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Neither Use Nor Ornament:
A Consideration of the Evidence for the Existence of a System of Communication and Notation in the European Upper Palaeolithic.

by

Judith Elisabeth Robinson.

A Thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

Department of Anthropology

The University of Durham
1993

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Abstract

This thesis is concerned with devising an objective means of testing whether or not the people of the European Upper Palaeolithic used systems of notation to create intentional records. I begin with a discussion of the theoretical parameters that I intend to adopt, notably an adaptive rather than a progressive model of change over time, and the need for a controlled use of analogical comparisons between present phenomena and prehistory. By briefly summarising the approach of past researchers in this area, I identified engraved mobiliary artefacts as the primary source of data.

In order to construct an objective model to test the hypothetical existence of notation, I first examine other forms of visual communication, notably iconicity, decoration and the use of signs and symbols. I conclude that any recognisable examples of notation would be structured in order to effectively convey information. As a result I devise a series of criteria based on first principles by which I hope to be able to distinguish between examples of representational, decorative, notational and purely random accumulations of lines.

To test the effectiveness of these criteria, I apply then to examples of known systems of visual representation taken from the Ethnographic collections of four museums. These include Australian message sticks, tallies, records of time and calendars. I conclude that my criteria are able to discriminate between examples of notation and other classes of meaningful representation. I also isolate the recurrent use of translational symmetry and rotational symmetry in notational artefacts, and the absence of mirror and slide refection.

By discussing in some detail the approach of past researchers to the identification of notation in engraved mobiliary artefacts from the Upper Palaeolithic I isolate certain practical and theoretical problems. To correlate my results with those of Marshack I apply my criteria to five of his selected examples and conclude that two out of the five are not notational by my criteria. I also test my criteria against some artefacts from the Piette and Saint-Périer collections in Paris and conclude that the structure of the marks on some examples conform to my criteria of notation. Marshack is criticised for claiming to identify evolving systems and traditions of notation using only a handful of examples from sites all over Europe and the timescale of the Upper Palaeolithic. I counter this defect by looking at a sample of data taken from a single site, Enlène in Ariège. The engraved artefacts date to Perigordian V and the Early and Middle Magdalenian and are backed by independent dating techniques and a wealth of complementary finds. By providing a detailed summary of the characteristics of this data set I was able to identify certain common characteristics of non-figurative engraved mobiliary artefacts.

By measuring the physical properties of the lines on the complete data namely their length, distance and orientation, I demonstrate the presence or absence of order and structure using Multivariate Cluster Analysis and Two- and Three-Dimensional plots. The cases are selected from Marshack's data, my Paris data, the complete examples from Enlène, with known examples of notation and randomly generated examples to act as controls. As a result of the identification of orientation and then inter-line distance as the prime indications of artefact variability, the broken bones from Enlène are included. Further statistical tests isolate certain artefacts as examples of low variabilty, which are confirmed by my criteria to be the most likely examples of notation or decoration at Enlène.

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Glossary

Tallying – The systematic one to one correspondence of one quantity to another, resulting in both quantities, or rather their individual *sum*, being the same.

Notation – The recognition of a given quantity by an individual, and the representation of this quantity in a systematic manner *without* the maker and user necessarily being able to count or understand the concept of ordinal numbers.

Decoration – The formal arrangement of repeated motifs using symmetry, about a given axis.

Style – When the form of a given visual representation is partially determined by the artists' participation within a certain culture.

Iconicity – When a representation visually resembles the object depicted either by the form or basic outline, or by characterising elements.

Sign – A representation with only one level of meaning.

Symbol – (Or 'visual signifiers') are signs with more than one level of meaning.

Pertinent Variation – Repetitive and standardised variations within a given representation.

Random Variation – Variation that is neither repetitive, or standardised.

Jack Cade:

'... I am the besom that must sweep the court clean of such filth as thou art. Thou hast most traitorously corrupted the youth of the realm in erecting a Grammar-school: and whereas, before, our forefathers had no other books but the score and tally, thou hast caused printing to be used; and, contrary to the King, his crown and dignity, thou hast built a paper-mill.'

Henry VI.–Part II, Act IV, Scene vii.

Chapter I

Notation and The Upper Palaeolithic.

'Is it not true that every tribe spoke and noted down numbers, that every tribe had to calculate whenever it faced life on the planet? Did man's relationship to the environment not also necessitate his relationship with numbers?' Menninger, 1969:v.

1.1 Introduction.

The present necessity of using number in most aspects of daily life can lead to the assumption that all people, in all places, and at all times, have used number to order and structure their existence. The evidence for the use of number in contemporary western society is certainly supportive of this, as whether individuals are enumerating their age, reckoning the day of the week and time of the year, or calculating the return of interest on a given sum after the rates have changed yet again, they are employing some elements of the complex system of mathematical reasoning.

The last century has seen westernised systems of political and economic organisation becoming the accepted and/or enforced principles of government for existing and emerging nation states. Concurrently Western ideas of 'education' representing the 'Three 'R's' – reading, writing and arithmetic – have followed this, and as a result the rudimentary recognition of number is geographically so widespread and such an integral part of all societies that it could be termed a universal cultural phenomenon.

However the ability to 'enumerate' either by words or written symbols, to 'count' and to 'calculate' are not elementary patterns of behaviour. All these processes require language and the use of symbols for their expression and a certain level of cultural complexity and homogeneity for their organisation and recognition. It is likely that the earliest forms of reckoning served a cultural function, such as the use of Linear B script on the Aegean Island of Crete to calculate tribute paid to

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the King. The ability to demonstrate the relationship of one quantity to another and then calculate their sum, is enhanced by assigning a word and a sign to each, a symbol to convey the nature of the mathematical transformation (in this case addition), and further symbols and signs to indicate the total. Thus expressed, the same process can be repeated and understood and therefore communicated to other individuals who share the same language and knowledge.

Defining the complexities of using number gives rise to the question of how and why number systems came to be in their present form and in what form did they originally exist. It has been argued that the recognition of number is to some extent innate, that we share with other animal species the ability to accurately assess number *without* actually counting and therefore enumerate, a phenomenon which Menninger terms 'number sense' (1969:11). On a basic level it is the recognition by an individual that he possesses five fingers on a hand and the same number of toes on a foot, without the need to either speak or symbolise the sum of 'five'. Yolngu in the Northern Territory of Australia use turtle eggs, grouped in a pyramid with four on the bottom and one on the top, to symbolise their counting in base five, (Williams and Mununggurr, 1989:76). The Iqwaye of Melanesia have developed a sophisticated system of counting based around the number '20', referring to the toes and fingers of an individual (Mimica, 1990:13).

Wilder (1968) concludes that the reason why there is a recognition of number in all societies, is that counting of sorts forms a 'cultural necessity', and it is in fact the environment within which man is obliged to interact that 'demands this recognition'. This being the case, it is possible to go on to assert that this forms a 'universal law' of human societies, and thus there is little need to show the diffusion of rudimentary counting, as all cultures are not only capable, but bound to develop it in some form. However he stresses that these aspects of number recognition then 'evolve' in each culture, thus again linking any further elaboration and diversification to a response either to social and/or environmental necessities. He assumes that as societies become more complex, they will require the recognition of sophisticated numerical concepts, such as counting, and possibly invent symbols for numbers to facilitate more complex calculations.

'True counting is a process whereby a correspondence is set up between the objects of the collection to be counted and certain symbols, verbal or written.' Wilder 1969:32.

If this argument is followed then it seems reasonable to conclude that all humans have always possessed this ability, perhaps even our direct ancestors *Homo sapiens sapiens* who populated Africa and then Europe from 90 000 BP. Yet this is pure speculation as the archaeological record does not retain evidence of this nature, and therefore any assessment of the cognitive ability of early humans must be deduced from the available, indirect material evidence.

1.1.1 The 'Creative Explosion'.

The fascination and need to locate the origins of certain phenomena has lead researchers to the Upper Palaeolithic, to the time when *Homo sapiens sapiens* reached Europe at about 40 000 BC. In common with Lower and Middle Palaeolithic the archaeological record of this period is characterised by widespread finds of flint tools at specific habitation sites. The classification of the tools over time divides the Upper Palaeolithic into 'cultures' each characterised by a specific tool assemblage (Bordes, 1973, Mellars, 1989). The precise chronology is disputed amongst archaeologists, who disagree on the minutiae that constitute a valid change and the 'boundary' between cultures. However the broad picture gives the Châtelperronian *c.* 35 000 BC, the Aurignacian *c.* 30 000 BC, the Gravettian *c.* 25 000 BC, the Solutrean *c.* 20 000 BC, the Early, Middle and Late Magdalenian *c.* 15 000 BC, 13 500 BC, and 10 000 BC, and the Azilian at *c.* 8 000 BC. These dates act as a guide, as not all areas of Europe experienced the same changes in lithic technology at the same time, and in some areas there is no evidence of a particular lithic assemblage.

The excavated finds from a site are dated according to the tools found in the same layer. Some sites provide particularly clear stratigraphic records with a good representation of tool assemblages in each layer and these 'type sites' often form the basis for cross site comparisons. Gamble (1986:139) focuses on the criteria of these key sites: some geological evidence to provide an absolute date; evidence that the data are *in situ*; some fossil human remains with good contextual evidence such as animal remains and pollen evidence; and good excavation and recording techniques. The other source of dating comes from other associated artefacts which are recovered in great numbers from many sites of the later periods. The Upper Palaeolithic is unique in the timescale of the Paleolithic in the wealth of 'art' forms that exist which include painting, sculpture and intricate carvings and engravings on cave and Rockshelter walls. It is this latter class of artefacts that is cited as conclusive evidence of the expansion of human capabilities, with Kitahara-Frisch linking the use of tools, language and symbols to the emergence of uniquely human cultures (1980:212).

The Neanderthal populations of the Middle Palaeolithic became 'extinct' by the end of the Châtelperronian, that is after the expansion of the *sapiens sapiens* populations over the landscape. The reasons for the apparent replacement of one human species by another are not fully understood. The old arguments that described how the 'primitive' and 'retarded' Neanderthals were simply replaced by the superior strategies and skill of the intrusive *sapiens* have lost much ground as further research now suggests that Neanderthaloid society and material culture was far more complex than previously thought (White, 1982, Mellars, 1973, 1989). The evidence of burials and 'grave goods' implies some ritual disposal of their dead, (Clark, 1970, Harrold, 1980). There is evidence from the excavated remains of Mousterian levels at Mount Carmel, Israel, that the hyoid bone may have been juxtaposed with the larynx in a way that would permit speech. The implication is that the populations of the Middle Palaeolithic would have been anatomically capable of speaking, (Arensburg *et al*, 1990). In addition there remains the possibility that Neanderthals produced art in perishable, or non-permanent media, and therefore any claims of specifically *sapiens* capabilities must be reassessed.

The reasoning, in answer to the question as to why notation first may have occurred in the Upper Palaeolithic and not before, follows the classic lines of the supposed *neanderthal/sapiens* intellectual transition, that only *sapiens* had the capacity for abstract symbolism and the ability to construct essentially 'abstract' forms of representation (Pffeifer, 1982). However sophisticated the Neanderthal cultures may have been, there is no doubting the sheer weight of evidence from the archaeological layers that attests the complexity of emergent cultures of the Upper Palaeolithic. Mellars (1985) identifies three key areas of evidence, firstly the number and density of sites that cluster together in identifiable areas, secondly the depth of the habitation layers which indicate dense occupation over time, and thirdly the wealth of artefacts occurring in many new forms as well as great numbers. The proliferation of art objects and cave art are sometimes found associated with habitation debris and are assumed to be part of daily life. However other examples of cave art are found in deep caves which gives rise to theories of initiation rites and the first religious expressions, another supposedly universal phenomena of human cultures. Items of personal ornamentation such as beads, shells and amber appear for the first time at around *c.* 35 000 BC. There are examples of portable art attributed to the Aurignacian, but the vast majority are recovered from the last 10 000 years of the ice age, namely the later Solutrean and the Magdalenian. Some of these are engraved with figurative art and occasionally sculpted, and some just have lines engraved over one or more surfaces.

There is more evidence to support the interpretation of the Upper Palaeolithic as a period of increasing social and cultural complexity. The hunting and gathering strategy is evident not only from the quantities of faunal remains recovered from the sites but from the proliferation and complexity of the stone tools (Mellars, 1973, 1982, White, 1982). The dense occupation of sites suggests both continuity and the aggregation of populations. These sites are thought to be located close to the source of concentration of a key resource, such as by a river for salmon spawning, or close to a pass where reindeer accumulate in their seasonal migrations. The very size of some of the sites suggests that some cooperation existed, possibly the rudiments of social order to coordinate and regulate behaviour to maximise the success of the group in their survival strategy (Conkey, 1980b, Bahn, 1982). There is some evidence of seasonal occupation as marine resources such as shells are found at inland sites (Bahn, 1984), and trade networks as flint and other minerals are found hundreds of miles away from their original source. The standardisation of the tools and other art forms such as Venus Figurines (Leroi-Gourhan, 1962, Gamble, 1982) over thousands of miles also indicates a transmission of information.

To summarise, it is hypothesised that the societies of the Upper Palaeolithic may have needed to use number to order and structure their existence. The evidence presented here suggests that the complexity of the art clearly demonstrates the ability of certain individuals to represent and possibly symbolise abstract concepts of their environment and these are precisely the skills needed to count or conceptualise number. The habitation sites indicate the aggregation and social interaction of people, and the cooperative hunts and gathering activities could result in the need to allocate resources and make provision for their redistribution by using number. If this is the case, then there may have been the need to make a more permanent record, in which case some researchers believe that they would make a 'tally'. Archaeological excavations have unearthed certain artefacts that are represented as 'tallies', and the earliest theories on their use in the Upper Palaeolithic suggest they were made to keep account of the number of animals killed, (Lartet and Christy, 1875) or number of participants in a ceremony concerned with 'hunting magic' (Breuil, 1952).

1.1.2 What are 'Tallies'?

Before going any further, it is necessary to briefly discuss what the term 'tallying' describes and then to explain why the term 'notation' will be used in reference to the Upper Palaeolithic. The ability to equate certain quantities as being 'the same' is the underlying process used in 'tallying' – a form of non-arithmetic counting, and therefore of notation. The linguistic evidence suggests that modern words associated with reckoning and numbers have their origin in words designed for tallying. The English word 'tally' is thought to come from the french word of the same meaning 'taille', which is derived from the Latin *talea*, meaning 'cut twig' or 'stave'. The word 'score' is still used to refer to accumulated 'totals', especially in games and bills for drinking and eating! The word originates from the old Saxon word *sceran*, which means 'to cut'.

'Tallying' is the systematic one to one correspondence of one quantity to another, resulting in both quantities, or rather their individual *sum*, being the same. Tallying can be an abstract thought process, for example by assigning a number to each object and therefore correlating three objects to the number 'three'. From ethnographic and historical evidence the most common method of constructing, demonstrating and recording a perceived one to one relationship between two quantities, or a record of a single quantity, is by making a distinguishable mark on a chosen surface. In this way it records the given items, and more importantly the record can be kept, and possibly 'read' by another individual who also understands the concept employed. It is anticipated that some tallies form permanent testaments, whereas others will be the result of a transient need and will be quickly discarded.

As this thesis is concerned primarily with examining the material from European prehistory to establish whether or not there is evidence to suggest that the populations of the Upper Palaeolithic used number and created a record of some kind, it is necessary to separate the terms 'notation' and 'tally'. The ethnographic and historical accounts of the use of tallies indicate very clearly that many such devices function within numerate and literate cultures. The term 'notation' implies firstly the *recognition* of a given quantity by an individual, and secondly the *representation* of this quantity in a systematic manner *without* the maker and user necessarily being able to count or understand the concept of ordinal numbers. The difference between tallying and notation is not necessarily reflected in the form of the tally. Instead the two terms are used to distinguish between a documented practice of recording number used by societies that are known to speak and use number (tallying), as opposed to the hypothetical making of similar records of quantity by the people of the Upper Palaeolithic who are not known to use speech and counting, (notation). These terms are discussed further in the next chapter, and are defined in the glossary.

There are two broad schools of thought concerning the question of notation in the Upper Palaeolithic. The first concentrates on the strong *probability* that the people of the late Palaeolithic were 'like us', and if 'we' need to be able to recognise number to order a successful cooperative subsistence strategy, and to socialise in large groups, then so did 'they' (Bahn, 1988, Marshack, 1972, Mellars, 1989, Trigger, 1989, Mithen, 1990). The evidence to support this claim comes from the tools, material culture, and habitation sites from the archaeological record. The second school is sceptical of such 'proof', challenging the ethnocentricity of projecting ideas uncritically of the present back to the past, and the absence of hard data (White, 1982, D'Errico, 1989, 1991).

I intend to concentrate on the possibility that some concepts of number may have existed at this time, and if they are to be located in the archaeological record they will be represented in the habitation assemblages of the period. It is *not* the aim of this thesis is to try and find out what 'tallies' were used for, as this is unlikely to be substantiated by hard evidence. The precise form of such artefacts is unknown, and the following sections describe the broad theoretical parameters I will adopt in order to begin such an inquiry and briefly outline the work done by other researchers in this area.

1.2 Adaptive versus Progressive Modes of Evolution.

> 'Haven't people always counted as we do today?
> We shall find the answer to this question if we descend the ladder of culture down to the very lowest steps, scarcely above the level where the mind could not rise above the environment.'
> Menninger 1969:9

1.2.1 Introduction.

Given that I intend to examine the archaeological record to pursue this line of inquiry it is necessary to establish the theoretical parameters I intend to use for its interpretation. The purpose is to challenge interpretations of the past that use a pattern of unilinear change to describe the transformation of the simple to the complex in order to achieve 'perfectibility'. This approach has been criticised for providing a 'Just So' picture of history, one in which the present is projected back into the past, and the latter explained accordingly. For the Palaeolithic, this meant a picture of cultural and economic limbo with populations just waiting for the Ice Age to finish so agriculture and real achievement could begin. Current research stresses the need to see the populations of the Upper Palaeolithic as fully adapted to their environment through complex social organisation and patterns of resource exploitation (Gamble, 1986, Mithen, 1991, Mellars, 1989).

The belief in 'primitive societies' can traced back to the social theories of the last century which are outlined in the following discussion. The implications for this discussion of notation is that some researchers have suggested that the Palaeolithic populations *must* have understood the mathematical regulations behind the patterns of the moons, sun and stars. This knowledge enabled them to understand the yearly cycle and seasons which was an essential precondition to the adoption of agriculture as the primary mode of subsistence later in prehistory. Ideas of a 'progressive' form of notation is explicit in the work of Alexander Marshack (1972). As Marshack's work on notation in the Upper Palaeolithic represents the only attempt to present a theory of notation during the Upper Palaeolithic his contribution will be assessed in detail in Chapters IV and V. Here it will be useful to consider the general probability of evolution as 'progress' and the second part of this section examines how this nineteenth century perspective of social evolution coloured the interpretation and classification of the archaeological finds, and how remnants of these practices continue today.

1.2.2 The Origins of 'Evolution'.

The study of prehistory has always to some extent been dominated by a search for the 'origins' of the phenomena that are present in the world contemporary to the enquirer. As excavations and therefore new insights were made into the archaeological past, the information from this research was naturally interpreted in the light of historical records but also heavily influenced by the prevailing trends in social thought at the time. Perhaps the dominant ideology was the general belief in the supremacy of white, Christian, industrialised, and above all, English speaking, nations over all others (Spencer, 1873, Tylor, 1865). Although undoubtedly ethnocentric and racist it was closely allied to the developments in technology that were seen as mastering nature, and therefore distancing man ever further from animals. In forwarding the idea of 'perfectibility' Lamarck (1815) made current the idea that mankind both physically and culturally was moving ever closer to its ideal state, and this was apparently confirmed both by the archaeological and ethnographic evidence of societies more 'primitive' than their own who were seen as servants to nature.

To a great extent, the concern of the early archaeologists was with material culture and with the formulation of general theories as to the fundamental 'nature of mankind'. As a result they became increasingly influenced by the findings of other researchers in the related disciplines of what later became known as anthropology and sociology. By the middle of the nineteenth century, European expansion into Africa and Asia resulted in the recovery of a wealth of new ethnographic information. This detailed documentation of the exotic and apparently irrational behaviour of 'primitive' societies gave weight to the argument of physical and mental differences based on 'race' (Mc Lennan, 1876, Morgan, 1877, Tylor, 1888, Lubbock, 1870). Therefore, although the anthropological work was conducted in societies directly contemporary to the investigators and theoreticians, others had no hesitation in adopting and projecting these societies into the past.

One theory conceived during this period and one that has continued to be refined and developed to the present day is that of 'evolution'. The term was first used by Herbert Spencer, an eminent Victorian man of letters, who used 'evolution' to describe and thus account for the changes over time and variation between human cultural and social behaviour (Spencer, 1850). This was later adopted by the Victorian Naturalist Charles Darwin in his theory of the principles of 'Natural Selection' which was applied to the speciation and diversification of all animal species over time (Darwin 1871). Subsequently 'evolution' has been used freely (even indiscriminately) by many researchers who believe that it provides an adequate and 'scientific' means of accounting for change over time. However it is evident that the word 'evolution' is often misused, with confusion over both the mechanisms and direction of change.

It is considered necessary for the purpose of this thesis to distinguish between what are often termed 'adaptive' and 'progressive' models of evolution. The former accounts for change a given phenomenon that is essentially non-directional, and although a change can benefit the organism this cannot be measured on a scale of values relating solely to a preconceived idea of 'progress' and refinement. Instead the success of the modification can be measured by its being retained and transmitted either laterally (non-genetically) or by descent and so surviving as a neutral or advantageous adaptation. If a modification is not perpetuated in any way it can be hypothesised to be non- or maladaptive. A 'progressive' model, in so far as changes occur and favourable modifications are retained, is similar to the adaptive model. However the former implies that the change conforms to a identifiable, predictable and preconceived pattern of linear development, and is therefore directional.

The principle reason why the two are often intermingled is probably the result of their being forwarded to the scientific world at roughly the same time – 'progressive' by Lamarck (1815) and Spencer (1850, 1873) and 'adaptive' by Darwin (1859, 1871). In his book *Social Statics*, (1850), Spencer used 'evolution' to describe essentially the change of *social* phenomena over time. Similarly it was Spencer and not Darwin who introduced the phrase 'the survival of the fittest' to demonstrate the effective results of change taking place. The core of Spencer's argument at this stage was that a fundamental law of progress was in operation, resulting in a gradual but observable change from the homogenous (simple) to the heterogeneous (complex). The mechanism for change was indefinable, but Spencer talked of a 'force' for progress, or 'orthogenesis', that made for continuous change, rather than any given population reaching an equilibrium.

Despite Freeman's claim that Spencer developed a theory without empirical observation (1968), the evidence that Spencer used to substantiate his argument came from many sources. Using the available ethnographic evidence to illustrate the many stages of development through which mankind was evidently passing at this point in time, he devised a scale with what are now termed hunting and gathering societies at the lower end and industrial nations as the most 'complex' at the top, (Spencer, 1873). Archaeological and historical evidence testified to 'primitive' societies having existed prior to those of Spencer's present, and similarly attested that they were gradually modified to produce what were according to Spencer more heterogeneous societies. Lyell's seminal work *Principles of Geology* published in 1835 provided fossil evidence entirely compatible with that which Spencer himself had observed from examining the stratigraphy of railway and canal cuttings, namely that animal, bird, and reptile species had also changed over time, no doubt due to behavioural modifications. Spencer used the word 'struggle' to characterise the necessary conflict between individuals carrying different traits in order to ensure that they were passed on to subsequent generations, with only the most advanced, the most 'fit' ultimately prevailing each time.

A significant factor for Spencer was the environment in which the individual exists which he believed influenced the nature of the change. As the social system of a given group of people can be viewed as their 'product', Spencer argued, it is necessarily also a reflection of their innate abilities. Any advantageous trait of social behaviour was transmitted from father to son, and in this way the characteristics became 'inherited', part of the culture of subsequent generations as reproduction and the transmission of culture continued. Gradual, incremental change was the key, and a society would have to pass through all the designated stages in order to reach perfectibility. It was therefore the cultural environment surrounding the individual that controlled his biological characteristic traits, and 'selection' would operate to ensure that these were carried on to the next generation (Spencer, 1850, 1873).

1.2.3 The Only Way is 'Up'?

Spencer's Victorian audience certainly found this a plausible explanation of variability and change as it was entirely consistent with the ideologies of the time. However Spencer did not dominate the field entirely and found his views challenged by other theorists, most notably from the natural sciences. Lyell's work (Lyell, 1835) was read with interest all over Europe, and it was known to have stimulated the interest of Charles Darwin, a naturalist who had recently returned from a voyage of collection and observation travelling to the southern hemisphere and most notably to the Galapogas Islands in the Pacific. Here he had encountered species of animals that were common to the mainland, but differed both superficially and fundamentally in their biological characteristics. Evidently some process of modification had taken place, and this is precisely what Lyell had observed from the fossil record. However Darwin did not chose to follow Lamarck and Spencer in assigning the physical change to a line of perfectibility. Instead he believed that change occurred naturally, but randomly, and was transmitted via reproduction to the next generation.

This crucial contribution was apparently derived from reading Malthus's *Essay on the Principles of Population* of 1826 in which Malthus asserted that while human populations increased at a geometric ratio, agricultural (subsistence) production could only do so at an arithmetic ratio. Thus left unchecked by poverty, disease and a high infant mortality rate populations would eventually be severely diminished by famine. As it was the poor who were generally the victims of endemic disease and premature death, this was regarded as justifying a policy of nonintervention by the wealthier middle and upper classes. There is some argument as to whether Darwin himself wished to advocate similar views, but as Marvin Harris points out, both Spencer and Darwin were but products of their time, and it is unnecessary to reiterate the prevalence of certain ideas about the nature of man's development (Harris, 1968. However Freeman (1978) believes that Darwin had already developed his theory based on empirical evidence from his travels, and Malthus' calculations on the rate of reproduction merely provided the appropriate means of transmission.

