Nr.3. Lund

Mayr-Harting, H.M., 1972, *The coming of Christianity.* London

Mayr-Harting, H.M., 1976, *The venerable Bede, the rule of St. Benedict, and the social class.* (Jarrow Lecture)

Mc Entire, S., 1986, 'The Devotional context of the Cross before A.D. 1000', in P.E. Szarmach, ed., *Sources of Anglo-Saxon Culture.* Kalamazoo

Meyer, P., 1951, 'Notes on the Art and Ornament', in E.H. Alton, *The Book of Kells*, Vol.III. New York

Meyer, P., 1960, 'The miniatures and ornamentation', in A.A. Luce, ed., *Evangeliorum Quattuor Codex Durmachensis.* Olten/Lausanne

Morris, Ch., 1938, *Foundations of the Theory of Signs.* Chicago

Morris, C.W., 1946, *Signs, Language and Behaviour.* New York

Montelius, O., 1885, *Om tidbestämning inom bronsalderen.* Stockholm

Müller, S., 1884, 'Mindre Bidrag til den forhistorike Archaeologis Methode', in *Aarb*, 161-216.

Nordenfalk, C., 1947, 'Before the Book of Durrow', in *Acta Archaeologica 18*, 141ff

Nordenfalk, C., 1970, *Die spätantiken Zierbuchstaben.* Göteborg

Müller-Karpe, H., 1975, *Einführung in die Vorgeschichte.* München

Ogilvy, J.D.A., 1968, *The Place of Wearmouth and Jarrow in Western cultural history.* Jarrow Lecture

Otten, C.M., 1971, *Anthropology and Art.* (University of Texas Press)

Purce, J. 1974, *The Mystic Spiral. Journey to the Soul.* (Thames and Hudson)

Rademacher, F., 1936, 'Der Trierer Egbertschrein. Seine Beziehungen zur fränkisch-karolingischen Goldschmiedekunst', *Trierer Zeitschrift*, 11.Jahrg., Heft 1-2. Trier

Read, H., 1964, *Modern Sculpture.A Concise History.* London

Riegl, A., 1927, *Die spätrömische Kunstindustrie, nach den Funden Östereich-Ungarn.* Wien

Roth, U., 1979, 'Ornamentik frühchristlicher Handschriften', in *Berichte der Römisch Germanischen Kommission 60*, 5-227

Ryan, M., 1983, *Treasures of Ireland.* Dublin

Salin, B., 1935, *Die Altgermanische Thierornamentik.* Leipzig

Sackett, J.R., 1982, 'Approaches to style in lithic archaeology', in *Journal of Anthropological Archaeology* I, 59-112.

Saussure, F. de 1974, *Course in General Linguistics.* London

Saussure, F. de 1966, *A General Course in Linguistics.* London

Schapiro, M., 1953, 'Style',in A.L. Kroeber, ed., *Anthropology today*, 287-311. Chicago and London

Schapiro, M., 1958, 'The Decoration of the Leningrad Bede', in *Scriptorium 12*, 191-207

Schapiro, M., 1973, *Words and Pictures. Approaches to Semiotics*, Th.A. Sebeock, ed., The Hague/Paris

Schapiro, M., 1977, 'On the Aesthetic Attitude in Romanesque Art', in M. Schapiro, ed., *Romanesque Art.* London

Semper, G., 1860, *Der Stil in den technischen und tektonischen Künsten.* Wien

Schiller, G., 1971, *Iconography of Christian Art I.* London

Speake, G., 1980, *Anglo-Saxon Animal Art and its Germanic Background.* Oxford

Stevenson, R.B.K., 1981-2, 'Aspects of Ambiguity in Crosses and Interlace', in *Ulster Journal of Archaeology*, Vol.44/45

Stevenson, R.B.K., 1974, 'The Hunterston Brooch and its significance', in *Medieval Archaeology 18*

Swanton, M., 1970, *The Dream of the Rood.* London

Thiel, E.J., 1970, 'Neue Studien zur ornamentalen Buchmalerei des frühen Mittelalters', in *Archiv für Geschichte des Buchwesens XI*, 1057-1126

Toynbee, J.C.M., 1968, 'Pagan motifs and practises in Christian art and ritual in Roman Britain, in M.W. Barley and R.P.C. Hanson, eds., *Christianity in Britain 300-700*, 177-92. Leicester

Turner, V., 1967, *The Forest of Symbols.* (Cornell University Press). Ithaca

Vierck, H., 1974, 'Werke des Eligius. Studien zur Vor-und Frühgeschichtlichen Archäeologie. Festschrift für J. Werner', in *Münchner Beiträge zur Vor-und Frühgeschichte*, Ergänzungsband 1, 309-380. München

Wallace-Hadrill, J.M., 1983, *Ideal and Reality in Frankish and Anglo-Saxon society.* Oxford

Wallace-Hadrill, J.M., 1983, *The Frankish Church.* Oxford

Washburn, D.K., 1977, *A symmetry analysis of the Upper Gila Area ceramic design.* Papers of the Peabody Museum 68. Cambridge/Massachusetts

Washburn, D.K., 1983, 'Symmetry analysis of ceramic design: two tests of the method on Neolithic material from Greece and the Aegean', in D.K. Washburn, ed., *Structure and Cognition in Art*, 138-164. (Cambridge University Press)

Washburn, D.K., 1988, *Symmetries of Culture.* (University of Washington Press, June 1988)

Watson, Le Blanc«Redman, 1971, *Theory and Explanation in Archaeology.* London

Werckmeister, O.K., 1964, 'Die Bedeutung der Chi Initialseite im Book of Kells, in V. Elbern ed., *Das erste Jahrtausend*, 687-710. Köln

Westermann-Angerhausen, H., 1973, 'Die Goldschmiedearbeiten der Trierer Egbert-werkstatt', in *Trierer Zeitschrift* 36, 9-155. Trier

Wiessner, P., 1983, 'Style and information in Kalahari san projectile points', in *American Antiquity* 48 (2), 253-276.

Wilson, D., 1984, *Anglo-Saxon Art.* London

Wilson, E., 1983, *Early Medieval Designs*, (British Museum Pattern Books). London

Wilson, D. M., 1959, 'Almgren and Chronology', in *Medieval Archaeology*, 112-9.

Whitelock, D., 1954, *The beginnings of English Society*, 2nd ed., (Penguin)

Wobst, M., 1977, 'Stylistic Behaviour and Information Exchange', in *University of Michigan Museum of Anthropology. Anthropological Paper* 61, 317-42.

Wölfflin, H., 1915, *Kunstgeschichtliche Grundbegriffe.* München

Zeman, J.J., 1977, 'Peirce's Theory of Signs', in T.A. Sebeok, ed., *A perfusion of signs.* Bloomington/London

Zimmerman, E.H., 1916, *Die vorkarolingischen Miniaturen.* Wien