For Charles Darwin, evolution was non-directional, and he comprehensively rejected the idea of perfectibility, (Darwin, 1859, 1871). Lacking as he did the precise knowledge of just how changes were generated, he maintained that they were transmitted from one generation to the next, and the success of one trait over another was purely a function of how many subsequent offspring carried it. Implicit in the term 'evolution' as it is applied by Darwin to biological phenomena, is the process of change, made possible by random mutations in the genes themselves, and 'selected' for or against on the basis of an increased or diminished reproductive success on the part of that individual. If the change is 'advantageous', that results in the production of more viable offspring, then it is 'selected' for. Thus eventually over time the majority of a population will possess the mutation, providing of course the increased reproductive rate remains a by-product of that mutation for a long enough period of time, (Darwin, 1871).

Certain natural restrictions operate to inhibit a unilinear pattern of development. As conditions change constantly, there is no guarantee that a mutation that results in reproductive success under one set of conditions will be able to maintain this if conditions change. Also, as mutations occur constantly, there are many, that although they may physically effect the organism, may not effect their reproductive potential either negatively or positively. In addition, there is the concept of mutations 'competing' with one another, and thus it is the most 'successful' (again in reproductive terms) that will supercede all the others, and may in turn be succeeded and made obsolete by another.

1.2.4 Evolution and Modern Theories.

There are obvious drawbacks in transferring the theory for biological organisms to the study of social phenomena. One of the most common, is the use of terms such as 'success', 'natural selection' and 'survival of the fittest' to describe interaction and change in social phenomena. Out of context, such terms have been applied in a literal sense to the past study of 'races', where it is proposed that not only were some races 'inferior' and doomed for extinction, but also that their cultural organisation, having come into 'conflict' with that of Western civilisations, was 'maladaptive', as it could not compete, and was superceded. The assumed 'scientific' basis for such reasoning was used to maintain this abuse of evolutionary theory, by treating populations as genetically homogenising 'types' or sub-species (Spencer, 1873, Laing, 1892).

Although many of the old-style interpretations of evolutionary theory have been modified and discarded by anthropologists as racist and ethnocentric, it is apparent that other related studies that draw upon their evidence have not entirely abandoned them, or adopted them in a piecemeal and therefore potentially misleading way. Either the misconceptions about 'primitive man' have been transferred to the study of the earliest anatomically modern humans and they are seen in the manner outlined above, or the people of prehistory are described as more culturally sophisticated than the hunter-gatherer populations of today, (Sackett, 1968, Marshack, 1972). The inferences that can be drawn from this, are either that the present day populations represent an evolutionary regression, a view that is now unacceptable to anthropologists, or that possibly the achievements of the European Palaeolithic peoples were the forerunners of the 'civilisations' of the world, with the 'static' populations remaining in cultural limbo since the beginning of the species, an interpretation also shown by archaeology to be invalid.

Surprisingly there are hints of Lamarckian 'perfectibility' in some archaeological accounts that stress the 'development' in each successive 'period' of the Upper Palaeolithic. It seems that some researchers expect to find evidence of 'improvement' rather than adaptation, so rather than looking at sources of variability in the data, they choose to concentrate only on the aspects that support their perspective (Breuil, 1925, 1952, Leroi-Gourhan, 1962). The ecological conditions are known to have varied over the Upper Pleistocene from the full glacial maximum at 18 000 BP and comparatively temperate interstadials. Although these climatic deteriorations were slow and incremental the eventual contrast would have required an altered response on the part of populations as the fauna and flora and the seasonal patterns changed, (Clark and Straus, 1983, Bailey, 1983, Bahn, 1983, Mithen, 1989). Evidence of change and experimentation is present within the archaeological record and researchers must be able to identify the nature and possible source of this in order to adequately reflect the dynamic nature of prehistory.

1.2.5 Towards a Theoretical Perspective.

This constant search for the origins of apsects of human behaviour has resulted in a rather blinkered approach in the interpretation of prehistoric material. The principles of natural selection theorise that any non-adaptive behaviour becomes obsolete over time, as it is superceded by a more 'successful' (in reproductive terms) strategy. The evidence that is used to test this hypothesis draws heavily on information gathered from the analysis of contemporary subsistence methods, and relies on the most appropriate, and therefore the optimum strategy being adopted. From a reassessment of recent ethnographic evidence, it appears that it is no longer plausible to theorise that the populations of the Palaeolithic were involved solely in maximising their subsistence and/or reproductive output, (Sahlins, 1972, 1976). Instead the majority of predictive or interpretative models accept that culture influences the precise nature of the adaptive strategies selected by a given population in order for them to achieve these ultimate goals. Thus it cannot be assumed that immediate 'reproductive success' or the desire for a maximum success in food procurement were the only motivation governing behaviour in prehistory. Rather, these evolutionary parameters were mediated by social interaction and the transmission of information.

Foley challenges the old view that populations throughout the Upper Palaeolithic were on a unilinear track of both physical and social evolution that lead eventually and inevitably to the agricultural societies of the Neolithic. His argument also discusses the view that morphology of human populations remained unchanged over the Upper Palaeolithic to the present. In a detailed study of the available remains he identifies variations in both sexual dimorphism and robusticity compared to human skeletons from the present, (Foley, 1991). By stressing the variability evident in the archaeological record, Foley presents a dynamic picture of successive 'cultures' apparently interacting with, and responding to the changes in their environment. This view is echoed by Bailey (1981), who stresses that 'resource exploitation' does not refer simply to static hunting and gathering strategies, based on patterns of essentially short term and opportunistic response. Instead the term describes a complex system of information gathering and planning, composed of a number of variations in strategies linked to animal husbandry, selection in kills, and strategic management of the resources. Therefore people, like members of other species, do not have to be motivated by reproductive success, as all that matters are the consequences of enhanced reproductive success. The goal may be to enhance the cultural life of the individual by creating and maintaining social relationships, (Sahlins, 1976, Dwyer, 1985). The result of the ensuing patterns of cooperation, such as reciprocal access to resources and mutual defence may lead to enhanced reproduction, but this is an *indirect* result. Recent archaeological work (Gamble, 1986, Mithen, 1990, Mellars, 1989, Conkey, 1985) interpret the Upper Palaeolithic as a specifically modern human adaptation to changing climatic conditions.

Perhaps the most important point here, is that there is a constantly fluctuating pattern of social interaction present in all societies, including those that once seemed to anthropologists most 'static' and unchanging, namely the politically acephelous gatherer/fisher/hunter societies, to which most of the prehistoric evidence has been related at some time. Not only is there evidence for change, but also for the process of invention and subsequent discarding or adoption of alternatives within the culture. The identification of such patterns in the archaeological record would present problems for the excavator who attempted to present all the recoverable evidence as adaptively advantageous and thus being the precursor of some form of contemporary behaviour. It can no longer be assumed that these societies are either 'living fossils', or so basic that their activities can be reduced to basic food procurement and superstition, with no mental ability for abstract thought. Instead, the archaeologist should look as much for evidence of variability, innovation, and reinvention in possibly disjointed or single occurrences, as for a continuous pattern of modification by degrees. Layton argues that the complexity of Upper Palaeolithic material culture is a specific response to glacial conditions, not a stage in 'progress', (Layton 1991:165).

1.2.6 Evolution and Material Culture.

Progressive theories of change have not only influenced interpretations of societies but also the conventional classification of the artefacts and other finds from prehistory. Again there have been attempts to establish a series of linear progression, all in the direction from crude to complex forms. Such a scheme is perhaps possible for an item performing a function, for example tools can be ranked according to their effectiveness in completing a particular task, but such measures are inappropriate for art objects. Thus it is misleading to discuss the 'development' of artefacts, implying that one is more advanced than another. Any judgements should be based only on specific and defined criteria, for example if knives are to be judged on how well they can cut, there is no way by which they can be ranked by the complexity of their construction or their ornament alone. Another challenge for the interpretation and classification of material culture is based on the obvious point that man-made artefacts are not organisms, and do not 'breed' in the way that organisms do. There is no inevitability or even predictability in the way that artefacts can vary, and there is no reason for supposing that two like artefacts are necessarily 'related' if they are separated by time and space.

The appearance of 'Venus figurines' in the archaeological record at around 29 000 BC *could* be attributed to processes of stylistic evolution and a gradual experimentation in all media. Although these factors presumably influenced their particular form, Gamble's hypothesis that they emerged as a specific response to a new cultural need, in this case the rapid and simple transmission of informations is more convincing. This seems to be more plausible than a hypothesis that simply places them as the result of a sequence leading from the bas-reliefs on the cave walls, eventually to the major subsequent sculptural traditions, (Gamble, 1982). A comparable approach is forwarded by Ucko (1987) in a paper that reconsiders this and other traditional misconceptions about the possible lines of 'development' in the various artistic manifestations of the Upper Palaeolithic.

One of the most notable aspects of the archaeological record from the Upper Palaeolithic is the phenomenon of painted caves, yet despite the fact that this and the 'artistic' expression embodied in the engraved mobiliary artefacts, spans a period of 15 000 to 20 000 years, the most influential theories describe the creation of such varied art forms as a unilinear pattern of stylistic evolution, from crude to complex forms, (Breuil, 1952, Leroi-Gourhan, 1965). There have been a growing number of critics of those who follow the traditional view of Palaeolithic art as a continuous development of various art styles in different media all over Europe, all reflecting a relatively homogenous cultural strategy. This view must be replaced by one that recognises the variety of forms and styles and thus can adequately assess the nature of their contribution, (Laming-Emperaire, 1962, Ucko and Rosenfeld, 1967, Conkey, 1982).

These theories have been challenged not only on stylistic and theoretical grounds, but by the development of new scientific techniques in Radiocarbon Dating. Small samples of the charcoal used to draw monochrome animals were taken from the caves of El Castillo, Altamira from Northern Spain, and Niaux in the French Pyrénées (Valladas *et al*, 1992).. Previously it was thought that the bison from El Castillo were stylistically similar and therefore contemporaneaous to those found at Altamira, yet the new dates from two adjacent bison from El Castillo of 13 060 =/- 200 and 12 910 =/- 180 yr BP are significantly later than those derived from Altamira at 13 940 =/- 170 and 14 330 =/- 190 yr BP. Dates of 12 890 =/- 160 and 12 440 =/- 190 from Niaux correspond to the excavated finds from La Vache on the other side of the valley, and the authors draw attention to the possibility that Niaux and El Castillo were painted by people of a common cultural background, (Valladas *et al*, 1992:70). Another challenge to the old interpretations comes from new evidence which has established that Palaeolithic cave art is a 'world wide' phenomenon. It is now accepted that the phenomenon of painting the surfaces of caves and shelters was not confined to the classic regions of Europe, as dates of over 20 000 BP have been attributed to the South African cave of Apollo 11, and to Koonalda in Australia, (Wendt, 1976). Recent work on the pigments found in the rockshelters of Judds Cavern and Laurie Creek using Accelerator Radiocarbon Dating suggest dates in the late Pleistocene, (Loy *et al*, 1990). Also the timescale of the parietal art and earlier examples of 'artistic' expression on engraved mobiliary artefacts spans a period of 15 000 to 20 000 years. Yet the old patterns of interpretation are merely stretched to accommodate this new data and no truly innovative approach to the study of art has been advanced.

The analysis of art in the Upper Palaeolithic has concentrated on the most spectacular examples of the parietal and mobiliary art. From the middle of the last century archaeologists preferred to search for sculpted spear-throwers and *bâtons de Commandment* in the caves and rock shelters of Europe rather than concentrate on the entire range of material recovered. To a great extent this practice has continued as still many archaeologists hope to find other similarly interesting objects amongst the mounds of bones recovered from the excavations in Upper Palaeolithic levels, to add to the growing art collection, (although see Conkey, 1978 and Chollot-Varagnac, 1980). Thus the classificatory system that has not changed in a century recognises artefacts such as *sagaies* and *lissoirs* immediately and assigns to them a certain place in the use and character of the site. So too iconic representations of animals are identified and documented and possibly a few 'decorated' bones might be included to demonstrate the range of art work present. When combined with the other excavated evidence, from tools and their use, faunal and pollen evidence, miscellaneous objects, possible fires, and associated dates, the excavator has everything he/she needs to present an idea of the site and the associated activities.

As the analysis of Palaeolithic art and artefacts has concentrated on the most spectacular examples of the parietal art, more numerous examples of mobiliary items were merely incorporated into this all embracing theory of development, and the differences in timescale, content and context were consequently neglected. Bahn points out that there are relatively few sites in which both parietal and portable art are found: 27 in France, 9 in Spain and 3 in Italy, (Bahn, 1989:39) and so it is not likely that exactly the same theoretical perspective can be used for the interpretation of both. For apparently non-functional mobiliary artefacts of bone, the classificatory 'options' of iconic representation or decoration, or 'unclassifiable' remain.

In this way archaeologists effectively ignores the vast majority of bones which are at first glance uninformative and uninspiring. However, these bones still represent a large residue of some form of human activity, and are not simply faunal remains, and thus provide a substantial 'sub-class' of data. Their common properties are that they are recognised as being *engraved*, but as this is usually only a few lines they are described as 'random', or more cautiously, 'non-figurative'. These very terms are unreflective and nonspecific, and even the most informative article usually fails to set out explicitly on what criteria a certain artefact is relegated to a particular class, and therefore excluded from others. This unacceptable neglect of an entire data set is undoubtedly due to the out of date classificatory system which has no place for them – considering such artefacts to be literally 'neither use nor ornament'.

1.3 The Ethnographic Record.

> 'The total length of time during which hunting-gathering adaptations have existed... is on the order of two million years or more. It would seem logical that Bushmen are many thousands of times more likely to be representative of all modern hunting-gathering groups than all such groups of the present are to be representative of the total range of hunting-gathering adaptations past and present.' Freeman 1968:264.

The following section expands on the theme that the weakness of many theories of prehistory lies in the uncritical projection of the present into the past. Certain concepts entrenched in the early stages ofthe development of human social theory, such as the belief that present day hunting and gathering societies were 'regressed' and 'primitive' led to the conclusion that all populations with the same lithic technology must have been so as well. Hence the people of prehistory were believed to be only beginning to evolve the rudiments of social and cultural complexity. This practice became widespread and parallels were drawn between modern 'primitives' and prehistoric populations solely on the basis of a perceived similarity in their material culture (Bégouën, 1929, Breuil, 1925, 1926). If links could be found, it was assumed that they shared a common pattern of social organisation and religion, hence the interpretations and references to 'hunting magic', rites of passage, shamanism, 'sanctuaries', and male dominated hunting societies are rife in the study of the Upper Palaeolithic (Bégouën, 1929, Breuil, 1952, Leroi-Gourhan, 1964, 1968). This widespread use of analogy is relevant to notation and the Upper Palaeolithic: is this practice just one more example of researchers projecting their ideas of society into the past, and locating the presence of a phenomenon on the basis that it 'looks like' something we have in the present?

1.3.1 Introduction.

It is widely recognised that researchers who are investigating the past are influenced by preconceptions derived from their present. This can affect not only the identification and interpretation of any material recovered, but more fundamentally it can influence where this material is sought. Historians and mathematicians have used the archaeological and historical records to trace the earliest numbers that humans are known or supposed to have made (Hogben, 1949, 1960, Menninger, 1969, Boyer, 1968). Other researchers have tried to look for the precursors of numerals by looking for the evidence of behaviour that might have preceded their development. This latter approach is characteristically based on the following set of assumptions already outlined in this chapter: if past populations are known to have constructed an elaborate material culture, have lived together in large aggregations, and transmitted their culture over a wide geographical area, then they must have needed some form of numerical system to order and structure their lives (Marshack, 1972, Baudouin, 1916, Leroi-Gourhan, 1964).

On this basis researchers examine all the material recovered from the site to identify the evidence for this presumed numeracy. Both approaches rely on the investigator being able to recognise the various forms in which the data may occur, the precise nature of which is rarely discussed and made explicit in advance. Instead the researchers assume 'they will know it when they see it', based on the premise that it bears some kind of resemblance to contemporary phenomena. As this thesis is concerned with the identification of notational systems in the Upper Palaeolithic and in devising an objective means to locate them, should they exist, it is impossible to ignore the fact that the recognition of such a system will be coloured by expectations. Therefore it is necessary to define any anticipated bias and the exact basis on which comparisons are made between Palaeolithic and modern material.

1.3.2 Finding the Missing Links?

' My thesis, then, is that though a candid appreciation of limitations is appropriate where analogical inference is concerned, its use in archaeological contexts is neither dispensable nor radically faulty. It can play a legitimate, constructive role in archaeological enquiry if used subject to the methodological constraints that have been emerging, under pressure of increasingly sharp criticism, since the inception of a methodologically self-critical archaeology.' Wylie, 1985:64.

The relevance of analogy to prehistory remains perhaps the most contentious and sensitive area in the subject. The sites discovered at the end of the last and the beginning of this century that we now know to date to the Old Stone Age were considered then to be part of a more recent past of thousands rather than tens of thousands of years ago. Based on a perceived similarity between the lithic assemblages, the material recovered from the european sites was compared to the ethnographic material from the 'living Stone Age' cultures of Australia, Asia, Africa and the Americas. From this it was deduced that similar artefacts must necessarily have performed identical functions and that the social systems and even religious beliefs must therefore have been directly comparable (Laing, 1892). What is more difficult to comprehend is why, as the understanding of the antiquity and true nature of prehistory increased, paralleled by the rejection of 'progressive' theories of evolution by anthropologists, the method of analogy remained as unsatisfactory as before.

What Wobst (1978), describes as the 'tyranny' of the ethnographic record, is the way in which archaeologists have in the past used ethnography as an observed and therefore 'factual' account of human behaviour, and then proceeded to interpret their excavated data along these recognised lines. Wobst's argument is concerned with the assumption that the observable behaviour of hunting and gathering societies is exactly replicated in the past. Instead he calls for the recognition of variation and also acceptance of the possibility of idiosyncratic and previously unknown forms of behaviour. Similarly Gould (1980) calls for a move away from the interpretation of all finds by analogy, as this is derived from the assumption that all contemporary phenomena bear a physical resemblance to their precursors and that all precursors lead directly to the present day phenomena without deviation and extinction. This misuse of analogy also assumes that all phenomena in the past are represented in the present and *vice versa*. Therefore relating all evidence from the past to the present, and assuming that two artefacts with the same form necessarily perform the same function and possess the same meaning inhibits true evaluation of the nature and the context of the material, and any potential contribution from the past.

The point made by Freeman (1968) on the limits of the validity of comparing small scale Hunter-Gatherer material to the Palaeolithic, quoted at the beginning of the section, is noted. If we accept the variability of human cultures as they exist in the present, then it is likely that differences existed *between* the populations of the past. As hunting and gathering societies have existed for tens of thousands of years and occupied all the habitable world it is unlikely that the present societies are representative of all hunting and gathering societies. Therefore although one cannot expect to locate in contemporary cultures patterns of behaviour that replicate the Upper Palaeolithic in totality, it is possible to look for ways in which particular patterns of behaviour replicate themselves in the archaeological record. As the timescale between the past and the present is so great, then the variability amongst present hunting and gathering groups, whether Australian aborigines, Innuit or Bushmen is likely to be less that the variation between any one of these groups and the population of the Upper Palaeolithic.

Similarly the point that anthropologists are not always privy to many aspects of private interaction in the society that they study; that they use informants , who as individuals cannot provide the overview that the archaeologist seeks; that many of the designated 'norms' of behaviour disguise a substantial amount of variation, are all freely admitted by anthropologists. Thus the limitations that Wobst identifies are taken for granted by an anthropologist reading a given ethnographic account, and so the conspiracy of silence over endemic problems in anthropological fieldwork that Wobst attempts to reveal, no longer exists. This is not to minimise the very real danger that Wobst has focused on, namely that the ethnographic record is used uncritically by many archaeologists, who then infer all kinds of parallels to their excavated material on the perceived similarity to the observed ethnographic 'facts'.

Perhaps as Orme (1981) suggests, the historical divergence of the disciplines of archaeology and anthropology is the root cause for the weakness of the interdisciplinary use of analogy. The development of two distinct schools of thought covering overlapping areas has not resulted in a fluid exchange of results, methodologies and perspectives. For the construction of appropriate analogies between the two has lead to an inadequate understanding of the theoretical issues on both sides. That the accounts of anthropologists are essentially abstractions of their general observations of human behaviour, are 'incomplete' with regard to the potential amount of information and often do not deal with variation of behaviour within communities, is a much discussed and recognised limitation within Anthropology. Orme distinguishes between an 'ethnography' and books of 'social anthropology', one being the account (in isolation) of a specific society, and the other is broadly speaking, the theory that is derived from looking at many such ethnographies, and represents an attempt to deduce any recognisable patterns of behaviour, and also to isolate the variations of this behaviour and the single occurrences. It is the latter body of literature, which perhaps gives the more cautious and accurate perspective of human behaviour that archaeologists neglect. Instead they tend to look at ethnographies for a given practice and thus draw 'piecemeal parallels', which is an unacceptable method of constructing analogies.

Given the difficulties involved in comparing the observed social present to the excavated artefactual past, it is hardly surprising that some have attempted to minimise the importance of the role of analogy. Although Wylie claims that Freeman

> '... insisted that analogical inference should be eliminated from all archaeological contexts', Wylie, 1985:88.

it is fairer to acknowledge that his intentions were more moderate. Freeman makes a number of valid criticisms of the techniques that have been employed in the past, yet he qualifies these misgivings by emphasising the usefulness of comparing and contrasting the cultural practices of any number of societies, if only to demonstrate the considerable variation that is known to exist. Thus he concludes that,

> 'I have not meant to imply that the comparison of past and present sociocultural adaptations can reveal no important similarities or identities. However, such parallels must not be assumed to exist before it has been demonstrated that they do.' Freeman, 1968:264-5.

Yet in the model that Freeman has devised for archaeologists to minimise the role of analogy to the strictly relevant, it seems that the solution that he is advocating resembles what Wylie describes as 'artifact physics' (Wylie, 1985). Based on 'the material aspects of culture', which were obviously derived from 'patterned human behaviour', he draws the distinction between behaviour that is influenced by 'biological factors', and that which is culturally conditioned. Furthermore, for the purposes of his model, any ideas or values that are not observable in the archaeological record, 'need not be considered part of culture'. Thus the archaeologist must focus his analysis and deduce any information solely from the assemblages in the archaeological record. The material culture is inevitably the product of behaviour, which as Freeman recognises, is to a greater extent socially determined, and yet how any valuable informative insights into this fundamental area are to be gained from his model is not explained. He talks of,

> '... the slow and painstaking isolation of regular types of associations of materials and their formal equation with activity types',

and yet much of the information that will be recovered in this way will depend on inferences made about how a given artefact was constructed, and what was its intended use. Thus Freeman is making a correlation between the material record and behaviour, which assumes known and predictable patterns of behaviour that he himself does not believe exists. Also he gives no account of how the material in prehistory must have accumulated over time; that is, given Freeman's misgivings about the way that contemporary hunter gatherers have changed over time, can we assume that the same pattern in the archaeological record was necessarily always generated by an identical action of behaviour? In addition Clark (1968) makes the point that archaeologists never know, 'what remains unknown and the variables among what is known', and so he cautions against making any reconstructions solely on the limited artefactual evidence presumed to be available. In fact, given all these doubts, it is impossible to see what archaeology has gained from the exclusion of analogy, but a sterile methodology and taxonomy, a basic classification of artefacts removed from their human context.

It is the task of the archaeologist to use the excavated remains to hypothesise as to the nature of the extinct society, yet it would appear that the model proposed by Freeman severely restricts this endeavour. The transition from the excavated material remains to the generation of a probable description of the type of social system that produced them inevitably involves the use of 'numerous intervening assumptions'. Freeman adds that,

> 'Were useable data available, even if all extant groups were found to exhibit a given correlation between social structural type and activity patterns, I am not prepared to admit that

it is justifiable to assume that past social groups with many or even most of the same activity patterns necessarily also had the social structural type that is their modern correlate.'
Freeman 1968:266.

1.3.3 Looks Like an 'Analogy'.

There are criticisms made of extracting information for comparative purposes away from its original context purely on the basis of a physical similarity. Gould advocates the use of 'continuous analogy', that is, a comparison of excavated material that can demonstrate by the continuity of its archaeological deposits that it can be linked to the contemporary populations of the same area. In this instance, material from the Puntutjarpa Rockshelter in the Western Desert (Gould, 1977), was compared to the contemporary assemblages of the Ngatatjara Aborigines. As there appears to have been a non-seasonal climatic constant for the last 10 000 years, Gould believes that these ecological constraints would have restricted the range of possible social and technological adaptations. Thus it is possible to conclude that the 'fit' between the ethnographic assemblages and the excavated material, which includes floral and faunal remains, expresses an identical response to comparable environmental conditions, namely in this instance, a hunting base-camp.

This parallels the work of Yellen and Harpending (1972-3) on the !Kung bushmen of the southern Kalahari to local Stone Age Wilton sites. Again the analogy is based on an appreciation of the relationship of the modern population to their environment. In identifying three broad principals of social organization, namely Anucleate, Intermediate and Nucleate, the authors stress that these models may not necessarily prove to be valid for archaeologists elsewhere. From an assessment of the ecology, they predicted that the !Kung would follow a non-nucleated pattern of residence and marriage, and on enquiry, the observable patterns of residence and measured gene-frequencies seemed to confirm this. In examining the excavated material from the Wilton site it appears that the same animals were hunted over the region, and the lithic scatters around the waterholes showed a considerable degree of homogeneity, with little regional variation. Thus the evidence implies that late Stone Age peoples followed a similar response to the environmental restrictions as the modern population.

The limitations of this method are, as Wylie points out, that for such analogical inferences to be valid the behaviour must a direct result of the environment, which is never the case with the human populations (Wylie, 1985). Clark links his analysis of the assemblages at Star Carr to a range of biophysical responses to the probable environmental conditions of the time, and yet acknowledges the considerable range of 'idiosyncratic' behaviour that could exist even within these constraints (Clark, 1954, 1972). In addition it is pertinent to consider the implications of this for the European Palaeolithic, as the range of cultural responses will have been possibly linked to the environmental conditions during the Upper Palaeolithic in Europe. Yet Gould believes that there exist 'principles about human adaptation in general', which include most aspects of human behaviour and can be extended by 'discontinuous analogy' to include past populations (Gould, 1977, 1980). It is therefore necessary to define the ecological limits or parameters that constrain cultural variation.

In a recent (unpublished) article by Good, Still and Valenti, (1989), the relationship of social adaptation and the environment was questioned. Previous theories, namely those of Gibson (1979), have tended to treat ecological factors as influencing the nature of culture, but retaining the two as separate entities acting together. The issue is dealt with in terms of 'affordances', which are the positive benefits that an individual gains by acting and reacting in a certain way, particularly associated here with the way in which certain behaviour can maximise the chances of survival in a given set of ecological conditions. Although the authors believe that the concept of affordances is universally applicable, there is no single universal set of affordances, as the variety of cultures even within the same ecological conditions demonstrates. Basically, culture should not be viewed as a 'screen' between a person and the world in which he exists; instead it is an all pervasive part of an individual's life from the moment he is born, and does not exist as a separate entity.

> 'If culture and individual perceptional functioning really are inextricably interwoven, there can be no 'Primary Mode' of perception independent of social and cultural influences.' Good, Still and Valenti, 1989:10.

Therefore they believe that ecological social psychology must accept the relationship between social adaptation and the environment, and that this governs the nature of the affordances in all activities and interactions with others. The relevance of this to anthropology is that although much of the psychology of interaction is articulated in terms of individuals, whereas both archaeology and anthropology are concerned with the communality of groups, one of the essential components that Good and Still isolate is the importances for 'affordances' of interaction *between* individuals. The affordances are to some extent reciprocal, and need cooperation and a symbiotic sharing of skills and resources. Thus the nature in which the affordances exist is the result of group action and reaction, which is bound to vary from place to place.

An alternative approach to the linking of past populations to the present is given by Layton (1987), when he introduces his discussion on the relevance of Australian aboriginal and San bushman parietal art to that of the Palaeolithic with the caution that we can only hope to discover, 'what is probable, and what is possible'. Given that the cultural context of the art of the San and the Australians is known to be different, the parallels that can be drawn must be specific and accurate, thus immediately providing a relevant theoretical framework for the subsequent comparison to the Palaeolithic. In isolating the frequencies of certain images in the repertoire, and not at this stage attempting to relate these to their known cultural context, Layton has moved away from the approach of Laming-Emperaire and Leroi-Gourhan both of whom linked the number and distribution of Palaeolithic representations to underlying concepts of style, sexuality and symbolism. In demonstrating how this approach can be of use to the Palaeolithic, and criticising these earlier approaches, Layton concludes that,

> '... looking for specific meanings in Palaeolithic motifs is frustrating and relatively unproductive. Looking for structure is easier, although there are problems in being sure that the structures we measure are always the direct reflection of Palaeolithic culture.' Layton 1987:233.

To extend the implications of this analysis Layton then relates the resulting San and Australian frequencies of the animal species to their known significance in those cultures, thus revealing whether the different way in which they are regarded is reflected predictably in the structure of the way in which they are distributed. As the Eland is of paramount significance to all the bushmen, it predictably featured as the dominant species in all the rock art. Whereas the totemic species appeared to predominate only in the areas associated with that specific clan, and so revealed a very different pattern.

This is hard enough to do for comparatively recent material, even when vestiges of that society are still in existence, and to assess this adequately for the Palaeolithic appears to be virtually impossible. However, I propose that a careful consideration of the ethnographic material with regard firstly to its physical form and the nature of the information which it encodes, or to which it refers, and then to further this analysis by examining how these are components of the various societies, will provide a framework that can be of relevance to the Palaeolithic. Thus if the mobiliary material from the Palaeolithic is analysed not only with regard to its form, and the degree of sophistication that this appears to demonstrate, but this also is related to its *physical* position in the archaeological record, and then finally to its possible place in the social order, then a body of related and relevant information will have been assembled that can at least claim to have considered the major issues involved in the identification of meaning in the engraved mobiliary assemblages.

For this set of assumptions to be valid for the Upper Palaeolithic, it is necessary to establish firstly that such societies were in existence, and secondly that their adaptation to their physical environment and thus the complexity of their social organisation made the use of notation adaptive. Thus it is not enough simply to assert that as the people of the Upper Palaeolithic were demonstrably human and their technology and the later manifestation of cave painting appears to permit the inference that they could recognise number. Although it is a plausible argument on the basis of the evidence, it cannot simply be extended to cover the phenomenon of notation: that is, to recognise number is one thing, but to then to *record* a given quantity is likely to be the response to a specific set of circumstances, the likely appearance of which must be identified.

1.4 Prehistoric 'Texts'.

'Artifacts and art forms survive to indicate a cultural system based on fully symbolic conceptual organisation. A careful analysis should shed light both on these early systems of conceptualisation and on stylistic variability within such systems, as well as their significance for the social interrelationships of these human groups.' Conkey, 1980:225.

The purpose of this section is to examine how portable artefacts from the Upper Palaeolithic can be identified and classified. All such material has been purposefully created with some investment of time and thought and as such they are clearly sources of information. However without documentary evidence how can this be deciphered and used? Should notational artefacts exist it is necessary to define certain criteria by which they can be identified, as it is hypothesised that the form and content of these artefacts will be structured and standardised. Some researchers have already located what they claim are 'tallies' and calendars. These artefacts have been identified by the nature and structure of the marks, and more recently through analysis of the order and manner in which the marks are made using a microscope. After a summary of their findings, I will explore the possibility that these researchers have isolated a potential 'class' of data that can be used for further research.

1.4.1 'Reading' Prehistoric Texts.

As a class of data the 'art objects' have made a substantial contribution to the understanding of the culture of the time period. Generally, any study of art is likely to include a discussion of the physical and cultural context of a particular artistic style, which is expected to elucidate to some extent its purpose and peculiar characteristics. Due to the paucity of independent contextual sources of cultural information from the Upper Palaeolithic, archaeologists are left with the inductive problem of inferring what social conditions *may* have promoted the manifestation of that particular form of artistic expression. Thus the content and form of the art from the Upper Palaeolithic is of crucial importance to any study of the period, whether technical, ecological, behavioural or concerned with the evolution of the complexity of the social organisation.

The presence or absence of certain stone tools in the Palaeolithic has become the crucial indicator for archaeologists in determining the primary function of an excavated site. There is information encoded in every man-made artefact, relating to the particular form selected and the tools and method used to create it. In this way archaeological material can be said to form 'texts', that is sources of potential information leading to insights into prehistory. These data can be used, with reference to other aspects of the archaeological assemblage which provide the context, to determine the designated purpose(s) of that tool. As tools relate to the precise or probable occupations and therefore subsistence activities of the inhabitants, there have been efforts to rigorously document the exact form of each recovered artefact, to correlate this with other examples from the same sites, and so establish classes and standardised 'types'. This has proved to be a successful strategy for the European Palaeolithic, and has provided a useful framework for any subsequent research.

Engraved Plaquettes, Venus Figurines and *bâtons de commandment* are probably the best documented and most widespread of the mobiliary artefacts, but there is a wealth of worked and engraved bone, antler and stone that similarly cannot be identified as performing a known function. That some of the material was neither the result of a chance event, nor a by-product of a known method of manufacture can be testified by the nature, number, extensive distribution and standardisation of these artefacts. There is not necessarily a direct correlation between the amount of time invested in the production of an item and the 'value' of the finished product, it is evident that some of the artefacts were the result of a considerable input of time and skill on the part of the maker. Carpenter recalls in a discussion of Eskimo art,

> 'When spring comes and igloos melt, the old sites are littered with waste, including beautifully-designed tools and tiny ivory carvings, not deliberately thrown away, but, with even greater indifference, just lost.' Carpenter, 1961:362.

What then was their purpose? Such artefacts no less than the stone tools of the period form 'texts' that can be interpreted, and yet without an understanding of the context, and the range of cultural experience to which it refers, any attempt to 'read' them and move towards explanation will be unproductive, (Layton, 1992:213). Although it is possible to determine the primary purpose of tools from their form and by any associated material, over the last few decades researchers have isolated secondary marks which relate to use wear patterns. These traces on the edge of the tool are thought to be the direct result of their use in identifiable situations which has enhanced further our understanding of food procurement strategies.

In stating that information can be gained from studying the material used, the style of marking and the structure of any marks on a given artefact, the problem remains of identifying their purpose, should they have one. Some additional features can occasionally be isolated that gives clues, but often a careful mapping of the distribution within and between sites of certain artefacts has provided additional information. Wobst (1977) and Conkey (1978a, 1980) stress the fact that some of the portable artefacts are engraved and some are not, is a remarkable feature in itself. It is an indication of the process of selection and intention.

> 'The transformation of a piece of raw material, whether bone, antler, or cave wall, into an artifact or cultural product is a form of communication. In Paleolithic art not just any bone, antler, or cave wall locale was selected.' Conkey, 1980:243.

There are many problems inherent in reading prehistoric texts which once defined can be dealt with by devising a pertinent methodology that takes account of certain specified conditions. Other problems cannot be resolved using the present store of archaeological and anthropological knowledge and yet none the less require identification to indicate that the researcher is aware of the potential limitations of her work. This is necessary to retain an objective approach to the area within prehistory, and perhaps more constructively to identify the areas in which further research is needed. Perhaps it is necessary to look at the approach of past researchers in the area to see how they have managed to isolate possible examples of notation from the repertoire of engraved artefacts.

1.4.2 Conclusive Identification of Notation?

Certainly a few examples of 'non-iconic' and 'non-decorative' engraved artefacts have been isolated for further analysis, and furthermore have been described as tallies, as notations, as calendars, in fact, as the earliest examples of recording 'number'. As early as the 1860's, Eduard Lartet considered the number of tiny, parallel engraved marks that adorned the side of a bone, were *"marques de chasse"*, and comparable bones from other sites in Europe were similarly classified over the years. The discovery by Karl Absolon in 1936 of a wolf's bone in Moravia further confirmed the presence of bones with marks that resembled examples of tallies extant in modern French society, (see Chapter III). Absolon's interpretation of the singular grouping of the marks as a 'five count' (1937), was followed by De Heinzelin's theory of the recognition of prime numbers and duplication (1962), and by Frolov's hypothesis of the significance of 5, 7, 10 and 14 (1970). This growing body of data, some retrieved from Magdalenian sites of Europe came to represent the earliest evidence of tallies, presumed to record the day's hunting or the number of people attending a ceremony (Breuil, 1952) as that is all, it was supposed, our ancestors did or, more importantly, could possibly *need*.

In an initially unrelated study of a marked Neolithic bone recovered from the site of Ishango near Lake Edward in Africa, Alexander Marshack went on to link this single find to earlier examples from the Upper Palaeolithic. Like Breuil, Marshack deduced that the configuration of marks on certain bones represented 'tallies'. According to his own unique methodology, he discovered records dating back to over 30 000 BP of the passing of days over time, representing the monthly patterns of the moon. The most comprehensive presentation of his work was documented in **The Roots of Civilisation**, (1972). From an examination of hundreds of artefacts from the museums of Europe, he devised a new means of classifying and interpreting the mobiliary artefacts of Prehistory. Marshack not only analysed the artefacts themselves but extended his work to relate these mobiliary examples to the parietal art, and from this produced a theory of the development of the artistic, notational, cognitive and linguistic capabilities of 'our ancestors'.

The apparent discovery and recognition of the tallies provided another detail to the emerging and 'evolving' picture of Upper Palaeolithic society as one capable not only of hunting and painting, but also of transmitting ideas and living and acting together as large social groups. Marshack too chose to look at the mobiliary artefacts as they represent an appropriate medium for the recording of information, whether for a group or as a mnemonical and therefore personal device. These representations can be broadly divided into two classes; iconic, that is, depicting a naturalistic rendition of a known and recognisable shape or form, or non-iconic. It was a small proportion of this latter class of artefacts that Marshack chose to examine.

1.4.3 Identifying the Data.

The examples that have been isolated by all the researchers from Lartet (1875) through to Marshack (1972) and Frolov (1978) have certain identifiable characteristics. In general terms they are of bone, antler or stone (pebbles and sandstone plaquettes) and are engraved by a flint or sharpened bone. The marks can be faint scratches or, at other times, deeper grooves made by a number of separate strokes, which are aligned along either the long or the short axis of the bone. The techniques of making the marks and the practice of spacing them means that they usually *appear* as single strokes, each roughly parallel to the next. However it is likely that each individual researcher will interpret these marks in a different way. There is the immediate question of which of the marks on the bone are to be included. There could be marks on the bone produced by ageing, post-depositional disturbance such as movement or rodent activity. The marks could also be the result of another human activity, such as the marks made when disarticulating a skeleton, commonly called 'cut-marks', or by using a piece of bone as a smooth working platform. The eventual category of marks that are isolated for further analysis will inevitably vary from researcher to researcher, depending on the criteria that are devised and on the skill and discernment of their application.

Even when the marks are isolated, how are they 'read'? In converting them from the three dimensions of the actual artefact to only two in a graphic representation, certain decisions have to be made as to where to start and how to orientate the bone. The result is therefore one of many possible ways of representing the bone. When an apparent 'sequence' or order is identified and the lines are transposed on this basis, they assume yet another of their *possible* forms. It is common to perceive such order around either the long or short axis of the bone, particularly as it is plausible to assume that this is a relatively objective observation as it may well have provided a *physical* constraint to the maker. There is also the difficulty of representing these marks on paper – is the depth of the mark important enough to mean that this should be conveyed, or the relative width of a deeply scored broad mark? Or is it more the length and the relative position to the other marks on the bone that are the most pertinent factors? Explicitly or implicitly these decisions are made by analysts, and it is time that they were only done so in the former sense.

The advances in scientific technology has made an impact on the ways in which possible notational sequences can be identified and interpreted. Marshack (1969, 1991) used an optical microscope to examine the marks on mobiliary artefacts from which he claims to be able to distinguish not only each individual stroke made by the maker, but also the number of marks made by the same tool, and therefore the number of tools used. The conclusion that he draws from this 'micro-analysis' is that,

> '... if it was made at one or two sittings, with one concept and one rhythm it could be decorative. If it was made by many points over a long time, it was probably not decorative.' Marshack, 1972:54.

As new technology became available, the later researcher Francesco D'Errico (1989, 1991) tested Marshack's findings by using both an optical microscope and a Scanning Electron Microscope (SEM), as well as a transmitted light microscope and a contourograph. D'Errico claims to be able to isolate the use of a single cutting edge or different cutting edges, and 'retouched' and 'un-retouched' edges, the *order* in which they were made, and then estimate the *time* it took to engrave such a composition. D'Errico claims that this methodology is more rigorous than that of Marshack – not only as a result of using advanced technology but in the use of specific and scientific criteria. The latter relate to the precise nature of each identifiable 'type' of notch, and a number of 'blind' experimental tests that confirm the validity of the criteria.

Evidently this investigation gives an enhanced insight into the ways in which the artefacts were manufactured. In his conclusion, D'Errico states that he would predict that a series of notches made on a single artefact by a number of points is *more likely* to be notational, as to change point for each individual marks is uneconomical in terms of time and resources. However Marshack (1989) questions D'Errico's claim of objectivity, and argues that such a rigid interpretation of the physical properties of the marks cannot adequately account for the different 'traditions' of notation that he believes exist in the Upper Palaeolithic. Marshack stresses the need for the analysis of the composition of each artefact and the structural principles therein. Therefore he concludes that micro-analysis is only part of the interpretation of the possible function of an artefact, and that notation specifically requires a methodology that incorporates elements of both scientific and structural analysis.

1.4.4 The Interpretations of the Marks.

Any assumptions underlying a stated hypothesis should be explored and explained in detail, and only on this basis can objective models be devised in order to adequately test the hypothesis. Even if these mobiliary artefacts were notations of some kind they can only be 'read' if the method of coding the information that they store is known to us. For example, Lartet's (1875) interpretation that the marks represent the number of animals killed on a hunt, and Breuil's (1952) concept of numbering participants at a ceremony, are presuming firstly that the makers were using a system of one to one correspondence i.e. one mark, one item, and secondly that the function was indicated by the context of the artefact, both stratigraphically, and socially within the cultural system that was inferred to exist. For example, if an artefact is discovered deep in a decorated cave, it is presumed to form part of the rituals that are commonly believed to have taken place there. Marshack believes that some of the marks form iconic symbols, and they depict or represent or refer to what is being tallied (Marshack, 1972). Yet such presumptions must be tested by further analysis of the precise nature of the marks, and a consideration of general propositions based on the ethnographic study of notation, and their archaeological context. Simply because it is plausible to suggest that notations were made, for whatever reason, does not mean to say that they *were*.

In 1969 Alexander Marshack published a paper on the artefacts from the Italian site at Polesini where, although acknowledging the contribution of Breuil (1952) and Leroi-Gourhan (1965), he described the use of the class of objects concerned as,

'... a long-term, cumulative, sequential use ... In the Upper Palaeolithic sets of marks such as these sometimes occur alone, sometimes with animal images, sometimes with non-representative symbols, sometimes with images of the female figurine or even a plant. The combined evidence suggests that they did not represent a tally of animals killed.' (1972:276).

If however the information 'stored' in their sequences is related to something as universal as the passing of the days and seasons, Marshack believes that he can begin objectively to deduce the information that the notations may contain. Following Baudouin (1916), Marshack believed that Palaeolithic populations will have observed the succession of the seasons and probably the waxing and waning of the moon, as well as the relative position of the sun in the sky over the year. Plausibly, observance could lead to understanding and then to prediction, and here the argument moves towards a 'calendar', which Marshack tends to avoid, particularly as it tends to be associated with an arithmetic understanding of weeks and months and not 'moons' or solar or stella phenomena. Instead the people of the Upper Palaeolithic would have used the information to 'adapt' more successfully to their environment by being able to use the knowledge of the diurnal pattern and to measure the time periods by tallying. As the patterns of the moon, sun and stars have not changed over the thousands of years from the Aurignacian to the present day, they provide the nearest we have to an 'objective' test of fit in deciphering any tally that relates to them. *If* they do exist, then it is possible that the information can be decoded as it should follow a recognisable pattern.

The ways in which they could be depicted will depend on the significance of any symbols used by the recorder. Marshack's argument is based on his belief that the cognitive processes used throughout the past are essentially the same as our own, (1979, 1983, 1985).

'I was trying not so much to solve the notation, as to understand the ways-of-thinking, despite the difference in language and culture, at a level that was more basic than language or culture because the process was human, kinesthetic, and cognitive, and because the brains of the maker and the interpreter were more or less equivalent.' Marshack, 1972:39.

This perspective is reminiscent of Bastian's *Elementargedanken*, the belief that if human brains function in the same way they will produce similar thoughts based on universal concepts. This possibility was explored by Boas at the turn of the century, and much of his ethnography was directed towards trying to establish these universal characteristics as stages through which all populations once passed, or will go through. For Lévi-Strauss such universal 'human' concepts could exist only at the level of structure as the cultures within which the individual existed would distort the patterns, and the more 'complex' the culture the greater the distortion. In studying the 'myth' of more 'primitive' cultures he hoped to be able to identify certain basic principles of thought formation, and thus identify structural universals, (Lévi-Strauss, 1963).

1.5 Theory, Method and Data.

'In analysing the process of the creation of material culture, there is increasing reason to believe that neither stone tool-making nor stylistically decorated cave walls and portable artefacts evolved gradually in terms of slow and accumulative transformations.' Conkey, 1980:227.

This section starts with a brief resumé of the arguments presented in the previous sections, namely the need to adopt adaptive rather than progressive models of evolutionary theory and to restrict and define use of analogy. From the discussion of the information derived from prehistoric texts and having briefly looked at the work of past researchers it is evident that a new and more objective approach is needed in order to fully investigate whether notation existed in the Upper Palaeolithic.

1.5.1 Evolution, Analogy and Notation.

Any methodology will incorporate not just a theoretical basis with which to structure and interpret the evidence, but a practical strategy outlining the exact nature of data and how to abstract information. One of the principle challenges in the question of notation is that there is no single accepted body of either method or theory with which to tackle this contentious area. It is not that attempts have not been made, but it is as much that the criticism has been such that they have not really provided appropriate models on which to build.

There are elements of Marshack's reasoning that are plausible: that some form of notation existed in the Upper Palaeolithic, and that the same populations had an understanding of the lunar phases, the sun's altitude and the rising of some stars, although deductive and not relying on known 'facts' *could* have occurred. This is not to say that it did. It is pertinent to consider exactly what is under consideration, a tally which is the result of recording certain aspects of natural phenomena, probably the moon, resulting in a pattern over 28 - 32 days. Marshack believes that the Taï Plaque also indicates the solar solstices, a six-monthly occurrence, (Marshack, 1990). These natural phenomena are evident and 'accessible' to individuals throughout prehistory and the world, and as Marshack has already attempted to demonstrate, the necessary cultural demand and level of sophistication was also present to record them.

The implication is that, as we know calendars and tallies existed later in prehistory and have formed a valuable aid in subsistence strategies, particularly for agriculturalists, that they must have been evolving for thousands of years before to reach their later level of sophistication. Firstly, however, the earlier prehistoric populations didn't *know* that they would be needed later, and so it is crucial to present only evidence that relates to their use and need *then*. There is no inevitability or even predictability about they way artefacts are produced, and there is no reason for supposing that two like artefacts are necessarily 'related' if they are separated by time and space. Therefore lunar tallies *could* have been invented and re-invented over the whole timescale, and develop in isolation, but there is no reason why they should have 'evolved'. Whether or not they did must be demonstrated by the evidence from the archaeological record.

Marshack goes on to trace the 'development' of lunar notation over the Palaeolithic timescale from the Aurignacian through to the Azilian, Mesolithic and Neolithic. Yet for an 'evolved' tradition to have existed requires further continuity not only over Europe but also over a long timescale, and although the transmission of information is evident from the homogeneity of the flint tools, for example, and other mobiliary artefacts, the identification of a 'system' of lunar notation requires very careful investigation.

It is equally speculative to discuss the 'development' of artefacts, implying that one is more 'advanced' than another. Supposed 'complexity' refers to the task which the artefact is expected to perform, but does not provide a place in the chronology and timescale on this basis alone. The uses and misuses of analogy concentrate too on how appropriate a comparison is between two phenomena, each from a different culture, and possibly separated by hundreds of years. Clearly the exact nature of the comparison must be defined, and the criteria by which similarity is assessed also made explicit.

Unfortunately Marshack applies his theory of evolution as a more or less linear pattern of progress to the tradition of lunar notation. For this to be an appropriate model Marshack must be able to demonstrate either that the *information* transmitted is more complex than before, or that the means of *communication* is more efficient. Furthermore the relation between two 'links' should be considered, otherwise it cannot be assumed that one from of notation was created as the direct result of the knowledge of previous examples. If there is no evidence from either the physical characteristics of the artefact or its location to suggest that it was related in some way to the other examples that chronologically preceded it, then it is equally plausible to assume that the example was created in isolation. In addition, although certain technical phenomena pass through a number of developmental stages, these could have been made in relatively rapid succession in one generation, a lifetime or a few hundred years to fulfil a specific need, and not necessarily thousands of years.

Such interpretations of change over time are misleading and inappropriate. The criticisms of the use of 'evolutionary' theory to interpret the patterns of cultural and technical changes of prehistory are directed at the misuse and misapplication of terms. An evolutionary perspective can present a constructive theoretical basis with which to interpret Prehistory, provided the limitations and misconceptions are recognised and understood. It is valid to start with the premise that for aspects of human society or morphology to have survived to the present day, they must have been selected for as the most successful available strategy over time. At no point however should it be suggested that there has been no modification over time, or that there is no possibility of an invention and diffusion of ideas, both of which have been constant aspects of man's historical development.

1.5.2 Where Do Data Come From?

'I would argue that art mobilier or portable art, would be more likely to be informed with stylistic messages than would either stone tools or wall art.' Conkey, 1978:79.

From a discussion of mobiliary artefacts and the data that other researchers have identified as 'tallies' or 'notations' a certain 'class' of artefacts has been isolated. The characteristics of this potential data set are by no means precise. A general description of portable artefacts of bone or antler, worked or unworked, with certain lines engraved by flints or sharp points on the surface appear are the only common characteristics discussed in the literature. Any other details as to the necessary *form* of the engraving, size of artefact, location and distribution are simply not accurately discussed, although see Couraud & Lorblanchet, 1986. In order to isolate such a group of artefacts for analysis it seems logical to look at as many artefacts of this class as possible to try to establish whether *all* such artefacts are possible examples of 'notation', or only 'some' as Marshack implies.

Relatively open access to material via national, town or private museums is currently regarded as an essential precondition of research, and yet despite this freedom it is still the case that researchers must 'select' their artefacts. Due to the sheer quantity of material recovered, it is unlikely that more than a small proportion could be included in a single or even a series of studies by an individual, due to the limitations of both time, resources and funding. In order to confine the scope of the study, researchers have narrowed their field, to concentrate on a single type of artefact, restricted to specific geographical locations, and to a defined timescale. These constraints may exist anyway, as indeed it is not uncommon that certain material is found only in one area, and then may occur only for a few hundred or thousand years, such as the ' Venus Figurines' which appeared *c.* 33 000 years ago, but are thought to be most numerous *c.* 25 000 to 23 000 BP. (Gamble, 1982:97).

There are many Upper Palaeolithic sites over Europe, which collectively span some twenty five thousand years. The sites which the majority of researchers refer to are inevitably restricted by the store of archaeological material current at the time. Excavators at specific sites were often solely responsible for the documentation of their finds and could therefore dictate the circulation of both the artefacts and reports, not all of which came into the public domain, with the result that some collections have been lost, or have not been used extensively for comparative purposes. There are artefacts from the Upper Palaeolithic that cannot be directly associated with any known predictable tasks. Due to the retrieval methods and stated aims of the early workers in prehistory, the majority of mobiliary bone artefacts lie neglected in museums. A recent study estimated that there were over 10 000 mobiliary artefacts in collections in the West alone, (Chollot-Varagnac 1980).

Although the distribution of sites all over Europe is not even, the apparent tendency of the sites to cluster is further stressed by the imposition of national boundaries over the landscape which divide up the sites to give an impression of discrete regions. This national tendency was exacerbated by the emergence of various schools of archaeology also constrained by linguistic and cultural boundaries, all with differing techniques of excavation and interpretation of the material recovered. The model used by Breuil, and later Leroi-Gourhan, represents the classic model for the Upper Palaeolithic, with the divisions into the Perigord, the Lot, Cantabrian Spain, and the Pyrénées based on the location of the painted caves. However inevitably this did not necessarily provide the ideal model when the material from sites with no parietal art, and the discovery of rich finds from open air sites were included. The location of cave sites is by necessity dictated by the relief and geology of an area, but there is strong evidence that the populations were not discrete groups, and probably did not exclusively occupy restricted areas.

1.5.3 Summary and Aims.

Such small mobiliary artefacts have been discovered within the excavated assemblages of all major habitation sites from the Upper Palaeolithic, including the cave sites with parietal art. Yet to merely isolate a possible 'type' of artefact is not really to deal with the true implications of whether or not these marks represent a system of notation. Simply because these objects do not have any other recognisable or deducible function, and they 'look the same' as examples of tallies from the ethnographic record is not sufficient evidence to assert that past populations made records of quantity of some kind. Instead the researcher must go on to confront and extend the enquiry to investigate *why* the marks might have been made and more pertinently, why *then*?

An appropriate perspective is to look at the various ways of structuring visual representations in order to communicate ideas. By examining their structure rather than their content it is possible to identify certain recognisable properties relating to the nature of the information transmitted. All such forms are designed to convey information *effectively* and isolating any common elements relating to their function enables a researcher to distinguish and categorise the artefacts. As it is the formal properties of the lines that are isolated, it should be possible to apply such a measure to an high proportion of engraved mobiliary artefacts, and so it not necessary at this stage to confine the scope of this thesis to items from a single 'class' or 'type'.

Any attempt to discover whether any artefacts *are* notational presents a challenge to the researcher. Some artefacts may be isolated as possible examples of notation from the identification of certain regularities in the structure of their lines. Another valuable source of information is the nature of the site from which these artefacts were recovered. By investigating the archaeological context of *each* artefact it may be possible to isolate additional key characteristics of such items to try and build up a profile of the data. However as it is unlikely that there will be any additional evidence in either their form or the context within which they are discovered that could conclusively determine whether or not they were made and used as notations. Therefore this thesis is concerned with testing the *probability* that notations existed in the Upper Palaeolithic rather than attempting to 'prove' or 'disprove' a hypothesis.

This thesis is not a purely archaeological discussion of sources of data. Instead it is rather a comparison of fully modern societies from the Upper Palaeolithic to those from the recent past. By integrating archaeology and anthropology I hope to demonstrate that a wider perspective can be gained of the cultural process of human adaptation. Anthropology provides the ethnographic data of systems of notation in use in numerate cultures (tallies), yet only archaeology can give the long-term perspective needed to study the evolution of human cultural adaptation. Rather than arguing for a universal need to encode and create notation, my hypothesis takes the form that conditions in the Upper Palaeolithic may have been conducive to notation. The question is how to develop a methodology to identify notational artefacts, should they exist, with a reasonable degree of probability.

The following chapters provide a discussion of the previous work on notation, and present an alternative model which is tested on original data from the recent past and prehistory. The work of Marshack on the subject of notation cannot be ignored, and it is referred to in some detail in the following chapters. However was my dissatisfaction with his work that lead me to devise a more specific and rigorous methodology. Chapter II looks at anthropological theory of art and decoration as means of visual communication, and I go on to formulate a methodology to identify notation, decoration and iconicity on mobiliary artefacts. Chapter III uses documented examples of notation (tallies) taken from the ethnographic collections of four museums to test my method for the identification of probable notational artefacts in the fully evolved society of the Upper Palaeolithic. Chapters IV, V, VI and VII concentrate on examining material from the Upper Palaeolithic.

Chapter II

Art, Decoration, Notation and the Use of Symbols.

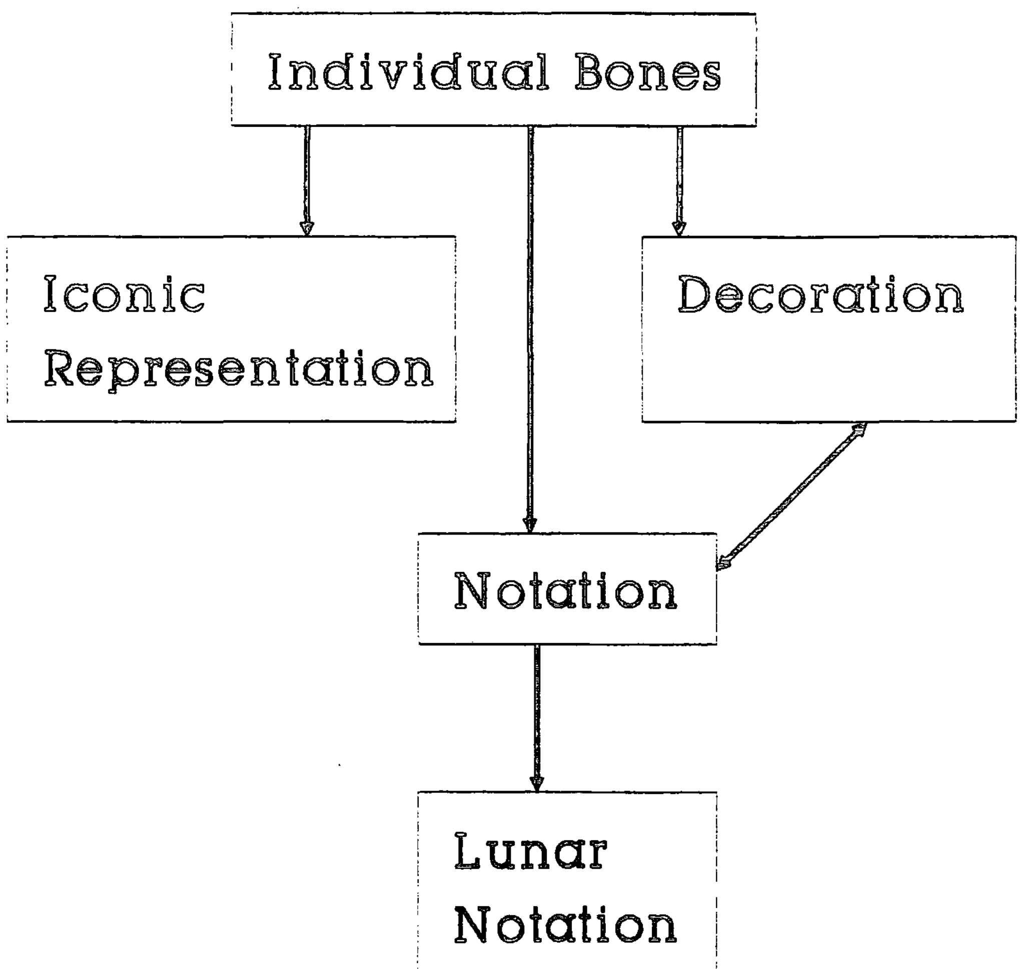
'No people known to us, however hard their lives may be, spend all their time, all their energies in the aquisition of food and shelter... Even the poorest tribes have produced work that gives to them esthetic pleasure, and those whom a bountiful nature or a greater wealth of inventions has granted freedom from care, devote much of their energy to the creation of works of beauty.' Boas, (1955:9).

2.0.1 Introduction

Having established in the previous chapter the theoretical parameters that I intend to use, I continue my discussion by considering possible ways of identifying examples of notation. The aim is to construct an objective model that can be applied to a varied body of data, yet is specific enough to locate possible examples of notation. By devising a set of criteria from first principles rather than from the data, the resulting model is predictive rather than reactive. In order to ensure that the discussion is relevant both to the present and to the Upper Palaeolithic in Europe reference will be made to both timescales when appropriate. It is necessary to include information covering all areas of visual representation, namely 'art', 'decoration' and 'notation' to provide alternative models in order to admit the possibility of two interpretations and classifications by my criteria as being equally valid. The aim is therefore to provide an integrated discussion of art and then notation, one in which terms and structural boundaries are relevant.

In the following sections I aim to devise a methodology which distinguishes between intentional methods of marking artefacts, and those which can be presumed to be random, such as the result of cut-marks and butchery practices. Certain pertinent criteria need to be defined which, when applied, can assign any available data to the most probable group. Table 2.1 illustrates the possible ways in which each bone can be classified by the criteria. It shows how a bone might be initially classified as 'decorative', but also as a possible examples of notation. Many classificatory

Table 2.1 — The Classification of a Bone.



devices already exist, and some of the artefacts and cave paintings of the Upper Palaeolithic are described as manifestations of 'art', and others have been called 'decorative', or designated 'symbols' or 'signs'. The following section attempts to formulate a precise definition of the key terms of 'art', 'decoration' and 'notation' (as illustrated in Table 2.1) and the associated concepts of aesthetics and the use of symbols and signs.

2.1 A Consideration of 'Art'.

Boas distinguished two essential attributes of 'art':

i. A purely formal one in which the enjoyment is based on form alone.

ii. One in which the form is filled with meaning.
Boas 1955:64.

The discussion in the following chapter adopts this division by looking first at the form and symmetry of iconic representations and decoration, and then going on to look at the use of signs and symbols. My argument follows Layton, that not all graphic representations possess both aesthetic and meaningful properties. Graphic signs are used in cartography which although meaningful are not arranged on the map according to the aesthetic motivation of the cartographer, (Layton, 1990). The related terms 'symbol' and 'sign' form an integral part of both artistic expression and number systems, and in common with the other categories provide evidence of a desire or need for forms of communication. It is extremely unlikely that researchers will discover exactly what ideas were being transmitted, yet careful study of the structure of signs and symbols and their contexts may reveal something of the complexity of the system involved.

2.1.1 A Certain Style.

The sorts of information that are known to have been transmitted in artistic expression over the last few thousand years are diverse – the use of colour can be used to symbolise abstract concepts such as 'black' for death and evil, and 'white' for purity and innocence, as in recent western society. Standardised variation, or 'styles' of certain key artefacts are used to date and identify specific periods of history, such as the Iron Age La Tène brooches (Megaw, 1970). In such instances the variations are known to correspond to identifiable periods of cultural and political change and thus provide useful archaeological markers. Similarly funerary assemblages or 'grave goods' indicate the approximate period, the relative status and sometimes the age and sex of an individual, as well as possible indications of ritual and ideas connected with and afterlife (Garland, 1985).

The chosen style of a visual representation may be connected to religious ideology as, for example, the technical virtuosity of the Islamic tradition of geometric representations is directly related to the religious prohibition on using figurative art in religious contexts. The particular form of an item can relate to the function of the artefacts, such as when a raised area of cross hatching around a handle provides a grip for the user. Boas similarly identified how the decorative binding around the rims of baskets reflected the primary need to finish off all the ends used to weave the body of the basket (Boas, 1955:55). The symmetry of handles on either side of amphorae relate as much to the need to balance the vessel as to ideas of harmony.

As we already know that a system of graphic representation existed in the Upper Palaeolithic it is necessary to devise some means of distinguishing notation from decoration and iconic representation. The purpose of this artistic expression is not known, but many researchers have moved away from considering the possible aesthetic pleasure it may have represented for the artists and their audience, commonly referred to as the 'art for art's sake' argument. Instead researchers have concentrated on the concept of the art transmitting ideas and concepts, (although what these were exactly is an open question).

The term 'style' is one that requires definition. According to Sackett,

> 'It [style] is based upon the notion that there are usually alternative means of achieving the same end, that the specific expression any given artefact assumes results in a sense from a choice made in any given cultural situation.' Sackett, 1973:321.

This links style to a purposeful selection of materials and design elements, not to an individual perception of aesthetic, or random coincidence, but according to cultural convention. Any change of these factors comes from within the culture on the same impulses that maintains a style for a particular period. Conkey uses a fourfold definition of style derived from the work of the art historian Gombrich and archaeological theory (Conkey, 1978). Firstly art is identified as a conceptual process which results in certain styles of art. Secondly, as the style reflects common ideas and values, these ideas could be common to a group of individuals, giving rise to 'family resemblances' (Conkey, 1978:64). As a result of this, the third component of style is that those participating in producing representations in the same style, will be interpreting each others work in the same way, and this leads to the fourth component, that style is 'anthropological' because all these processes reflect the interrelation of these individuals and the identification of their common culture.

Style is the result of certain selective pressures on artists to represent cultural ideas in the most effective way, a process described as 'finding-matching-making', (Gombrich, 1961). The interpretations of each successive style will vary from artist to artist which is in itself a source of additional information about individuality and stylistic boundaries. The result is to enhance the cultural values that the style expresses, and this is why a number of researchers have moved away from Binford's interpretation of style as the residue *after* all functional aspects of the given form of an artefact have been isolated, (Binford, 1962:65). Instead style is viewed as performing a socio-cultural function in the transmission about mutually shared values, (Conkey, 1978, Wobst, 1977).

The recognition and identification of pertinent stylistic details is based on certain criteria devised by each classifier, although these criteria may come to be widely recognised across the field. As styles can persist in certain geographical areas after they have been discarded in others, or vary from example to example as well as changing in detail over time, the chronologies that are thus established are not absolute. There is also the possibility that one particular artefact may change stylistically but all other artefacts continue in the old style, so researchers must decide which artefacts represent society and change, and those which do not, as well as those which vary according to idiosyncratic personal taste.

These varied examples serve to illustrate the many ways in which colour, form and the explicit use of symbols have been used by human societies to transmit ideas which are then reinterpreted much later by historians and archaeologists. The most notable achievement of all in this field was the development of written languages, that could use either a series of signs, symbols and pictographs to convey direct messages, which retain much of the information the creator intended to convey. This ability to represent more or less precisely the form of the original abstract idea is what makes writing, and of course the use of 'numbers' such an effective way to transmit ideas. Problems of interpretation still remain, and many works of literature suffer from endless debate over what exactly the author *meant* by a particular term. Although artistic expression can also be used to transmit 'messages' these are not so specific, and as there is no 'syntax', interpretation by 'outsiders', who may not be familiar with the artistic conventions of that culture, is likely to differ substantially from the original intention of the maker.

2.1.2 Aesthetics and Representational Art.

This problem of cultural subjectivity in the interpretation of visual representations presents the greatest challenge to researchers into the art of the Upper Palaeolithic. The tendency to see the history of art as an evolutionary process, working from crude and simple to more elaborate and expert forms has prevailed since the eighteenth century. This western view, which regarded an exact mirror of nature as the artistic ideal, meant that all iconic forms of representation, whether from Europe or elsewhere in the world, were once measured against this single strict criterion. Any deviation from this absolute measure of achievement was classed as the inferior result of shoddy workmanship, or incapacity on the part of the artist. Although this position has been revised over this century, there still remains a certain line of aesthetic judgement that sees the majority of images of the parietal and mobiliary art as the crude and tentative expressions of early man, that laid only the foundations for the much later expressions of the 'true art' of the Egyptians and the Greeks.

All such arguments can be reduced to the relativity of any judgement that bases its assessment on aesthetics;

> '...the study or theory of beauty and of the psychological responses to it; specifically, the branch of philosophy dealing with art, its creative sources, its forms, and its effects.' Webster's New World Dictionary.

The difficulties of applying this subjective measure to the assessment of Palaeolithic art is immediately apparent, and therefore the term needs to be broken down in to its tangible manifestations. It is recognised that an artist will always select attributes that seem to him/her to be the most significant, according to his or her individual perception of the world, which is naturally influenced by the culture in which he/she participates. Thus the image that artists create can only be accurately assessed if we can judge what they have portrayed against what they intended to convey and therefore be able to estimate how closely they have succeeded.

This must obviously remain an ideal, even in a situation when artists themselves can be called upon to account for their individual style of representation. Visual representation is a form of expression that cannot be exactly recreated verbally; that is, an image is complete in itself, and only the artist himself can assess how accurately the image has conformed to his mental picture. If an artist has to 'explain' to others how well the picture conforms to the original mental image he can only convey this graphically, and not verbally, as only this conveys the true rendition of a graphic representation. Yet this has already been attempted and so now cannot be done, as this is precisely where the artist has 'failed' in the first place. Although such an argument must inevitably lead to the conclusion that any criticism of an image, other than that by the creator, is purely subjective, and therefore inappropriate, this can be countered by reintroducing the idea of a formal structure that is present in all intentionally created art, or an intersubjective milieu for interpretation. Gombrich asserts that,

> 'If art were only, or mainly an expression of personal vision, there would be no history of art.' Gombrich, 1977:3.

Boas has linked technical virtuosity with the production of the most aesthetically pleasing artistic works,

> 'Ornamental art has developed in those industries in which the greatest skill is attained. Artistic productivity and skill are closely correlated.' Boas, 1955:19.

Yet an assessment of the relative skill of an artist is hardly a measure of artistic intention. Gombrich comments that, 'The problems of expressive modes are rarely disentangled from that of varying skills. Thus what looks like progress from the point of view of the mastery of a medium can also be viewed as a decline into empty virtuosity.' Gombrich, 1977:8.

Thus the cognitive ability shown in the manufacture of the Upper Palaeolithic tool kit would not necessarily facilitate the transference of the skill required for the manipulation of flints, to the technique of scratching straight lines on a pebble. Equally the straightness of the lines might reflect an unknown artistic convention in conveying that particular idea. The form reflects the personal vision of the maker, related to the social context within which it was used. Therefore if the lines waver, or are faint, we cannot assume that there was no artistic intent, or bad artistry but possibly that the 'message' was adequately conveyed in the given manner. Just as 'doodles' during a 'phone call are not 'touched up' or redrafted after the creator leaves the phone, or a shopping list does not use the same handwriting style as a greeting in a birthday card or a formal letter. Thus, for the purposes of this discussion, the subjective concept of aesthetics will be broken down into the observable properties of an image, and will be only used to describe images in which the defined properties are apparent.

2.1.3 The Origins of Art.

Just what can be deduced from any visual representation has been subject to intense debate, and the controversy has ranged over the fields of bio-psychology, ethnology, and evolutionary theory. Whether or not the ability and desire to express oneself using more or less permanent media is innate (Leach, 1976, Pffeifer, 1982), or is the result of a quite specific range of social and/or cultural requirements (Bloch, 1977, Conkey, 1978, Gamble, 1982), there is a general consensus that the form and the content of any such representation must be more than a simple random configuration of lines made possible by access to the materials needed to construct it, and the cognitive ability to do so. Grosse (1894) believed that the primary purpose of art was practical, as a means of communicating ideas via significant marks and symbols. This reflects the work of Durkheim (1915), who saw the development of graphic expression as being directly linked to the origins of language and mathematics.

The hypothesis that the roots of artistic expression are in realism was forwarded by anthropologists during the last century (Haddon, 1895, Holmes, 1886). Boas (1955) believed that all ornamental forms were initially inspired by observation of the natural world, for example straight lines could have been based on the flight path of a projectile, or the straightness of a reed. This position is particularly interesting as, taken to its logical conclusion, it would lead to the inference that all the engraved lines and dots on the very earliest examples of parietal and portable art were iconic, which is unlikely to be the case.

However, Mithen (1988) has suggested that some of the marks on cave walls that have been interpreted as symbols are iconic representations using minimal symbolism, of animal footprints, their characteristic faeces etc. in order to educate hunters and/or to transmit information regarding hunting. The appearance of cave art corresponds to the onset of the last glacial maximum, and Mithen linked this need to transmit information as a result of a decrease in species numbers, which would require a careful hunting strategy in order to maintain high yields. Leroi-Gourhan (1962) classified the symbols or non-figurative signs found both in wall art and mobiliary artefacts. The initial classification interpreted many examples of non-figurative representations as minimal icons, and certain standardised forms were described as 'tectiforms' and 'claviforms'. Although these terms are still used they are retained purely as descriptive terms.

2.2 Art and the Upper Palaeolithic.

Durkheim (1915) advanced the proposition that there exists amongst mankind the need to classify the natural world in order to explain the diversity and function within it. Conkey's (1982) reference to the Palaeolithic reflects the widespread belief that the cave and portable paintings and engravings of the Upper Palaeolithic represents the earliest evidence of 'art'.

> '... there exists among humans, at least since the paleolithic... a cognitive necessity to establish discontinuities in nature and culture, in order to segment and organise experience.' Conkey, 1982:117.

The earliest known recovery of artefacts from the Upper Palaeolithic dates back to the 1840s but at this time it was thought impossible that such material could be anything other than Celtic. It was not until the meticulous excavations of Eduard Lartet and his sponsor Henry Christy in the 1860s established a chronology that placed these artefacts towards the end of the 'Old Stone Age', or Palaeolithic, that the true idea of their antiquity was accepted in academic circles. Finds of recognisable 'art' on recovered items lead to a spate of diggings in cave sites and shelters and as the number of artefacts increased it became evident that the people of the Upper Palaeolithic were more than simple primitive hunters. Yet despite this realisation it was not until much later that the cave art was recognised as part of the cultural ensemble of the time.

Some of the caves of Northern Spain and the regions of the Perigord, Lot, Pyrénées and Ardèche in France had been explored and visited for hundreds of years, and in certain cases the paintings in a few of them were seen and known to be of animals. Yet even engravings and paintings on the walls of caves that were excavated and plundered for their Palaeolithic deposits were seen as recent graffiti. Not until De Sautuola was working at Altamira and his daughter saw the 'oxen' on the ceiling there in 1879 was the link finally made.

Initially the reaction from the body of prehistorians to this claim by De Sautuola was hostile, and he was seen at worst as a liar, and at best the dupe of forgers. The basis of the criticism was that the representations were too good, and they must have been created using modern paints and lighting techniques. The best summary of the accumulation of archaeological finds that finally forced the most prominent prehistorians of the day to concede that the painting and engravings were genuine is given by Bahn, (1988:20-25). One of the most convincing finds was at La Mouthe (1895) where engravings were discovered in a cave chamber blocked by debris from the Upper Palaeolithic. Also notable was the find by Daleau in 1896 at the cave of Pair-non-Pair near Bordeaux where an engraved panel was found to be covered by a Gravettian deposit.

Once these images on the cave walls were accepted as being from the Upper Palaeolithic they were initially compared to the more familiar engravings on the portable artefacts. As the stratigraphy of more and more sites became known, the perceived similarities between the art of the two media was used as a basis for dating the cave art. Despite the early recognition of other marks on both the walls and the portable artefacts, which are now broadly classified as 'signs', the study of iconography predominated. Abbé Breuil devised a chronology of the various styles of representational art that he perceived on the cave walls based on ideas derived from Art History concerning the evolution of artistic ability (Breuil, 1952), which was later modified and extended by the work of Leroi-Gourhan, (1965). The selection by the artists of the Upper Palaeolithic of certain animal species as their primary subject is generally interpreted as a reflection of their hunting activities, and the abstract 'signs' are usually assigned a subsidiary rôle.

2.2.1 Art and Communication.

Conkey (1978) has criticised the use of the term 'art' for the Upper Palaeolithic preferring to use the phrase advanced by Munn (1966), namely 'systems of visual representation' as a less anachronistic and more appropriate description of the variability in form and content evident over the period. If the timescale of the Upper Palaeolithic is calculated as a proportion of the total history of art, it represents about 75 %, (Layton, 1986). Therefore it is unrealistic to speak of the entire range of Upper Palaeolithic material as representing single cultural phenomenon. As Mellars has demonstrated, the full range of carved clay figurines, the bas reliefs, the parietal and the mobiliary art were never all present at the same places at the same or even consecutive times, and therefore to talk of a single trajectory of artistic expression over the full 20 000 year period, would neglect the variability of any information obtained from a close analysis of the material, (Mellars, 1989).

A progressive evoloutionist would reason that the first expressions of art would be non-representational, or extremely crude and abstract forms, that would gradually develop into the more 'accurate' and 'artistic' images of some of the parietal art, (Leroi-Gourhan, 1962, Breuil, 1952). This possibility is explored by Ucko (1987), and he states his belief that the parietal and mobiliary artefacts were predated by, and contemporaneous with, art in other media, probably on animal hide, wood, sand and body painting. As the wall art is so difficult to date, Ucko question the sequences of Breuil and Leroi-Gourhan, and suggests that various styles evident in the art could be represented over the 25 000 years of the Upper Paleolithic. The variety of the form of the different artistic 'traditions' reflects the communication of different information rather than a chronological variation, (Ucko, 1987).

Although Conkey (1982) believes that the principle of iconicity underlies much of Palaeolithic art, she too does not see the various styles and modes of representation as being indicative of a simple unilinear pattern. Instead, she sees the 'earliest' representations possibly becoming over time more abstract and schematised as a specific response to the changing context in which they were required, yet overall, following no direction. This view is linked to the concept of the adaptive changes in subsistence strategies being reflected in the style of some of the visual systems of representation. Therefore if an evolutionary pattern is followed in the art, and it is inextricably linked to the changes in the social structure, it would be more profitable to look at the different methods of resource exploitation and relate the evidence of this to the stylistic changes, than to simply look at the stylistic changes in isolation. This method of analysis for Palaeolithic art is forwarded by Conkey, who seeks the identification of,

> 'Formalised, repetitive, rule-bound systems for the creation of material forms, and formalised, repetitive, rule-bound contexts for the use of these forms. Conkey, 1985:305.

If, consequently, stylistic changes are to be detected over time, then evidence of the development or adaptation or ecological context of the rest of the culture must be included. The other aspects of culture can be regarded as the 'environment' for the artistic activity, as they create/impose/exert relative, selective pressures and confer interactive advantages to certain among alternative cultural forms. However it is necessary to avoid attributing equal influence to all aspects of culture on artistic styles. Until we know the function of the art, that is, in which particular cultural context it was used, we cannot attempt to isolate some factors as being more significant than others.

In summary, if it is accepted that the intention of all motivated art that appears regularly on a variety of objects and sites is to communicate information, then at some level the meaning can be interpreted. However this cannot be attempted in isolation and the greater the depth of study into the context and form of the subject, the more information will be gained.

2.2.2 Criteria for the Recognition of Iconography.

An 'iconic' representation is one that visually resembles the object depicted. Whether or not an image is 'iconic' can be conveyed either by the form or basic outline, or by characterising elements. Only one of the above need be present, but it must be clear and unambiguous. One difficulty is that there could be a chance resemblance, or the characterising details may have been summarised into a minimal iconic form that, in the absence of the contextual evidence of the indigenous culture, has become unrecognisable or unintelligible to us. The subjectivity of interpretations is highlighted when two researchers present alternative hypotheses. An engraved pebble recovered by Piette from the cave site of Gourdan, Haute-Garonne has recently been subject to such a reinterpretation. Chollot (1964) 'saw' an image of a cervid on each of the two sides, whereas Buisson and Pinçon contend that the engraving on one side represents a bird resembling a Bustard, (Buisson & Pinçon, 1986).

The difficulty of identifying certain images has been recognised by Clottes (1989) and he stresses the need for caution particularly as investigators, confronted with a series of lines, will try to make sense of them by forming them to a certain known image. As it is accepted that naturalism and schematisation existed contemporaneously, Clottes stresses that certain forms that are unintelligible to us need not have been so to the maker and other members of that culture, (Clottes, 1989). For this reason it is unprofitable to search for a resemblance to a known natural form, and instead attention should be directed at looking for structural and contextual regularities if the same image is repeated elsewhere.

In a discussion of the form of an image, it is often difficult to describe a particular form without suggesting that it represents a natural model, for example 'serpentine' lines. One method to counter this problem, and to qualify the essential subjective interpretation of abstract forms, is to use the convention of 'x' and '!', where 'x' is an inferred meaning, and '!' is a purely formal descriptive convention, (Layton 1990). For example, 'x creature' would refer to a form that suggests a creature to the analyst, although this cannot be proved; whereas '! star' refers to a radiating form that is called a star for convenience, without suggesting that this is what it represents. Conversely, a non iconic representation is distinguished by possessing no resemblance to anything yet known, nor any characterising detail that can hint as to any other similarity with the signified construct. However, a chance resemblance to something known is very probable, and so therefore iconicity must be proved, otherwise non iconicity will be assumed.

Thus the criteria that would need to be fulfilled in order to classify a representation from a Palaeolithic assemblage as iconic can be summarised as; a similarity identifiable by either a lack of ambiguity in its,

i. Basic outline, or form.

ii. Any Characterising Element.

2.3 Decoration: The Concept of Symmetry.

'Symmetry' is used to describe patterns of duplication, or where the two parts of a form replicate one another exactly about a given axis. Many of the principles of symmetry were devised in relation to the study of crystals which represent the most perfect symmetrical forms presently known. In identifying their complex patterns of duplication certain rules emerged which have been applied to the analysis of other natural forms, and also to intentionally created visual representations.

Boas, (1955), identifies expressions of symmetry, a rhythmic repetition of certain elements, and a general harmony to the composition as a whole, as the key indicators to objectively assess artistic intent. Conkey used principles of symmetry to classify engraved mobiliary artefacts from Cantabrian Spain, and concluded that the shape of the artefact influenced the motifs used. On this basis she isolated three broad structural principles used in the organisation of design elements in space: 'the longitudinal principle (nine variants); closing structures (three variants); and continuous principle (three variants)', (Conkey, 1980:240). A study of the decoration on bone points or *sagaies* by Baulois confirmed these findings, as she too found decorative elements that transcended the traditional typology, and confirmed that the selection of the design reflected the morphology of the artefact, (Baulois, 1980). In isolating the preference for decorating the dorsal or lateral sides, Baulois suggests a link between this and the function of the artefact, perhaps to facilitate the transmission of poison into the blood of the animal on contact, sometimes with larger grooves for the insertion of small flints.

The connection between decoration and function is complex and has been discussed specifically by Allain and Rigaud. They identify three key concepts parts to an analysis:

i. The primacy of the *function* of the tools

ii. The 'notion of decoration indissociable from the aesthetic feeling'

iii. The 'adaptation of decoration to function'. Allain & Rigaud, 1986.

In a practice reminiscent of Binford's work on the identification of style, Allain and Rigaud actually recreate the artefacts and, by using them in experimental contexts, they believe they are able to isolate the aspects of decoration that relate to function. Those which do not are assumed to have been included on aesthetic grounds. This indicates that the engraved 'decoration' of areas of tools can relate to function as well as aesthetics, although such experimental work is never conclusive in its results, and so it can only offer useful insights into the ways in which the artefacts may have been used rather than definitive proof.

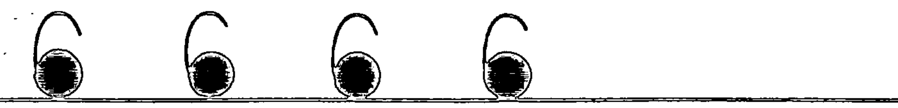
Following Washburn's (1983) method of identifying the various forms of symmetry, (see Figure 2.1), it should be possible to avoid much of the relativism associated with the concept of aesthetics, as intuitively perceived beauty. Washburn develops Boas' techniques of analysis which involves identifying a number of design elements which are repeated to form a pattern. By assigning each a letter, it is possible to reveal the structure and repetition used in the design, (Boas, 1955:29). Symmetry is defined by Washburn as the superimposition of a shape over an exact equivalent, or moving about a given point or line axis. These processes give rise to a pattern, that is here taken to be,

> '... a design with regularly repeated parts, called here fundamental parts.' Washburn, 1983:138.

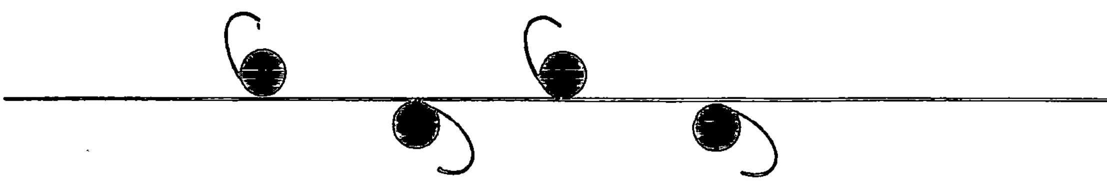
The number of possible patterns that can be generated by a rotation around a point axis is obviously finite, whereas along a line axis, whether one or two dimen-

Figure 2.1 — Washburn's Principles of Symmetry.

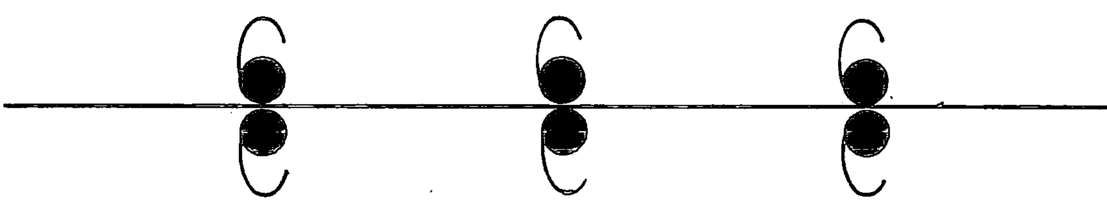
Translation - being the movement of the motif along a given line axis.



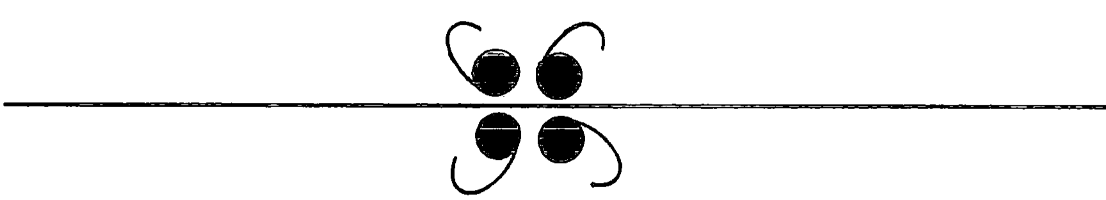
Slide Reflection - the reflection of the motif along a line axis, but the image is displaced horizontally.



Mirror Reflection - where the image is a direct reflection over one axis, e.g. Horizontal Mirror Reflection.



Rotation - where the image is rotated around a point axis.



sional, the number is infinite. Washburn has identified the four basic principles of symmetry which are summarised on Figure 2.1 using Washburn's own illustrations.

Following Boas (1955), the concept of **balance** is intimately related to the principles of symmetry, as it is based on the observance of certain regularities of form and direction. However, a balanced composition may involve the asymmetric combination of form and colour to achieve an aesthetically pleasing effect, which is not regulated exclusively by the mathematical precision of symmetry. Always involved with the two principles above, is that of **harmony** as a harmonious use of colour and form is crucial to the creation of balanced composition which is in turn pleasing to the eye. The degree of harmony in a given composition is possibly best expressed as being to a great extent the result of balance and symmetry, particularly in the case of the 'geometric' compositions of the Upper Palaeolithic as the additional element of colour variation is only rarely present. This being the case however, harmony is seen as a subjective value, and therefore inappropriate to describe the material from the Upper Palaeolithic.

The use of repeated symmetry is essentially a *rhythmic* process, as

> 'La répétition des éléments crée le rythme'. Sauvet, 1990:89.

Different design elements can be repeated in complex sequences which are impossible to describe in terms of symmetry. However Sauvet talks more generally of alignment, duplication and 'concatenation' which he describes as the various ways in which points or lines are repeated in simple or complex rhythmic patterns, illustrated in Figure 2.2. In this sense the need for exact symmetry is dispensed with, as these terms describe images that use the repetition of certain lines in a purely *rhythmic* and *harmonious* fashion. The purpose of repeating and combining design elements for Sauvet is primarily to communicate information, possibly conforming to a known system of arrangements.

The criteria by which we should be able to recognise an example of decoration can be laid out as follows:

1. **Symmetry**

i. Translation

Figure 2.2 — Rhythm and Symmetry, after Sauvet, 1990.

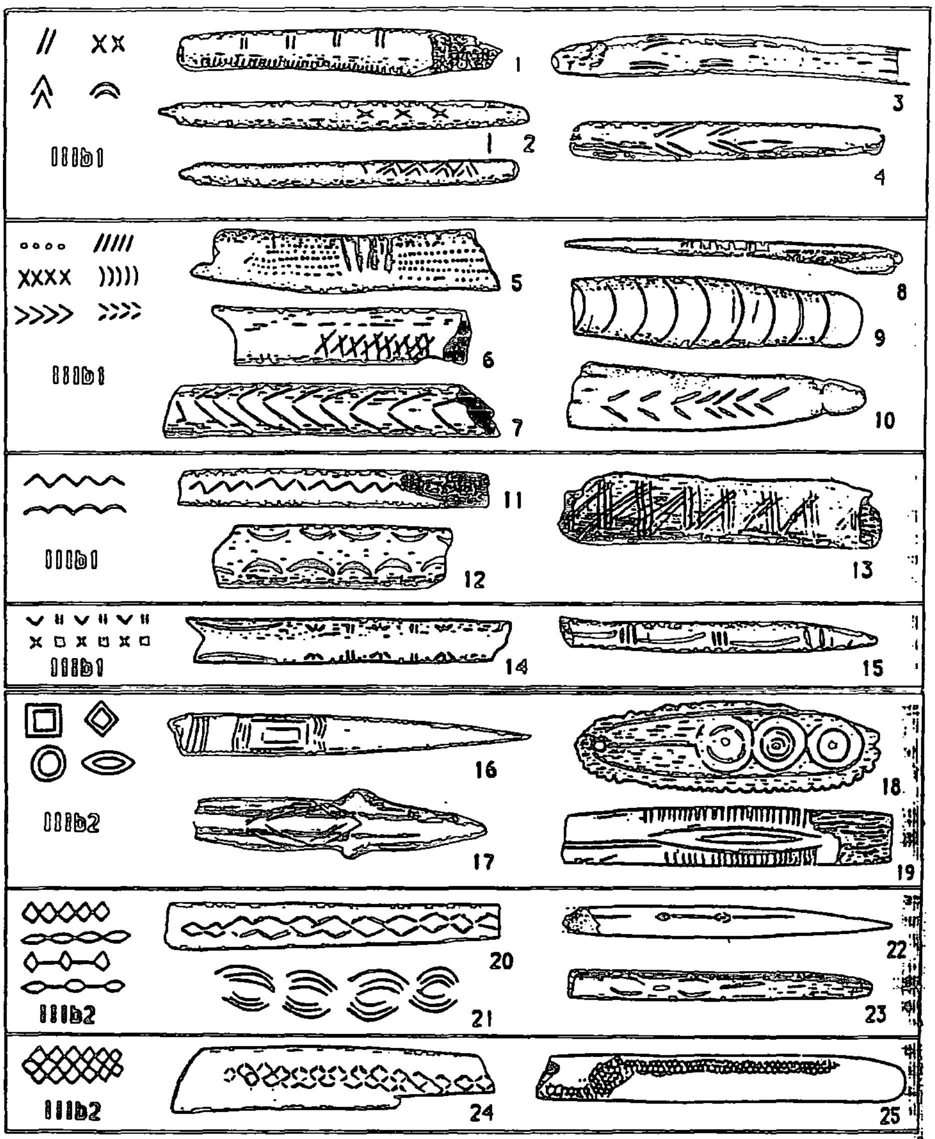


Fig. 4. Éléments de composition paléolithique : le rythme (IIIb). IIIb1, répétition de points et de lignes (duplication, alignement, concaténation, alternance) ; IIIb2, répétition de plans élémentaires (emboîtement, concaténation, accolement en damier) – 1, 5, Brassempouy ; 2, 12, le Mas-d'Azil ; 3, Lascaux ; 4, le Placard ; 6, 9, la Madeleine ; 7-8, Lortet ; 10, Cueto de la Mina ; 11, 19, 25, Laugerie-Basse ; 13, Altamira ; 14, Isturitz ; 15, Gourdan ; 16, Romito ; 17, Limeuil ; 18, Saint-Marcel ; 20, Bruniquel ; 21, la Vache ; 22, Ermittia ; 23, Laugerie-Haute ; 24, Raymonden.

Sauvet, 1990:90, fig.4.

ii. Slide Reflection

iii. Mirror Reflection

iv. Rotation

2. **Balance**

3. **Rhythm**

This summary is also presented on the separate sheet at the back of the thesis which can be referred each time that an example is reassessed in the following chapters.

2.4 Symbols, Signs, and Icons.

At the beginning of the chapter I adopted Boas' definition of art, namely

i. A purely formal one in which the enjoyment is based on form alone.

(concerned with aesthetics, iconicity, decoration and associated ideas of symmetry), and

ii. One in which the form is filled with meaning. Boas 1955:64.

It is the latter type that conveys ideas and information via the use of symbols and signs, that transmit the information either by their form or colour. Symbols, or 'visual signifiers', are taken here to be, 'signs that evoke more than one level of meaning', (after Saussure, 1959, and Layton, 1985). A sign, in this approach has only one possible level of meaning. Alternatively, Bruyn (1966) breaks down signs into 'pictographs', which provide the graphic communication of an idea, whereas a symbol is an 'ideograph', which is essentially abstract, and no specific concrete form is required.

Pierce (1934-48) and Morris (1938) assert that an icon is a sign that which has a resemblance, via shared properties, with what it represents. With iconic symbolism, there is the strong implication that the various natural forms were possibly deliberately selected from the almost infinite variety of the natural world, and the choices that were made reflected to a greater or lesser extent, an aspect of the signified construct. A modern example is the association of a lion with royalty, thus linking the supposed ideal properties of the dignity, strength and power of a monarch, to the characteristics attributed to a lion.

It can be argued that such associations become self-reinforcing, as a rhinoceros might also exemplify these virtues, yet because it is not the common modern Western European symbol, it might be construed as an inappropriate metaphor, as among the common ideas associated with a rhino are ugliness, bulk and aggression, and would thus be considered an appropriate symbol in another context. Yet this is not a universal rule, as the totemic images of the Australian aborigines are not so much concerned with the observable properties of their totem, but it merely represents the physical manifestation of their totemic myths. Thus a totem can be a plant or a sand-fly if it is associated with an ancestral being. The rules that regard the treatment of the totem vary over Australia, as sometimes it can be eaten, or consumed ritually, or even avoided as a food item altogether.

Thus there is a certain degree of arbitrariness in the meaningful properties that are considered to be characteristic of a given natural form, and even if we assume that all human thought *processes* are the same, we cannot extend this to include the *ideas* that are generated. As Mary Douglas states,

> ' ...a cross-cultural, pan-human pattern of symbols is an impossibility.' Douglas 1970:11.

Why is often it assumed that there were cross-cultural symbols in the Upper Palaeolithic? The opinion of Durkheim (1915) is that,

> '... social life, in all its aspects and in every period of its history, is made possible by a vast symbolism.'

He adds that,

> '...we must refrain from regarding these symbols as simple artifices, as sorts of labels attached to representations already made in order to make them more manageable: they are an integral part of them.' Durkheim 1915:271.

Mary Douglas follows Durkheim's Structuralist method, arguing that

'... a symbol only has meaning from its relation to other symbols in a pattern.'
Douglas 1970:11.

In this view it can be hypothesised that the iconic symbols of the mobiliary artefacts do not represent the individual associations of the engraver, and are instead meaningful to members of his social group. Conkey has demonstrated in the case of Altamira that different artefacts use the same restricted range of motifs, and concludes that the populations of the Upper Palaeolithic used stylistic variation to transmit cultural information as a 'culturally integrating mechanism', (Conkey, 1978:67). In an analysis of Venus Figurines, Gamble links the morphological variations between examples to a desire to express at once social solidarity within the group, and to signal group identity to outsiders, (Gamble, 1982).

Symbols arise through interaction, and serve interactive functions, and are thus the product of social life. Examples of restricted access to many symbols has been recorded from studies of contemporary symbol systems, both physical and conceptual. For example, a given representation can be interpreted at many levels, with only those who are initiated being able to fully understand all the implications. Restricted access to certain forms of graphic symbolism is also quite widespread in the contemporary world, such as the Australian Aborigines' sacred art, and in the Freemason's Masonic Lodge.

2.4.1 Symbols and Signs in the Palaeolithic.

Vialou identifies two sets of 'signs' in the repertoire of Paleolithic art: iconic representations such as the animal images made to graphically represent the species in question; and the geometric signs, that are not known to resemble any known natural form, (Vialou, 1986). This latter class is further divided into 'signes élémentaires' and 'signes construits', to reflect the relative graphic complexity. Elementary images are made up of simple dots and straight, sometimes parallel, lines, whereas 'constructed' or composite signs refers to 'arrows', 'claviforms' and 'tectiforms'. It is this latter form which interests Vialou, and he advances the idea that the *meaning* of the tectiforms changes with its relative form and position in the cave and its association with other graphic images, (1986:15). This approach mirrors the earlier work of Nancy Munn on the central Australian Walbiri, where

Figure 2.3 — The Graphic Elements, after Sauvet, 1990.

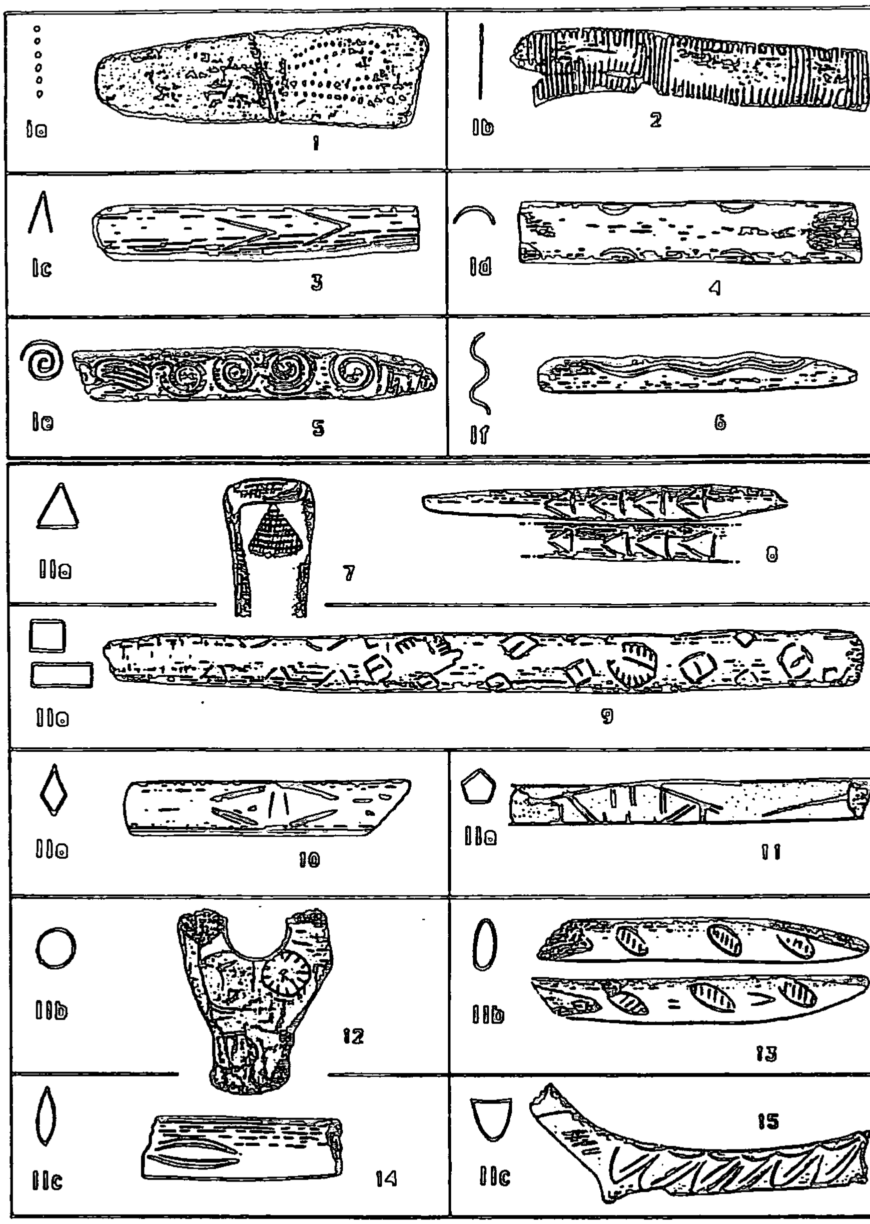


Fig. 2. Formes élémentaires de l'art mobilier paléolithique : points et lignes (I), plans (II) – 1, abri Blanchard ; 2, le Placard ; 3, 8, 14, la Madeleine ; 4, 15, le Mas-d'Azil ; 5, 9, Isturitz ; 6, 12-13, Gourdan ; 7, la Marche ; 10, le Chaffaud ; 11, Altamira.

Sauvet, 1990:86, fig 2.

she divides the visual representations into *elementary* and *composite categories*, (Munn, 1966:936).

Sauvet (1990) reiterates the need to see any Palaeolithic signs as existing as part of a wider system. In its most simple form this would be represented by a number of signs, the meaning of each totally independent of the other. In a more complex system, signs are used in various combinations to transmit alternative messages, in this way form an elementary syntax, which Sauvet compares to musical notes and words used in speech. Deploring the tendency of prehistorians to ascribe all non-figurative images in Palaeolithic art the term 'sign' Sauvet states categorically that all traces are *not* signs, that is, the evidence suggests that they were not made with the specific intention of communicating ideas or concepts. The criteria Sauvet uses to identify signs are based on the isolation of graphic units of a standardised form which are repeated in a manner to make it a strong possibility that they are meaningful and possibly part of a system of signs. In this way Sauvet avoids determining in advance that all such signs are non-figurative, particularly as the standardisation and combinations of representational images suggest that they were part of such a system.

Concentrating on the lines of the engraved mobiliary artefacts, Sauvet identifies the elementary forms illustrated on Figure 2.3, which are then classified using Kandinsky's *Point-Ligne-Plan*, (Kandinsky 1926). The single dots and lines of **1a** and **1b** form part of an indeterminate category, as the extreme simplicity of their form does not indicate whether or not they were used as 'signs'. The circles, 'chevrons', arcs, spirals and 'serpentine' lines make up the elementary points and lines, with triangles, rectangles, squares, 'lozenges', pentangles and rare hexagons make up the 'planned' elements, (1990:87). The combinations of these elements into graphic representations is also illustrated.

If a given iconic representation, such as those found in the Magdalenian levels of Europe, can be deduced at one level on the basis of the form and/or characterising elements, to then call it a 'symbol' and proceed to superimpose apparently 'universal' associated ideas is unlikely to be an accurate method of interpreting the meaning. For example, Marshack (1972) interprets a form on a bone from the

Grotte du Roc de Courbet at Bruniquel, that Breuil (1952) believed to be a fish's tail, as a plant or tree, by arguing that,

> 'Ice age fish tails are usually made to capture the balance, rather than the disorganisation of the tail image.' Marshack, 1991:201.

This is unanswerable, except to reiterate that we can have no such categorical ideas about forms of artistic expression and intent from the small collection of engraved images that have survived.

If an iconic depiction is associated with other images on the same piece of bone, it is possible to begin to deduce why, or by what principles, these images were selected to be juxtaposed in such a way. The work of Leroi-Gourhan (1962) and Laming-Emperaire (1962) concentrated on identifying such associations in the iconic depictions of the cave art of France. Their results suggested that there was a non-random and repetitive association of certain species. This they interpreted as a symbolic opposition of male and female principles. Their interpretation was extended to cover the abstract 'signs' of the caves, and by their form and association with the iconic representations, they were variously classified as male and female. As their form was crucial to this method of classification, they are essentially still regarded or interpreted as iconic, even though these 'signs' are intuitively abstract and schematised.

2.5 Definitions of Notation.

2.5.1 Introduction.

In this section, I intend to further explore the concept of 'notation', and to discuss the means by which examples can be recognised in the archaeological record. The results are summarised as a list of criteria to which the engraving on a given example must conform if it is to be regarded as most probably notational. The method of identifying possible examples of *lunar* notation must be more specific, and a set of separate criteria are forwarded as being the most satisfactory means of attempting this. It is crucial to be able to distinguish a notational sequence from both random configurations of lines and intentional patterns of decoration, and I attempt to resolve this analytical dilemma below. Finally, a list of the minimal requirements for the inclusion of an example for analysis are presented at the end of this section.

If not all Palaeolithic visual representation is 'art', that is, it includes non-figurative signs and symbols and some decorative, it has been suggested that some of the geometric patterns might be examples of notation. The concept of mathematics is closely allied to that of 'art', as for each there exists the basic argument that they rely on innate processes of the mind, which serve to structure, order and make sense of the world via representations of concrete or abstract constructs. The history of mathematics is usually seen as being based on evolutionary, and occasionally diffusionist, principles. Leroi-Gourhan noted that the marks found on engraved pieces of bone could be seen as

> '...the earliest representation we have of a rhythmic arrangement with regular intervals, the beginning of the evolution that lead to the ruler, the calendar, and the peristyle of the temple.' Leroi-Gourhan, 1967:40.

There is perhaps justification for this perspective, as the basic problem solving approach of mathematics needs no accompanying aesthetic criteria in experimentation. Thus the more complex and diverse the use of numbers, the more 'advanced' the form is. Technical execution does not obscure the message communicated, although it may well require an adherence to a set system of expression, comparable to the use of signs and symbols in art in the visual expression of an idea. Nor need mathematics possess an additional significance other than the direct message. In certain specific cultural contexts numbers have been interpreted as 'lucky' or 'unlucky' such as the numbers 7 and 13 respectively in English folklore.

The use of symbols at an advanced stage of mathematics, in the form of coded, standardised forms, again allies it to forms of aesthetic expression. Signs such as = , + , and x, or non-figurative numeralisations such as 2 or 8, rather than simply or as \\\\\\\\ , may appear to be straightforward, but this level of cipherisation in history has only been required for codifying large numbers, or maintaining written records. There would need to be a level of cultural integration, as the common knowledge of the meaning, with its maintenance and transmission would need a pattern of constant interaction and information exchange amongst the participants. Unless the mode of representation is understood amongst the relevant population, then the information is encoded in so limited and idiosyncratic a way, that it is meaningless to speak in terms of sign or symbol. We shall see in the course of thesis that there is no evidence of such complex systems of encoding during the Upper Palaeolithic.

Tallying uses a 1:1 correspondence between the number of items counted and the number of marks used to record them, presuming an intuitive or learned recognition of the direct relation of the quantity thus expressed. A form of finger or body counting probably preceded this, but tally sticks provide the earliest permanent accounts of notation, from which we can assume that the need had arisen to keep even a transient record of number. It is possible that the development of tally systems is related to the payment of tribute, where a greater degree of accuracy than a 'rule of thumb' may have been required.

Seidenburg suggests that the necessity of participants coming and acting in a strict order, promoted the use of ordinal numbers, (Seidenburg, 1962). This theory is reminiscent of Aristotle's account of their origin being connected with priestly leisure activities and ritual. Herodotus records that the origin of geometric calculation was created as a response to practicalities of measuring the area of land lost to floods in Ancient Egypt. Therefore it is possible to deduce from such tentative and highly speculative accounts that the emergence of the need for records was strongly linked to a level of organisational complexity, which is usually associated with a centralised and structured social system. Yet as Gamble (1990) points out in a discussion of the relation of art to 'social complexity', the definitions of complexity are universally applicable, and only 'differentiated by scale'. The means of measuring the 'complexity' of past societies is equally subjective deduced from,

> '... art styles, population density, maximum settlement size, housing, cemeteries and grave goods. In other words high visibility in material output confers the label of complexity.' Gamble, 1990:5.

From an assessment of the historical and ethnographic records, tallying is usually indicated by a simple stroke rather than by a cipher. The origins of the concept of zero was possibly invented in Greece, but the earliest evidence of the use of a specific symbol comes from a inscription of 876 AD from India, (Smith, 1958:69).

Whether or not this would even be required for anything other than actual arithmetic calculations is unclear. An absence of a quantity may be indicated acceptably by an obvious interval, or an omitted or incomplete stroke, but this again must be culturally standardised for it to be 'read'. The identification of this, in the absence of ethnographic information, is further hindered by the grouping of marks, which inevitably leaves spacings. Therefore whether it is the groupings that are significant, or the spaces left, may be impossible to deduce.

As all origins are obscure I shall not attempt to identify the earliest notational examples. Any notational example is evidence that amongst past populations the need arose to construct a record, however transiently, to convey an idea of quantity, whether abstract or actual. This implies that the information so contained would be required later, and used as a source of reference which could be added to, and possibly be interpreted by others. It follows from this, that in order to facilitate the recording and rereading, the information would be recorded in a structured and ordered way. However there are certain characteristics that are an integral part of a notation, and others that are seen to be secondary. This is not intended to minimise the pertinence of the latter, but to emphasise that only certain properties are common to all examples of notation. Thus my initial hypothesis is that the recognition of a notational sequence must follow the criteria listed below:

Primary Characteristics.

1. There should be a sequence of marks, consisting of some element that is repeated and standardised, and constructs a regulated pattern. A sequence is here identified as an ordered repetition of an element with regard paid to what preceded it, and what follows. If there is any variation, it must be repetitive and standardised before it can be isolated as being probably pertinent to meaning. A purely random accumulation can never be entirely ruled out, but it would not in all probability possess any of the further criteria specified below.

2. Each mark must be clearly definable, and consequently there should be some degree of regulation in the spacing.

3. The sequence must run along an identifiable area, either on a horizontal, diagonal or vertical path, or along an edge.

4. Allowances should be made for pertinent variation, which may be difficult to isolate. As form is not here believed to be a crucial component of a notational sequence, non-pertinent variation may occur that does not affect the meaning.

Secondary Characteristics.

5. Subdivision of the marks into groups may occur, either to make the information contained discrete, or to order and structure the information to facilitate a reading. N.B. the actual number in each group may not be as significant as the general quantity that it represents.

6. If the notation is mathematical, we would expect a number count, that is, 'positional notation'.

7. There might also be evidence of 'cipherisation', that is, the substitution of a sum, or a procedure such as addition or subtraction, by a sign. This would imply a degree of sophistication in the general method of recording, possibly required for the manipulation of large numbers and for complex methods.

These criteria are summarised on the separate sheet which is located at the back of this thesis as Table 1.

It should be added here that for each of the examples that are analysed, the technical execution of a notation is not considered to be a significant factor in determining the meaning. Boas (1955) specifies technical excellence as an essential attribute of artistic and aesthetic merit, and undoubtedly straighter lines, deeply and evenly scored, would enhance the plausibility of an interpretation of a notational sequence. Yet the *meaning* of the notation would not be altered in any sense simply because the lines were not exactly vertical and the spaces between them precisely even. This is not intended to obscure the fact that minor changes could have been intentionally made by the engraver for the express purpose of altering the meaning of a notation, but unless these differences are *repetitive* and *standardised* there are no grounds to assume that minor variations in the spacing, length or depth of a stroke alter the meaning or validity of an example. These variations which are designed to convey information are termed 'pertinent variation'.

The criteria above introduce a number of points that require further clarification. The first of these is what exactly can be considered to be pertinent variation? As previously mentioned, the quality of representation in a notational sequence does not actually affect the content of the information transmitted. Yet as variations in the technical execution can be used to transmit differences in information, they must be distinguished from imperfections, and other forms of non-pertinent variation. One relatively fixed principle is that a variation must be *standardised* and must be repeated at least once to be considered a potentially meaningful variation. It is not possible to establish universal laws here, as the examples are so varied that a degree of flexibility must be retained. The factors that might be utilised to indicate pertinent variation are *size, form, colour* and *position* and they can be used in any combination. The examples in Figure 2.4 are an attempt to show just some of the possible forms that variations could take.

With the recognition of such factors, it is tempting to retreat into a negative level of assessment, and so rather than attempt to identify what variation is pertinent, instead say what is not. Therefore, the more even the *quality* and the *height, colour* and *form* the marks are, the more likely it is that any minor variations observed are nonsignificant. This assertion is based on the premise that any significant change in the information would correspond to a significant change in the notation. Yet there is no reason to suppose that if there is a great deal of variation present, it is necessarily pertinent to the meaning. If there is recognisable variation, it can only be considered pertinent if it is *standardised* and *repetitive* and so its pertinence can reasonably be assumed. This is not an attempt to impose too stringent a measure of pertinence, as there will be variations within such specifications. Thus if in one example there is found to be a variation that occurs many times, in the same place and exactly the same manner, it can be put forward with a greater degree of certainty as being pertinent, than a variation that occurs a relatively few number of times, or each time in a different context within the sequence, or one that slightly changes its form each time.

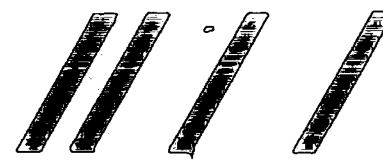
2.5.2 Definition of Pertinent Variation.

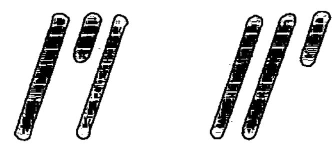
For the purposes of subsequent analysis I will rely on the following hypotheses. For a variation to be pertinent, rather than just the result of a lack of concern for

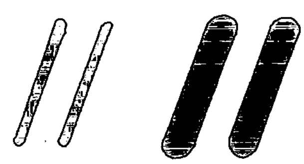
Figure 2.4 — Possible Variations in a Notational Sequence.

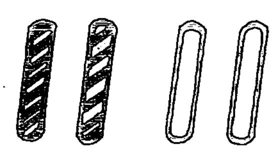
a. Are these equivalent? 

or does  change the meaning?

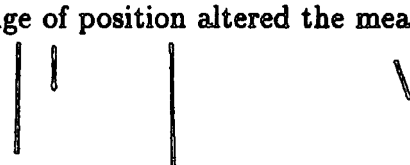
b. Are these equivalent, or does the space matter? 

c. Are these equivalent
or does the position matter? 

d. Are these equivalent
or does the thickness matter? 

e. Or colour 

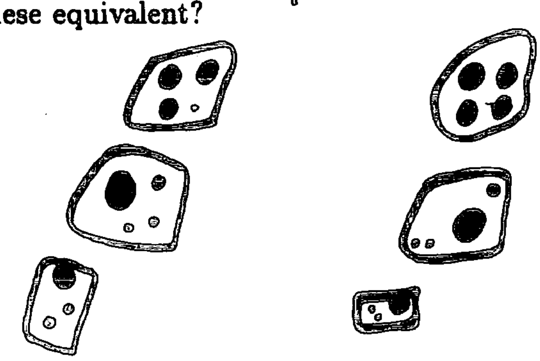
f. Do  and  have an additive meaning in association with one another
that they do not possess when separated? 
or has the change of position altered the meaning?



g. Are these equivalent?

Or these?

Or these?



the form on the part of the engraver, it must be recognisable either by,

i. **Thickness** – which must be at least twice as thick as the average of the width of the other marks, and consistently rendered.

ii. **Height** – which need not be necessarily double the average, although this would make an assertion of its pertinence more valid. The reason for this is that as the form the notations take is predominantly linear, any additional length is visually recognisable more immediately than a proportional increase in the width. Where the notational element is not linear in form, this does not apply.

iii. **Change in form** – which could be from dots to dashes, or from the main face of an artefact to the edge marks.

iv. **Direction** – either horizontal to vertical etc.

v. **Spatial Differentiation** – involving a clear use of boundaries in the form of either lines or spaces, to possibly indicate discrete areas of information. This is best expressed as the ratio of the standardised distance between the marks, to the greater distance, for example as a ratio of 1:7, or 1:3, or 1:10. If there is no standardisation of the spaces between the marks to act as a value this is itself a measure of the *lack* of standardisation in spacing.

It must be added here, that these variations could all occur repeatedly without there being any pertinent change of meaning. Also not considered above is the possible combination of one or more of the elements listed above, and whether that would render the marks doubly or trebly significant. Thus no assertion of a mark's pertinence can be proved, merely forwarded as a likely explanation to account for its apparent deviance from the form of the rest of the sequence. The other point to be raised from the notational criteria, is how a grouping is to be identified. There is an element of overlap here with the discussion above, as changes in form, direction, height and thickness as well as spatial differentiation can create formal boundaries, and can in addition, be an indication of a change in the information transmitted. Groupings usually occur,

i. To make the information they contain discrete

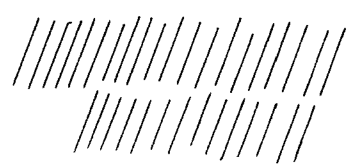
ii. To order and structure the information to facilitate a reading.

The latter case is of particular importance if we are to assume that the notational systems of the Upper Palaeolithic are essentially non-arithmetic. It is possible to recognise the difference in the quantity of two given groups of information without the need for conscious and explicit counting.

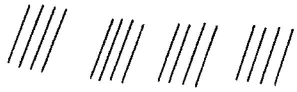
For example, the difference between \ and \\\ , or \\\\ to /ɾ , is visually self-evident. However, once larger numbers are involved, such as

and it is far more difficult to recognise

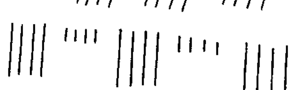
the difference. It could be argued that because of this, it is not the actual quantity that matters, but more the general impression of a roughly comparable size. The example just given however is structured, and a comparison between two more random sequences is manifestly more difficult. The answer might be to reduce the two sequences to a single recognisable element with an even method of spacings and then superimpose the two,



or alternatively, the strokes can be grouped into a more decipherable form, like this,



or this,



or this ,

and thus again the difference is revealed by **structuring** the information.

Although the definition of such criteria allows the analyst to be specific in the classification of engraved objects, and they help to eliminate the subjectivity that has dominated the recognition of possible notational examples, there remains the problem of distinguishing between notation and decoration. Although any information gained using the technique of micro-analysis (Marshack, 1972, D'Ericco, 1989) would provide an interesting and relevant supplement to other methods, for reasons outlined above, it is not considered to be a conclusive means of determining this difference alone. As the relativity of personal aesthetic judgement was

ii. To order and structure the information to facilitate a reading.

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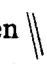
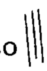
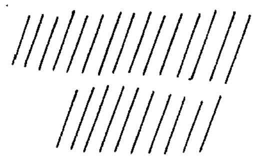
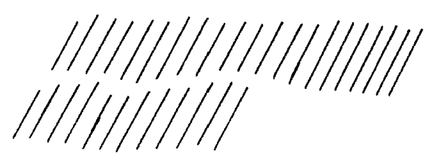
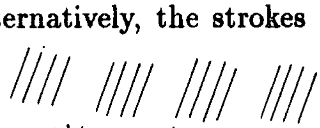
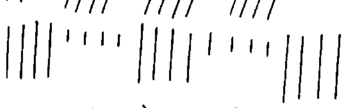
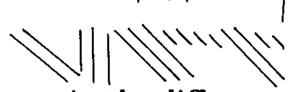
For example, the difference between  and  , or  to  , is visually self-evident. However, once larger numbers are involved, such as



and it is far more difficult to recognise the difference. It could be argued that because of this, it is not the actual quantity that matters, but more the general impression of a roughly comparable size. The example just given however is structured, and a comparison between two more random sequences is manifestly more difficult. The answer might be to reduce the two sequences to a single recognisable element with an even method of spacings and then superimpose the two,



or alternatively, the strokes can be grouped into a more decipherable form, like this, 
or this, 
or this , 
and thus again the difference is revealed by **structuring** the information.

Although the definition of such criteria allows the analyst to be specific in the classification of engraved objects, and they help to eliminate the subjectivity that has dominated the recognition of possible notational examples, there remains the problem of distinguishing between notation and decoration. Although any information gained using the technique of micro-analysis (Marshack, 1972, D'Ericco, 1989) would provide an interesting and relevant supplement to other methods, for reasons outlined above, it is not considered to be a conclusive means of determining this difference alone. As the relativity of personal aesthetic judgement was considered unreliable in an earlier discussion in this chapter, it is no longer enough to intuitively assess whether the primary function of an engraving was notational or ornamental. Instead, certain properties of both specific processes should be identified, and then stated as criteria, against which each example can be assessed.

The principle problem stems from the fact that the basic characteristics of decoration and notation as visual representations are very similar. Both require order, the former for rhythm and harmony, and the latter for legibility within a sequence. Essentially what must be sought are any identifiable expressions of the intent of the engraver, that is, whether if in the engravings themselves there are possible regularities of form that could be indicative of either a decorative or a notational design.

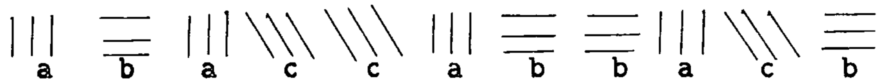
The primary function of decoration is to be aesthetically pleasing, although as discussed earlier it can be included as a necessary by-product of a particular technique, or contribute to the function, (Boas, 1955:55). Yet however strong the link is between pragmatic and technical considerations and decoration, it is *design* that is the most dominant aspect, and that imposes itself most strongly. Design involves a skilful planning and artistic arrangement using the formal elements of art, (see criteria for the identification of notation). The elements of design cannot vary as they can in notation; the relative heights, widths and colour of strokes is important, and yet an inordinate degree of precision and accuracy is not required. The elements that form a design are essentially non-randomly selected and repeated. The significance of this for the discussion of decoration versus notation is best illustrated by the use of examples.

2.5.3 The Structure of Design.

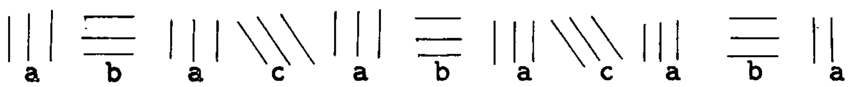
This section presents a number of examples to illustrate just some of the ways in which marks can be ordered. The purpose is to demonstrate the degree of variability, and also the conceptual and therefore theoretical difficulties of ascribing certain patterns to categories of 'notation' or 'decoration'. A single straight line was chosen as the design element, as a more complex graphic unit would be subject to further interpretation, that is, the following sequence shows variation, but the one following shows greater variation as it is subject to *formal* as well as *structural* change.

Example One.

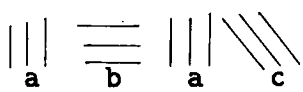
i.



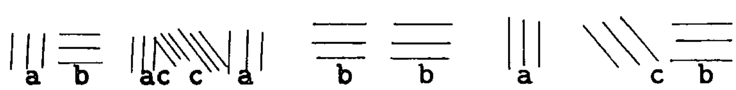
ii.



iii.



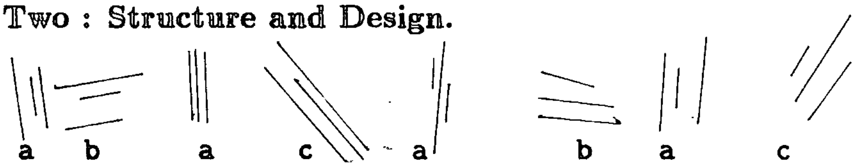
iv.



As an example of notation, the sequence at i. is acceptable, as the basic structure involves a degree of order that is consistent with the criteria specified, (see the separate sheet). However, what the sequence at i. does lack is *design* - there is no symmetry, and no harmony in the way the elements are repeated. There is rhythm, as the spacings between are even, but when the same sequence is repeated at iv. with gaps, this is lost. Thus i. fails to comply with the criteria that are considered requisite before an example is reasonably deemed to be decorative. The sequence repeated at iv. would still qualify as notational. The sequence at ii. however, is decorative, because it shows *design* in the regular repetition of the design element shown at iii.

The basic element of ||| shows bi-fold rotation to ☰, and slide reflection to \\\ in a consistent and harmonious way, (after Washburn, 1983).

Example Two : Structure and Design.



As a form of notation, this is acceptable according to the specified criteria, because it displays a degree of order, and the various heights and the spacing do not necessarily affect the meaning. Example Two represents a distortion of the sequence shown in Example One at ii., which was there considered to be decorative. The transformation shown as Example Two has lost all its regularity of form, harmony and rhythm, and is therefore now considered to be non-decorative. It is not just the content of the marks that matters for an example to be identified as decorative, but the *form*.

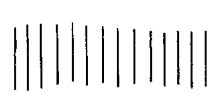
Yet *structure* and *design* still share common elements, and Washburn describes symmetry as,

> ' ... a mathematical concept' to describe 'the repetitive property of structure', (1983:6).

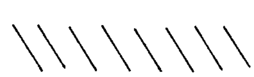
Also, there is inherently some degree of rhythm and harmony in any ordering of items. Thus the new dilemma emerges, namely, where is the boundary between other forms of structure and design? It is perhaps much easier to identify where design begins, than where the structure of notation ends.

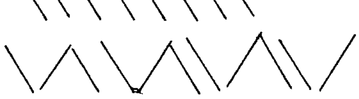
Example Three : Structure and Design.

If this is a basic form of notation,



Are these variations decorative or notational, that is, were they structures for legibility, or designed for effect?

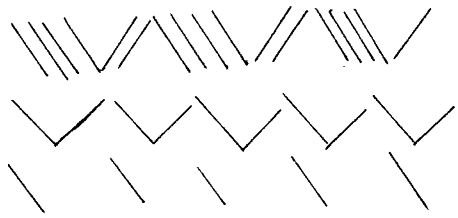
a. 

b. 

c.

d.

e.



Thus a grey area remains within formal patterning of 'decorative notation', in which the dichotomy of *structure* versus *design* cannot be resolved. However as this thesis is concerned with probabilities rather than certainties, this should not present and obstacle to further analysis.

2.6 The Question of Lunar Notation.

To be able to decipher to some extent the information that the engraved sequences recorded, there must be some clue in their structure that would enable us to recognise one interpretation as being more valid than another. For the information that the engravings might have recorded to be lunar, the structure must reflect the invariant and repetitive nature of the lunar cycle itself. Thus we can use the moon to 'calibrate' the alleged notations in a way that it is not possible to do if it is believed that they record a given quantity of which we can know nothing, such as the number of people present at any one event, or the number of days passed in a particular location. Although there are possibly and even likely to be discrepancies in a recording of the cycle, owing to days when the moon may be obscured, the overall pattern should be self-correcting, as the moon itself cannot get out of phase, and therefore a lunar month will always be limited in length.

The allowances that can be made for any errors are considerably reduced, if not eliminated, if one accepts Marshack's assertion that there is an element of continuity running through all the sequences during the Palaeolithic, implying that there was a direct transmission of the information about the moon from generation to generation over thousands of years, (Marshack, 1972). Each sequence was produced within the same cultural conditions which implies a foreknowledge of certain patterns of behaviour.

Yet this approach further questions the validity of using the results of microanalysis to distinguish a lunar notation, or any notation, from decoration. As the microscope reveals a change of tool point in a simple sequence, it is plausible to follow Marshack's argument that the finished engraving was the result of several 'sittings', though whether these were over minutes, hours, days or years we have no means of calculating, unless we already know precisely what it was that was being recorded, and why. Marshack begins with the hypothesis that the marks were made over a lunar month, with an observer recording each night the position and/or nature of the moon's cycle and appearance at that point, in a coded form. Yet if this was the case, surely it would be expected that *every* mark would be made by a different tool? From Marshack's work on the tool changes it is evident that the pattern suggests that the marks were commonly recorded in whole groups, that can range in size from 1 to 65. Thus it seems that Marshack is accepting that the people of the Palaeolithic could actually **count** so as to record a phenomenon retrospectively, and particularly one that appeared over a number of days. This suggests that something more than a simple tallying system of direct day to day correspondence was in operation, and that in fact the record we must have, is one that was constructed some time after the moon had manifested itself in that particular form.

Of course, if we accept that Palaeolithic populations already knew the path of the moon, it is not counting that has occurred, but simply the use of memory. Yet if it is the case, it is difficult to see why firstly, there is the need to have more than one sitting to record the entire sequence, which would make it by Marshack's own criteria, decoration, and secondly, if there was cause for each phase of the moon to be actually re-recorded each time, why it was not unerringly accurate, and more structured and standardised. This does not assume that information must be structured in a consistent way to be able to transmit information to the people who made it, but it must be so if we are able to recognise the information that it contains some thousands of years later. It follows that only the very earliest examples should contain inaccuracies, as in an 'evolved' tradition, it is assumed that the basic form is understood,and it is merely refined and altered to fit a given situation.

2.6.1 The Structure of Lunar Notations.

If there was a recognisable way of recording the phases of the moon, it could only have been devised retrospectively: it is implausible that a structure was imposed in advance on an on-going empirically observed sequence. The fact that we have no reason to suspect that such a structure was in existence, and there is never a perfect correspondence to his lunar model, means that it is plausible to assume that all the examples that Marshack asserts are lunar, were in fact made empirically, *without* prior knowledge of the structure and organisation of the lunar month being recorded. Furthermore, if all the examples were made without prior knowledge of the phases of the moon, there can be no evolutionary tradition of such notation, as Marshack postulates. Thus it follows that even if the examples are lunar, they do not represent the actual forerunners of the later developed calendrical systems, as there is no evidence of culturally standardised communication of evidence.

Thus it can be assumed, that if we are to identify any notations as being lunar, they must correspond to quite specific criteria, that must be flexible enough to allow a varied range of possible notations to be incorporated, yet not be so general as to include almost every engraved sequence. For example, the same restrictions should apply to the recognition of pertinent variation as in the criteria for notation, namely that it should be consistent and standardised. If it is asserted that the height of a stroke in a notation *doesn't* matter, then there should be a range of heights evident: if the spacing of groups *does* matter, then they should be structured and regulated. It is surely important that any significant variation should be identified, even if it is just one unique example that consequently cannot be meaningfully interpreted, owing to its isolation. Also, there should be room for comparison from one possible lunar month to the next, otherwise as discussed previously, this would imply that no consistent convention had been used, and therefore the meaning of the notation is impossible for us to deduce.

The criteria below are forwarded as being the most likely to allow an identification of lunar sequences.

1. The marks must be decipherable in some way, for example, there should be an exact count of 28 - 30 marks in each group to correlate with the lunar months.

2. Consistency in the groupings, with some repetitive elements.

3. If the groupings are irregular, there should be a recognisable method of showing that the significant lunar points (here taken to be the periods of full moon,

invisibility/crescent moons and the two half moons) are consistently indicated in some way, either by the heights of the strokes, the use of pertinent spacing, or possibly by the use of a symbol or sign at such key points.

4. The sequence should correspond accurately with a *consistent* lunar chart, that is, one that includes all the significant lunar points at all times, although it is acceptable if there is a correspondence to only one or more of the lunar points, as long as any chance correspondence to one of the omitted points is not regarded as being pertinent to the meaning.

5. The overall structure must be standardised, and visually recognisable as such.

These Criteria are summarised in Table 1.

2.6.2 The Need to Establish a Context for an Artefact.

In addition to the criteria already stated, there should also be some specifications that must be met, before a given example can be considered as a suitable example for any subsequent analysis. This is crucial if the results from a given example are to be considered representative of an archaeological culture as, unless there is some knowledge of the approximate age, context, and state of preservation of an artefact, then any conclusions must be discounted. Marshack tells us that for the purposes of his analysis, he was,

> '... picking up piece after piece that seemed partial, broken, or non-notational'.

Marshack, 1991:44.

Although he never explicitly records how he deduced that this was the case.

The following criteria are an attempt to counter this subjectivity or lack of explanation.

Criteria to Establish a Context for the Artefact.

1. The site location and approximate date of the artefact should be detailed as fully as possible.

2. As part of an excavated assemblage, any associated finds in earlier or later levels could be relevant, as well as the direct context within the stratigraphy.

3. Whether or not the artefact is known to be complete, which can be related to the general state of preservation, is critical when assessing whether there is decoration or a notation, let alone a lunar sequence.

4. There should be grounds for assuming that the marks are man-made, with the explicit isolation of any that are not.

Ideally, two further points should be added to this list of criteria:

- That there should be an attempt to implement controls and checks.

- That all the examples should be approached with the minimum of preconceptions, and analysed initially in isolation from all previous findings, at least insofar as these could prejudice the result. That is, the belief that one example is an example of notation should not result in it being used as a model for other notations.

2.6.3 Conclusion for the Section.

It is now accepted that the relatively sudden appearance of the cave art of the European Upper Palaeolithic was more than the inevitable result of the people of the time discovering that they could paint and engrave. The manifestation of the cave art is now seen as part of a cultural continuum that probably first expressed itself during the Middle Palaeolithic (White, 1982, Mellars, 1989). The dramatic increase in the incidence of portable art and the use of cave and Rockshelter walls is believed to reflect a new desire and possible *need* to transmit cultural information in this new media. By interpreting the art as 'meaningful' researchers emphasise the possible social and ecological conditions that may have promoted it, such as a contraction of resources towards the onset of the glacial maximum at 18 Kyr, resulting in a shift in the subsistence base and the possible emergence of a new social order to adapt effectively to these changes.

The interpretation of these systems of visual communication requires a careful use of terms. Any assessment of the art based on purely aesthetic criteria must be rejected as an interpretation based on personal or cultural bias. Any attempt to assign a specific meaning to an iconic image must err on the side of caution, and use the convention of 'x' and '!' to denote actual and inferred resemblance to a known natural form. (Layton, 1990). The recognition of an association between two engraved or painted images, and especially the identification of abstract images, is still essentially subjective. As argued previously, the relation of an image to the form of something in the natural world is more likely than not, then a specific attribution of iconicity must be demonstrated. It is not enough to identify a resemblance, and if it is one that appears to 'fit' plausibly with other more recognisable images to assume this to be the 'proof' of its identity (Clottes, 1989b, Lorblanchet, 1989). If a convincing resemblance cannot be demonstrated, then an image must be classified as apparently non-iconic.

The classification of the non-figurative 'signs' made by Sauvet (1990) identifies certain common principles of construction and searches for their presence and combination within a system of signs. Washburn (1983) also classifies non-figurative representations according to their use of symmetry. By breaking down combinations of lines in to their basic parts she reveals similarities between two images based on their common use of symmetry. Artefacts grouped together in this way can be easily compared, and this facilitates the isolation of true changes and variability in the use of structural principles. By adopting these models of symmetrical manipulation of certain elements she avoids the subjectivity of certain terms such as 'chevron', preferring,

> 'one-dimensional designs generated by horizontal mirror reflection.' Washburn, 1983:144.

As the identification of representative images and decoration can be relatively straightforward, notation in this sense forms a 'residual' category, that is, we can ask if a configuration of lines is not iconic or decorative could it have been notational? The problem of distinguishing between possible notational and decorative sequences has been addressed but not wholly resolved. However as I am only really examining the *probability* of identifying examples of notation, such conclusive rejection of the example being decorative is not needed.

Chapter III

A Consideration of Ethnographic Material.

'The Pima of Arizona make use of a tally... The year-notches are alike, yet when a narrator was asked to go back and repeat the story for a certain year he never made a mistake.' Nilsson, (1920:104).

3.1 Communication Through Signs and Symbols.

This chapter is concerned with validating the criteria formulated in the previous chapter which intend to provide an appropriate means of classifying the marks made on artefacts from the Upper Palaeolithic, summarised on Table 1 at the back of this thesis, and here as Table 3.1. As these criteria were derived logically from first principles it should be possible to objectively apply them to a range of selected data from ethnographic collections. The reason for testing these criteria against known examples of notation is to provide a control. Should the criteria prove to be apt when testing against known examples of notation, this will provide sufficient grounds to proceed to classify the Palaeolithic data according to the same criteria.

3.1.1 Introduction: The Present into the Past.

The problems of relating material from the present to the Upper Palaeolithic has already been discussed in the introductory chapter. The discussion focused on the use of analogy, specifically the problems encountered when comparing material from the known present to that from the past on the basis of perceived physical similarity, and from this to infer that the two might have other none observable properties in common, such as a common social function or cognitive structure. A summary of the difficulties inherent in the misuse of analogy, as well as constructive advice on how to avoid them is given by Alison Wylie (1985). Wylie demonstrates that the alternative methods proposed by Gould (1980, 1982, 1988) and Freeman (1968) to provide more objective models of interpreting the past, are not only equally subjective and liable to abuse, but also based on analogical inference. She stresses that analogy can,

> '... be a profoundly creative, expansive from of interpretive argument'

This can be true only if the basic difficulties are acknowledged by the investigator, and the analogies made are restricted to those specific points that are forwarded for consideration.

I concluded that although parallels can be drawn between examples that share identical or similar physical properties, or a perceived similarity of form, this cannot be presented as evidence that these artefacts performed the same function. This further step can only be taken if the form of the contemporary artefacts can be demonstrated to relate *directly* to their function, and that the same principles are evident in a representative number of artefacts. Such an argument is considerably enhanced by identifying the context within which the artefacts are known to have functioned, and so the retrieval and consideration of objects that have documentary evidence, or in the case of prehistory, an accurately constructed archaeological context is preferable to the selection of objects at random.

Therefore, only when these principles of construction have been abstracted from the ethnographic data, and demonstrated to correspond with the criteria that I have devised, can these criteria be related to the material from the Upper Palaeolithic. It is necessary to stress that the criteria will be applied in exactly the same way to both sets of data, as the aim is to discover whether or not the same principles are in operation. As with any research, it is possible that the artefacts from the Upper Palaeolithic were constructed and represented in an entirely different way from those of the ethnographic present, however this would not invalidate the methodology. Should the results be entirely negative the conclusion could be that,

i. Different principles were in operation, that could not be predicted or accounted for by the present information available from the archaeological record.

ii. That the artefacts that I chose to examine were not selected from the appropriate group, that is, the people of the Palaeolithic did make notations but not on mobiliary artefacts, and therefore testing the same criteria on other classes of artefacts might prove to be more fruitful.

3.1.2 Sources of Data.

The scope of the comparisons that I intend to draw between ethnographic and Palaeolithic material in the following sections is minimal. The examples I have collected come from the Pitt-Rivers Museum, Oxford, The National Museum of Scotland, Edinburgh, The Museum of Mankind, London, and the University Museum, Manchester. The material differs greatly in both form and content, although it is still possible to classify the artefacts under the general heading of 'meaningful visual communication'. As the primary foci for this enquiry are notation and calendars, I considered it appropriate to examine ethnographic examples that were used for communication of a direct message, rather than an abstract idea or a general concept.

The material presented here was to a large extent 'selected'. This is not to imply that I have included only material that I anticipated in advance would demonstrate the validity of my thesis, but that I was aware that certain very broad classes of artefacts, such as the Australian message sticks that were apparently meaningful in some way, would provide a fruitful and interesting collection of data. Also, some of the museums contained tallies which could provide a source of information about the ways in which a given quantity could be recorded, and I felt that this was essential for any discussion of the relevance of this material to the main focus of my thesis, namely the evidence for notation in the Upper Palaeolithic. However beyond this, the examples that I have examined were selected as examples of apparently non-iconic marks on bones, or at least, as was the case with Australian message sticks, they were not instantly recognisable as iconic.

3.1.3 Translating Tallies.

The material can be initially divided under the broad headings of calendars, which are predictive models of time, and tallies, which are a record of days or other quantities. The latter category will be addressed first, and further divided in to two sections: tallies from within a literate culture and those from other cultures. A related group are isolated as 'tallies of time', which are distinguished from calendars on the basis of their being a responsive as opposed to a predictive record of time. Decorative representations will form a further category, yet whether or not these

Table 3.1 — The Criteria to Classify Decoration/Notation

Establishing a Context for the Artefact.

1. The site location and approximate date of the artefact.
2. Some knowledge of the associated finds and context.
3. Whether or not the artefact is complete and the general state of preservation.
4. Grounds for assuming that all the marks are man-made, with recognition of any that are not.

Criteria for Iconicity.

5. A resemblance to a known natural form by the basic outline and/or form.
6. The presence of any additional characterising detail.

Criteria for Decoration.

The characteristic properties of design, following Washburn (1983),

7. Symmetry
   i. Translational
   ii. Slide reflection
   iii. Mirror reflection
   iv. Rotation
8. Balance
9. Rhythm

Criteria for Notation

Key Characteristics:

10. The repetition of a single element, with pertinent variation.

11. The identification of pertinent and non-pertinent variation

12. Each mark should be clearly definable

13. Recognition of the 'path' of the sequence.

Subsidiary Characteristics:

14. Any apparent divisions should be recognised

15. Positional notation

16. Cipherisation.

Criteria for Lunar Notation.

17. Fit with a lunar/ solar/ astrological sequence by,

a) An established, consistent and repetitive pattern

b) Clear indication of any characteristic points relative to the sequence.

artefacts are meaningful will be predicted only when the criteria that I have devised have been applied.

Certainly an examination of museum collections illustrates the range of forms, techniques of construction, size and material that notational records can take. This alone emphasised the need to examine the contemporary record, if only to realise the diversity that one broad class of material can assume. It must be mentioned, that although I found sufficient material to conduct my analysis, there does not appear to have been a systematic collection and donation of tallies to these museums, with the notable exception of the Pitt-Rivers, Oxford. Any examples that I came across formed part of larger collections and had little or no documentary information, other than a brief statement of their location and purpose. In some instances further documentary evidence could be gathered, although for others this is simply unavailable.

In confining myself to analysing a comparatively representative selection of the artefacts available there is an emphasis on material from hunting and gathering societies. However this is a reflection of the collections, rather than a particular bias of mine, and the selection made was primarily for convenience. The same analysis could have been performed on a range of material from any modern or historical collections, and the methods that I employed and any conclusions drawn from the results in this instance would have been based on identical premises. The only particular parallel that I feel is warranted at this stage is that, judging by the archaeological material available from the Palaeolithic and the material from the museum collections, the level of technology employed in their construction is comparable. Whether or not this implies a comparable level of skill and understanding in any other area is something that must be demonstrated by a more detailed analysis.

I will analyse the following examples with regard to,

- The nature of their content (if known).
- The cultural context within which they functioned.
- Their form and structure (using my criteria).

As these examples come from all over the world, it is necessary to analyse each artefact in some detail. In providing an adequate description of all the known variables for each artefact it will be possible to build up the context in which they functioned. Superficially this data will vary from culture to culture, although it may be possible to isolate some general principles as to the basic role they played, which could relate to their form. The primary purpose of this analysis is to identify and then try to isolate by using the criteria, any specific characteristics or general principles of form and/or construction, that may prove to be common to all the artefacts.

3.2 The Nature of Directed Meaning.

The following section will concentrate initially on establishing the method of analysis using Australian message sticks to illustrate the points, and then continue, with reference to this work, with the other examples.

3.2.1 What are 'Message Sticks?

Australian 'message sticks' were used by the aborigines (except the Arunta) to facilitate the transmission of information from one tribe to another. They form part of a wider system of visual communication, which includes sand drawings, body paintings bark paintings and rock paintings. Hamlyn Harris (1918) identified four categories for their use, which although not exclusive do impose a rudimentary classification:

- As a means of **introduction**
- As a **passport**
- As a direct encoded **message**
- As a **mnemonical** message to the bearer

The first two categories ensure the safe passage of the bearer(s) of the message sticks through alien and possibly hostile territory, and his acceptance as an emissary at his destination. The remaining two relate very much to the artefact itself – whether the marks represent an easily decoded message that is decipherable to the recipient, or whether the marks mean something only to the bearer and the sender, and the message is actually delivered verbally. Here message sticks can be differentiated from *Toas*, which are also elaborately carved sticks and are part of information exchange via material culture. However *Toas* can be left for another group to find, and so they are a message in themselves rather than a mnenomical device (Morphy, 1977). Hamlyn-Harris quotes from R.J Cooper who lived on Melville Island,

> 'I have heard them read them ... and then another person may get a stick differently marked altogether and the same meaning applied, and vice versa. I have received 'message sticks' myself personally, but always the bearer has told me what is wanted, and the stick explains itself.' 1918:14.

The common principles of their construction is that they are made of wood of all kinds, and that the surface is specially prepared in a time consuming process using stone tools, and then they are engraved. The nature of the design is at times specific only to the message to be conveyed, but there is evidence that totemic symbols and specific signs are used that can be directly interpreted by the recipient. In such cases the geographical range of the message is necessarily limited to groups that share a common system, and certainly Hamlyn-Harris' informants were adamant that Westerners would be unable to decipher the content, which is corroborated by Cranstone, (1973).

There is also evidence to suggest that 'message sticks' were also involved in barter, that is an individual would keep a record of the articles in a given transaction to aid his memory. The work of Howitt (1904) concludes after a detailed and informative description of the use of message sticks amongst some aboriginal groups in South-East Australia,

> 'The evidence shows that the message-sticks are merely a kind of tally, to keep record of the various heads of the message, and that the markings have no special meaning as conventional signs conveying some meaning.' Howitt, 1904:710

Howitt describes how the *Kongait* tribe sent a particular stick to the *Tongaranka* to invite them to an initiation ceremony:

'This message stick is made of part of a small branch of a tree, and is wrapped round with a few strands of a man's kilt, with which article of man's attire the boy is invested after initiation. The whole is tied up in about two feet of the cord made of twisted opossum fur, which the novice wears for a time, after his initiation, as evidence of his having been made a 'young man'.' Howitt 1904:692.

3.2.2 Mountford's Work With the Tiwi.

This work is included here to 'test' my analysis of the message sticks at this stage. The Tiwi inhabit Melville and Bathurst Islands, two of the largest Australian islands. In the opening paragraphs, Mountford states that the art is,

'.. highly formalised, and cannot be interpreted without the aid of the artist',

and from this he deduces that the art of this aboriginal people more closely resembles that of Central Australia than the familiar animal silhouettes of mainland north Australia. Whether the criteria that I have devised and applied to the other examples of message sticks will prove to be appropriate for those that Mountford has documented will be investigated.

Mountford describes the function of the Tiwi's message sticks, or *purunkita* as being used for,

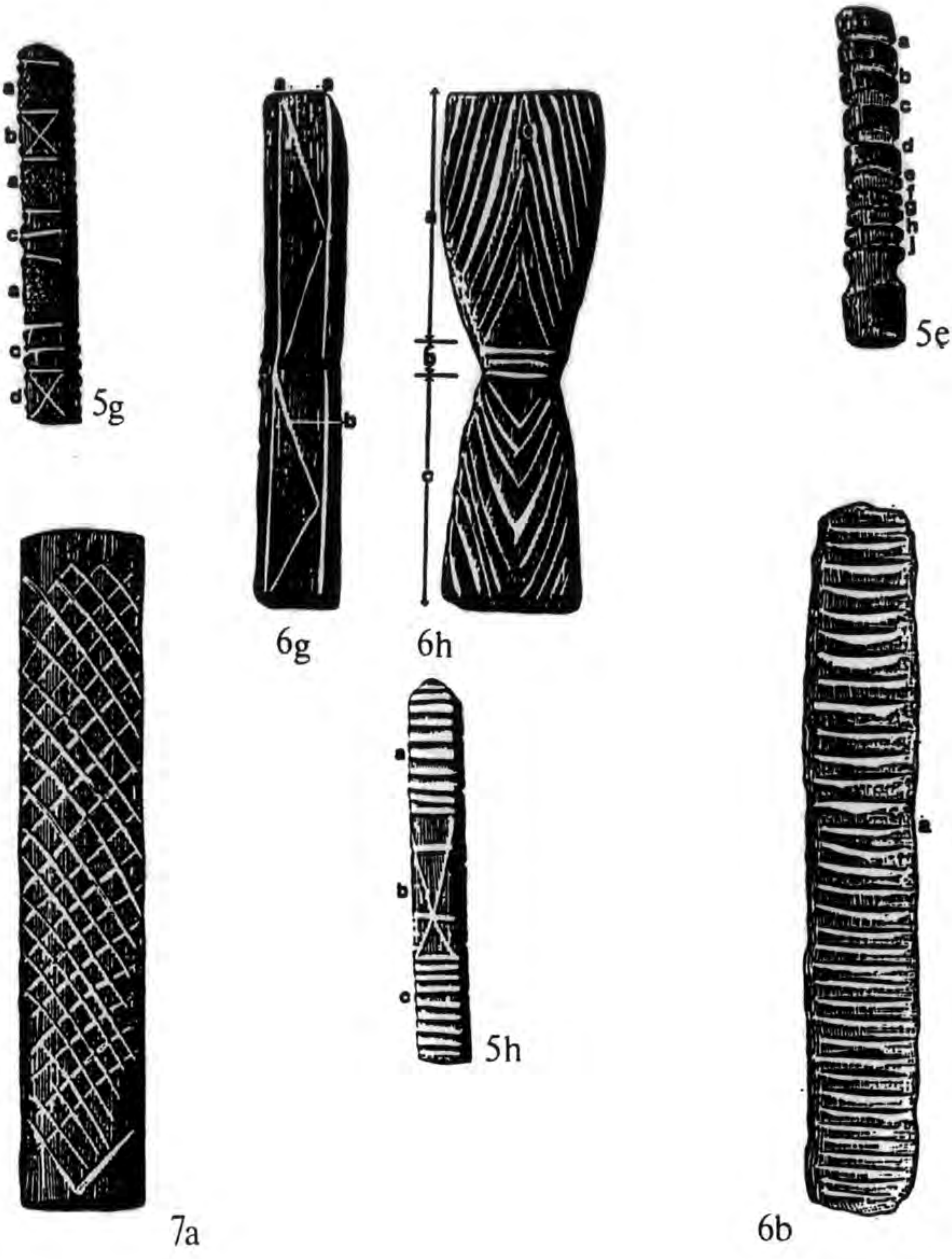
' personal requests from fellow tribesmen, asking for presents or supplies; invitations to other groups to perform ceremonies, and in association with *pukamuni* (funerary) rituals.'

This emphasises a fundamental point in the discussion of message sticks, that they are always *delivered* by hand and therefore their meaning does not need to be transmitted by, and therefore inherent in, their form alone. In one instance, Mountford records that the message stick (7C) that was carried to the people at Bathurst Island referred only to the topographical features along the road, and not at all to the news of *nulatini's* death, which was the reason for sending it.

3.2.3 Six Examples from Mountford

The message sticks that Mountford draws, illustrated on Figure 3.1, are also 'translated' for him by aborigines from the area, some being specially made and others were still being used. From the summaries that he gives, only six appear to refer

Figure 3.1 — Illustrations from Mountford's 'The Tiwi'.



to a quantity of any form having been recorded, and of those, only in three is it suggest that the actual number is indicated, namely at 'Side G ', and the two 'shopping lists' of points '4.' and '5.'. The examples are listed below as points 1 – 6, and all the bold emphasis is mine.

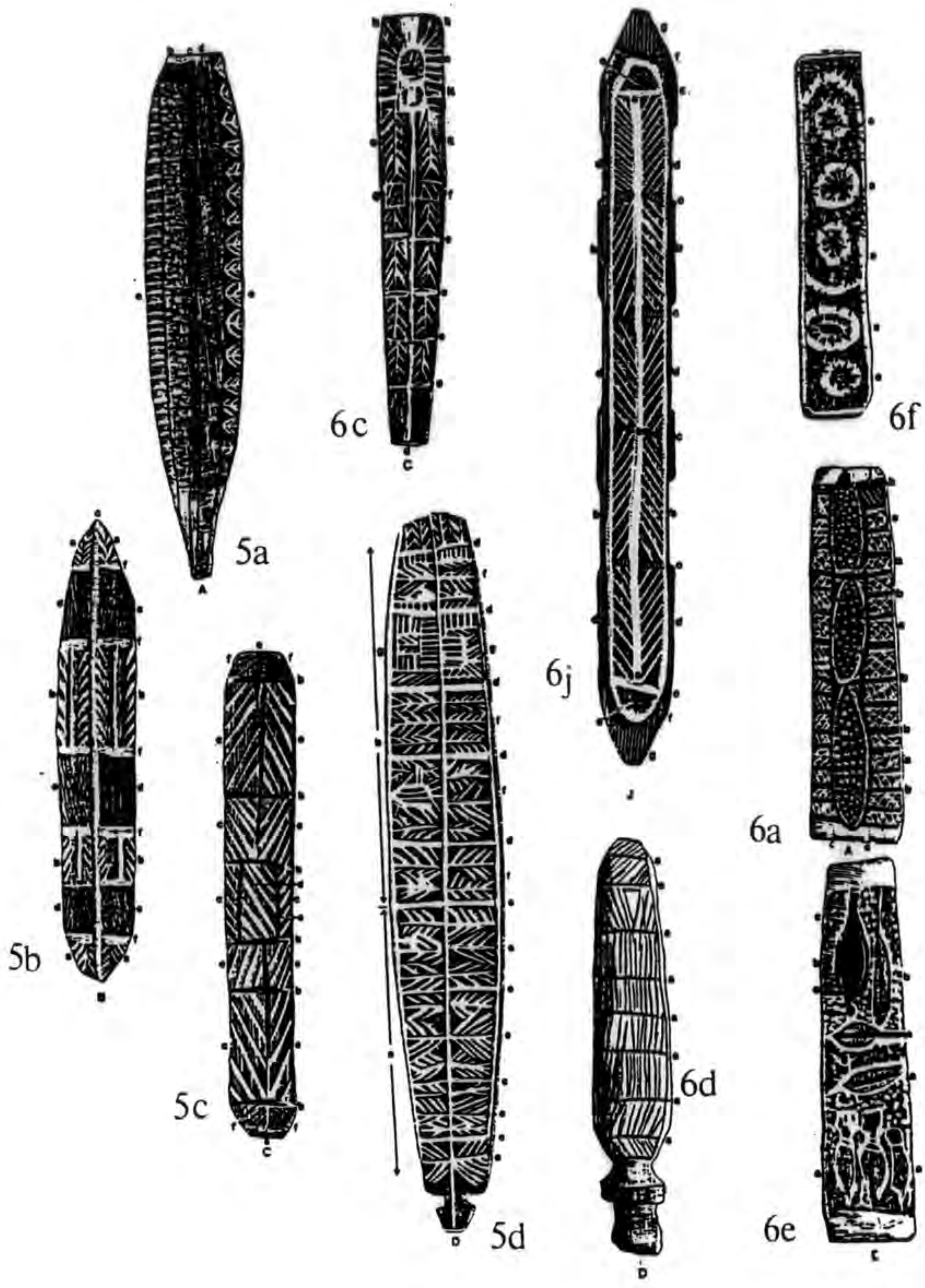
1. Side G in Mountford's group 5, 'on side G, the crossed square *d,* is the *mil-imika* of the Bathurst islands group, and *b,* that of the Melville Island people. **Groups of lines, *c, c,* refer to the number of 'working men' to be appointed,** while cross- hatched areas, *a, a,* indicate a request to the 'workers' to do their tasks well and happily.'

2. 'Fig 6B is a *purinkita* sent by an old man, *Tipumbriaria,* in Bathurst Island, asking him to bring many aborigines to the forthcoming *pukamuni* ceremony at Melville Island. **The cross-lines, *a,* indicate the required number of men.'**

3. Fig 6G,H, illustrates a message stick (not associated with a *pukamuni* ceremony) from the Melville Island people, inviting the aborigines on the Coburg Peninsula to pay them a visit and to perform some of their Mainland ceremonies. On the obverse side, Fig.6G, the parallel lines, a, a, symbolise the shores of the Coburg Peninsula, and the zig-zag line, *b,* a mangrove creek in the same locality. On the reverse side, 6H, the V-shaped patterns, *a,* indicate **the men who have been invited form the Coburg Peninsular**, and those in the lower section, *b,* the women. The short transverse lines at *c,* **represent the Melville Island men who will act as hosts to the visitors.'**

4. 'The diamond patterns on Fig. 7A refer to the numbers of men in the large *Mungdunkala* totemic group. On the reverse side (Fig. 7B), the zig-zag line *a,* is the road between Snake Bay (upper end, *b,*) and Cockle Point, in Apsley Straits (lower end, *c*). At *d, d,* is a request for two six-pound bags of sugar; *e,* for tea; *f,* sufficient printed calico for a loin cloth; *g,* three sticks of tobacco; *h,* a tin of tobacco; *j,* a pair of trousers; *k,* a pocket knife, and *m,* a pipe. The crossed lines at *n* indicate the camp of *Tjamalumpua,* the sender of the message stick.'

Figure 3.2 — Mountford's Message Sticks with Lines of Symmetry



5. 'Fig. 5E is a secular message stick sent to an aboriginal, *Marawani,* who was on a visit to Darwin, asking him to bring back the following goods; *a,* tobacco, *b,* matches, *c,* a pipe, *d,* a calico loin cloth, *e,* a pair of short trousers, *f,* a shirt, *g,* sugar, *h,* tea, and *j,* flour.'

6. 'On side *5H* , the lines, *a,* refer to burial poles to be erected around *Wani-amperi's* grave; *b,* to the chief *pukamuni* men at Melville Island, and *c,* to the Bathurst *pukamuni* men whom *Jibunglialumi* will bring with him.'

An examination of the construction of these marks that Mountford identifies as notation, reveals that the groups *c, c,* show translational symmetry in three marks; that 6.B is composed entirely of marks following the principles of translational symmetry; Fig.6G, H groups *a, b* and *c,* all follow the combined effects of translational symmetry and horizontal mirror reflection; 7A shows 'diamond' patterns, with translational symmetry and rotational symmetry, and on the other side interestingly, all the requested goods and quantities are indicated by lines following translational symmetry; and for 5E, similar requests are indicated by cuts around the short axis, all parallel to one another, and therefore roughly following the same principle. Example 5H also follows the principles of translational symmetry, both for the possible quantity of the men, and for the burial poles.

Thus, all the forms described by Mountford as being records of quantity share the principle of translational symmetry, and the other examples that Mountford describes and illustrates, meaningful as they evidently are, include other forms of symmetry and other design elements, such as circles, zigzags and waving lines. There are of course examples such as 5H, where the translational symmetry occurs in relation to iconic imagery, as the lines at *a,* refer to the forms of burial poles rather than notation, and see also 6A and 6E, 6J. For the artist of 6D, the horizontal lines, *a, a,* symbolise the waves breaking on the beach, and the groups of short lines, a pattern of shallow gutters which had been formed on the sandy shore by the fresh water seeping from a nearby lagoon. Figure 3.2 clearly demonstrates the presence of horizontal mirror reflection about either the long or the short axis, or both, in all the examples except 6E, which is painted and still in use. However even this example had elements of ordered rhythmic repetition, and possibly translational symmetry.

3.3 The Message Sticks: Manchester Museum.

The examples MM/1, MM/2, MM/3, and MM/4, are from Manchester Museum, hence MM, and I have isolated them as a group as not only are they visually similar, but they are also unique in their contemporaneity. These message sticks are remarkably standardised in their morphology, with lengths ranging from 10.4 – 11.3 cm, and widths from 1.8 – 2 cm, and are illustrated as Figures 3.3 and 3.4. Although at first glance it appears that the marks on each example are very similar, it is quickly apparent that there is variation within their common form, which is broadly speaking, vertical cuts around the short axis with two longer diagonals on one of the two engraved sides. This variation will be discussed later, as initially just MM/1 will be analysed as being sufficiently representative of all four.

3.3.1 Analysis by my Criteria.

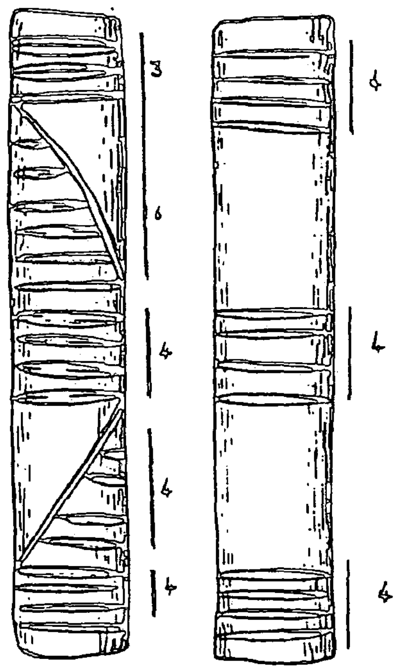
Establishing a Context for the Artefacts.

These message sticks were brought from the Groote Eylandt area of the Gulf of Carpentaria in Northern Australia. They were made by request for Peter Worsley while doing his fieldwork there in 1952 by the people of the *Wanindiljaugwa*, a term which is used by the original inhabitants of Bickerton Island to collectively describe the original inhabitants of Groote. A mission was established in the area in 1921, but it was not until the 1940s that any aborigines chose to settle in the immediate vicinity. The reason for the move, and the later influx of people from Bickerton Island, was probably to obtain the trade goods and the benefits of a 'white' lifestyle. In his work conducted in the Groote Eylandt area, David Turner makes no reference to the use of message sticks. However the shift in residence by the various territorial groups of the Groote Eylandt area to one of the three mission stations could account for the lapse in the practice of sending them:

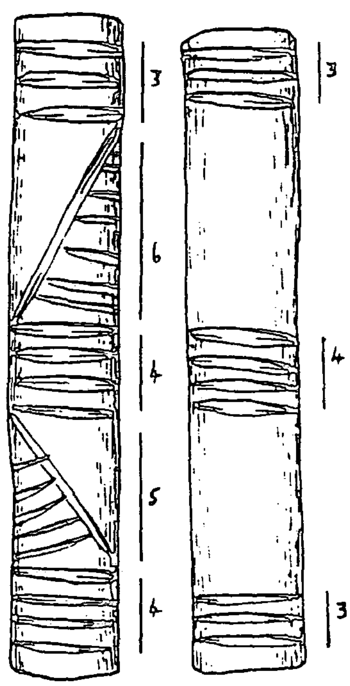
> '... following the migration of all these peoples from their traditional territories into areas of white settlement, ... work for wages replaced the barter economy.' (Turner, 1974:182).

The examples are made from a light porous wood, and covered with ochre. The latter is interesting as Hamlyn-Harris records that the older message sticks (in his

Figure 3.3 — Two Message Sticks from Groote Eylandt.



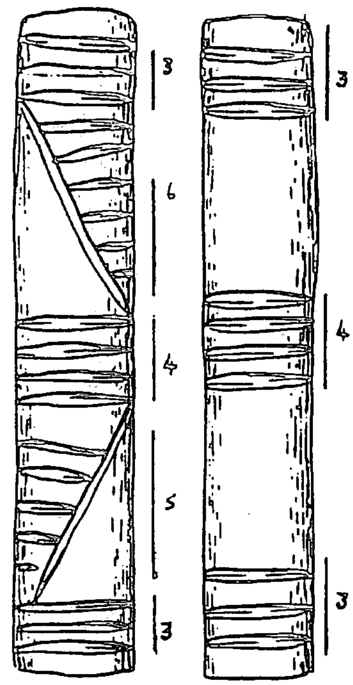
MM1



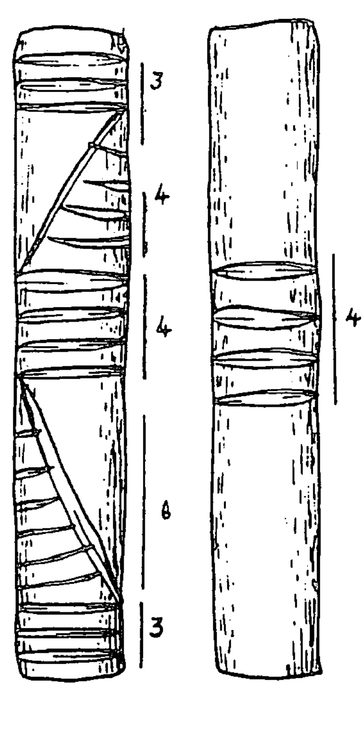
MM2

Figure 3.4 — Two Message Sticks from Groote Eylandt.

MM3



MM4



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experience) were rarely ochred, and this is corroborated by Banfield (1906) who stated,

> 'I have no information as to ochre on message sticks, except during current times when it is sought to catch the eyes of collectors.' source:Hamlyn-Harris, 1918:19.

It is possible that these are made with western ideas or preferences in mind, or that by the middle of this century all message sticks had become ochred simply as a matter of course. All the examples are complete.

Criteria to Assess Whether the Engravings are Iconic.

The examples do not appear to be iconic either by their form or by any characterising details.

Criteria for the Identification of Decoration.

The principle example to which I will refer will be MM/1, although the other three will be referred to when appropriate. This analysis is intended to demonstrate that it is difficult by simply isolating any regularities in the form, to predict what were the significant factors that the maker intended to be recognised. This is obviously specific to that culture, although what the analysis has shown is that the sequence generated by **number** alone, namely that of **'a b c c c'**, is the least patterned, and thus it is only when the design elements are grouped by the structure of their **design** properties, into the sequences of **'a b c b a'** and **'a b a b a'** that a pattern of repetition and symmetry emerges. Thus if these are examples of decoration, then the suggestion is that the actual **number** within each design group is not significant, and that it is their overall form.

From Figures 3.3 and 3.4 it can be seen that the marks on what I have designated as 'side two', follow a basic principle, the element common to all being centrally placed lines, and all but MM/4 have additional lines at the ends of the pieces. The number of lines for each example are as follows,

```
MM/1 = 4 - 4 - 4
MM/2 = 3 - 4 - 3
```

```
MM/3 = 3 - 4 - 3
MM/4 =     4
```

The variation of **MM/4** is evidently the most visually significant, although if each mark is to be counted then the variation between **MM/2** and **MM/3**, and **MM/1**, namely that the latter has an additional mark at each of the end groups must be seen as significant.

An Analysis by the Isolation of 'Design Elements'.

In identifying the repetition of design elements, following Boas (1955), it is possible to follow two interpretations –

a) There is a 'central band', with two other 'design elements' at each end, and thus the four sequences could be read as,

```
MM/1 = 4 - 4 - 4   MM/2 = 3 - 4 - 3   MM/3 = 3 - 4 - 3   MM/4 =  4
       ---------          ---------          ---------           -
       b   a   b          a   b   a          a   b   a           b
```

or, b) Or in more simple terms, the repetition of one band and therefore represented by,

```
a   a   a
```

or, c) by counting the number of marks in each group, they could read as,

```
MM/1 = 4 - 4 - 4   MM/2 = 3 - 4 - 3   MM/3 = 3 - 4 - 3   MM/4 = 4
       ---------          ---------          ---------          -
       a   a   a          b   a   b          b   a   b          a
```

which certainly emphasises the difference between **MM/1, MM/2** and **MM/3**, and also the continuity of the central group of four.

Thus the examples **a)** – **c)** demonstrate that the classification of certain design elements determines the sequence produced. This serves to illustrate the element of selection inherent in the analysis of structural principles via the isolation of design elements.

If the designated 'side ones' of examples MM/1 – MM/4 are divided into five design elements, as shown on Figures 3.3 and 3.4, the following pattern emerges:

- ○ The 'upper'[1] band of lines
- ◎ A series of shorter horizontal lines along the diagonal
- ◎ A central band of horizontal lines
- ◎ A series of shorter horizontal lies along the diagonal
- ● A 'lower' band of lines.

3.3.2 A Consideration of the Number of Marks.

An examination of the total number of engraved lines in these design elements is illustrated as follows;

```
MM/1 = 3 - 6 - 4 - 4 - 4
MM/2 = 3 - 6 - 4 - 5 - 4
MM/3 = 3 - 6 - 4 - 5 - 3
MM/4 = 3 - 4 - 4 - 6 - 3
```

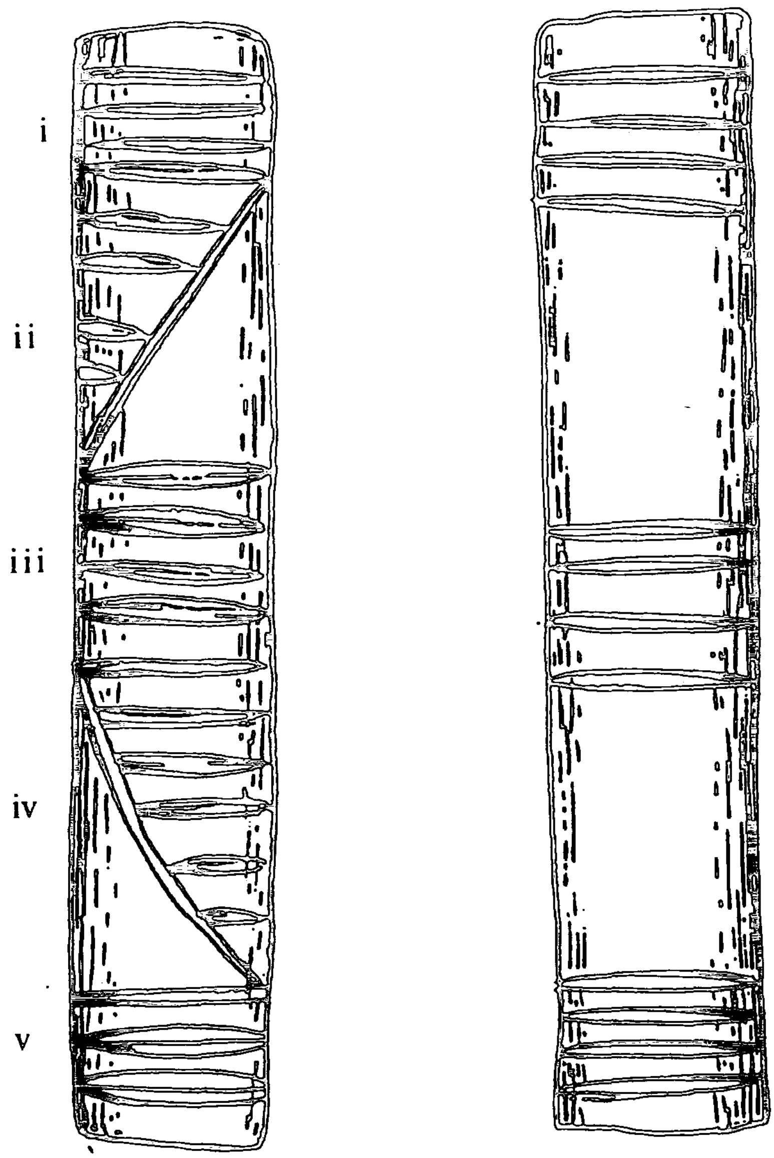
Just using MM/1 to illustrate the following points, it can be seen again that a number of patterns can be generated using Boas' lettering technique, as mentioned in Chapter II.

Therefore if it is **number** that is important, then MM/1 will read as,

```
MM/1 = 3 - 6 - 4 - 4 - 4
       -----------------
       a   b   c   c   c
```

[1] The top as shown by the orientation of the artefacts in Figures 3.3 and 3.4.

Figure 3.5 — The Possible Divisions of MM/1



Or if it is the number in each of the horizontal bands at i), ii) and iii) that is considered as pertinent, then it could be

```
MM/1 = 3 - 6 - 4 - 4 - 4
       -----------------
       a   b   c   b   c
```

thus aligning the middle and lower bands of '4' and isolating the 'upper' band of '3'.

Yet another variation would be to equate both the diagonal/vertical bands of ii) and iv), and then the 'upper' and 'lower' bands of i) and v),

```
MM/1 = 3 - 6 - 4 - 4 - 4
       -----------------
       a   b   c   b   a
```

Or to equate the diagonal/vertical bands, and all the horizontal bands to form,

```
MM/1 = 3 - 6 - 4 - 4 - 4
       -----------------
       a   b   a   b   a
```

The permutations of the various structured division of the lines are therefore seemingly endless. There is the obvious central design element of four marks in a band on 'side 2', perhaps the immediate response of an observer who is attempting to discover any regularities of form is to isolate the band on 'side 1'. Yet it is possible to look at the sequence as being composed of **three** elements, namely vi), vii) and viii), as illustrated on Figure 3.5. Thus the numerical grouping becomes ' 3 - 10 - 8 ', that is, the central '4' is incorporated into the '6' at the end of the 'upper' diagonal/vertical sequence, and the '4' at the bottom is similarly incorporated into the 'lower' vertical/diagonal sequence. Only the '3' is left isolated, and therefore forms a separate design element. It can be seen that the four examples of **MM/1**, MM/2, MM/3 and MM/4, all followed the same pattern of symmetry, namely a twofold combination of horizontal and then rotational symmetry. However, interestingly this analysis reveals that MM/1 is the horizontal mirror image of the other three, as shown on Figures 3.3 and 3.4. Thus at one level these examples are identified as all having the same principle characteristics in their form.

Summary for the Groote Eylandt Message Sticks.

Therefore, if the same criteria and principles of analysis are applied to this group of message sticks a number of points emerge. Firstly that no example is like another, and this extends also to MM/1 - MM/4 which share a number of common features. The number in each group differs; 'side 1' of MM/1 is the inverse of MM/2 - MM/4, and MM/4 'side 2' is different from the others in that group. Also, although the 'side 2's of MM/2 and MM/3 are identical, MM/1 has an additional stroke in the upper and lower bands.

However the common characteristic that has emerged from the analysis, is that although a strict 'count' of the line components in each of the 'groupings' reveals differences that could be significant, the recognition of the essential **form** of the 'groupings' emphasises the perhaps overriding similarity of form. That is, all the examples appear to have three sets of horizontal lines that completely span the short axis, and these occur consistently at the 'ends' of the sticks, and roughly at the centre. Furthermore the space between these 'groups' is crossed in all cases by a long diagonal that exactly spans the distance between the three groups. It is from this diagonal that shorter horizontal lines emerge, either to one side, or to both, occasionally crossing in a single stroke. Washburn's principles of symmetry again are useful in identifying differences between the message sticks, as revealed by the simple horizontal symmetry of MM/1-4 'side 2' compared to the more complex processes involved in MM/1 - MM/4 'side 1' for example.

3.3.3 Summary for the Australian Message Sticks.

From this analysis then I would conclude that it is the **form** rather than the number of lines that can be counted that give these examples their 'decorative' quality, and that a more detailed analysis that breaks down the decorative elements too far runs the risk of obscuring the overall pattern. There remains the problem of whether the differences in the number are significant, but this point is better analysed with regard to the question of notation rather than decoration. From the examples from Manchester Museum, I was able to conclude that where there was no obvious translational symmetry and grouping of a single element, then there was unlikely to be a readily identifiable system of notation in operation. However, where there was symmetry in other forms, and the repetition of an element then this was likely to be decorative, and possibly meaningful.

Therefore although this evidence from these message sticks is not enough to establish a general rule, it is possible to form a hypothesis on the basis of these results that a pattern is emerging, namely, that although the presence of translational symmetry does not imply notation, where there is notation, translational symmetry is present, and whilst notation could exist in other forms, and meaningful communication evidently does, notation does not appear to be indicated in the case of the Australian message sticks lacking translational symmetry. In short, it seems to be significant that where there is the translation of a single element, then there is also the possibility of notation. However, when other principles of symmetry are in operation, namely rotational symmetry, horizontal mirror reflection, and slide reflection, and involve a complex configuration, composed in itself of several lines, then there is unlikely to be any record of quantity encoded in its form.

3.3.4 Are Message Sticks Notational?

As the previous analysis demonstrated to some extent the relationship of all of the message sticks in both groups, the subsequent inquiry will reflect this, and examine examples **MM/1 - MM/4** inclusive. As the two sides of **MM/1**, **MM/2**, **MM/3** and **MM/4**, are not the same, only 'side 1' will be referred to.

The Key Characteristics.

1. The first point concerns the repetition of a recognisable element, with due consideration given to any pertinent variation. The basic design element for these examples are the horizontal lines, running parallel to the short axis. The only radical variation to this element are the long diagonals, running down the long axis, which occur twice, sometimes in opposing directions, on each of the sticks. Their consistent place, number, and appearance on all the sticks

makes this a pertinent form of variation. The other variation is in the length of the horizontal lines. Those along the diagonal naturally vary in a manner consistent with their correspondence to the angle, whereas the lines that are not in contact with the diagonal exactly span the short axis. Therefore there is a recognisable element, the horizontal lines, although there is pertinent variation in the length of the marks, and a possible third group of the two diagonals.

2. The variation between the *elements* has already been discussed, and resolved into basically three classes. However the variation between the *examples* must also be addressed, as it could be that the differential structure of the elements and the numerical composition of the groups is significant. The variation is between the position of the shorter horizontals and the diagonals, as shown in the line drawings on Figures 3.3 and 3.4. The other variation is in the numerical composition of each of the classes of elements, both on the stick from one side to another, and between sticks. *If* this example is notational, then this is of undoubted significance, as it is just such a variation that is likely to contain significant information. The fact that the shorter horizontals vary in each case, but the 'complete' horizontal bands only vary *between* examples should also be noted.

3. If the marks are definable, that is, not visually confused by constant crossings, mandarins and indeterminate areas, there should be regular spacing to facilitate this order. For these message sticks this is certainly the case, as the space between each of the horizontal lines is remarkably regular.

4. The recognition of the 'path' of a sequence is also relatively straightforward for these examples. The edges of the message sticks forms a boundary to which the horizontal lines all conform, at least at one end. The exception is where the shorter horizontal lines are terminated by contact with the diagonal, which in itself thus becomes an identifiable 'path', as its presence has regulated the direction of the other elements.

Subsidiary Characteristics.

5. The possible subdivision for discrete areas of data is on the basis of form, namely the different elements of the horizontals, the shorter horizontals and the diagonals. However, the other possibility relates to the combination of these elements to form larger groups. For example for MM/1 - MM/4, the central band can be 'incorporated' into the upper diagonal and the shorter horizontals, and the lower band into the lower set of horizontals with the diagonal, thus leaving the upper band of horizontals isolated.

6. Whether these identifiable potential 'subdivisions' are to order and structure the information is always difficult to define, and often the best response to the question is 'unknown'. However with these examples, the fact that the structure is repeated on each example, and is comparable for all examples means that there is a strong case to suppose that an order and structure is being consistently and consciously imposed to arrange the elements.

7. The evidence of positional notation again relates to the difference between elements, and whether their relative positions can be deemed to be pertinent to the possible 'meaning'. As there is variation in the form of the elements this could be related to meaning, although this cannot really be assessed. It could be that the *length* is pertinent, in which case the variation between the shorter horizontals along the diagonal could also possibly be intentional signifiers for change of meaning.

8. There is no real evidence of 'cipherisation' in any of these examples. This is not to say that it does not exist, but that for it to be recognisable it would have to be in the form of 'composite' marks, repeated at least once.

3.3.5 The Evidence for 'Notation': 'Side 2'.

Key Characteristics.

1. There is the repetition of a single horizontal line, spanning the axis of the message sticks.

2. There is no real variation in the basic 'notational' element, as it remains remarkably standardised throughout all the examples. However there is variation *between* the examples, both numerically, and in relation to the overall structure of the lines. Firstly there is a difference in the number of lines on the message sticks, although there is standardisation on each stick, as all 'groups' on MM/1 total four, and for MM/2 and MM/3 the pattern is '3 - 4 - 3', with the two 'groups' at each end remaining even. The example MM/4 is alone in not possessing these groups at the lateral ends, and would appear to be outside the group were it not for the fact that they are positioned centrally, and all the other examples also have '4' horizontal lines in the middle group.

3. The marks are definable, and all are separated by spaces. There is also a regular pattern of spacing between MM/1, MM/2 and MM/3, where the horizontal lines are separated by at times a small space, and at others a considerably greater distance.

4. It is the regular vertical edge, and the parallel alignment of the lines that regulates the direction of the 'notational' elements.

Subsidiary Characteristics.

5. It is the spacing that forms the possible subdivisions, as for MM/1, MM/2 and MM/3 there are a 'group' of lines at each of the lateral ends of the message sticks, and another in the middle. This arrangement creates the maximum distance between three groups if they are all parallel along a short axis.

6. These divisions do order and structure the information, as the horizontal lines are clearly separated into 'groups ' of '4 - 4 - 4', '3 - 4 - 3', '3 - 4 - 3' and '4' for MM/1, MM/2, MM/3 and MM/4 respectively.

7. There is possibly positional notation, as the 'groups' are separated by spaces which create potentially three and certainly two 'positions', namely the 'centre' and the 'end' position.

8. There is no evidence of cipherisation, as there is the simple repetition of a single element.

3.3.6 Conclusion to this Section of the Analysis.

The evidence for a system of notation is quite strong, as there are certainly elements of order in the manner in which the lines are arranged, and consistency in both this and the variation in the form of the elements. However, it is the fact that the evidence for notation is so dependent on changes of form and not form combined with differential spacing that is perhaps the principle problem with the evidence in favour of notation. A crucial point is that the actual *number* in any of the 'groups' is difficult to assess *without counting*. It is even possible that the smaller design elements that I chose to isolate and class are not the principal components of the fundamental structure, and it is the larger 'mixed' groups also considered that are. Basically there is certainly order, but not of the kind that would be necessarily expected for a notational record, that is, the information is contained as much by rules of symmetry as by the expected need for basic spacing and smaller groupings.

However the same cannot be said for the 'side 2' of **MM/1**, **MM/2**, **MM/3** and **MM/4**, where there appear to be totally different principles in operation. Here there is a single design element, definitely grouped in fours or threes, and at all times maximising the potential for visual impact, namely horizontal lines that fully cross the short axis, strict parallel alignment, and even spacing, running to the maximum possible distance between 'groups'. It is therefore possible to conclude with this justification that these sides could very well represent a notational sequence of marks, intended to convey a record of quantity of some form or another.

Thus on the basis of the two different analyses conducted on the seven examples, namely for 'decoration' and for 'notation', a number of factors have emerged. The fact that the seven examples form a 'group' is demonstrated by the underlying similarities of design elements and form. However the same principles of symmetry are shared only between **MM/1**, **MM/2**, **MM/3** and **MM/4**, which distinguishes them as a single 'group'. If the examples are classified as 'decoration', and it is the form that matters, and they are taken as if each side represents a composition, then this would also justify their segregation, thus forming one group, and the others seen as related, but individual examples. It is therefore suggested on this basis, that a different pattern might imply another form of information if the design is meaningful.

However from a notational point of view, all seven examples are different numerically and therefore the role of 'form' may function to isolate what exactly the notation refers to, or maybe this renders all the information transmitted different. On the basis of the analysis of 'sides 2' of MM/1 - MM/4 it seems possible that here is the true candidate for classification as 'notation', as it conforms in a most satisfactory way to all my criteria. This being the case, it seems appropriate here to classify on the basis of form the other 'sides' and examples as 'decoration'.

3.4 Tallies – Sticks and String.

It is perhaps rather bold to assert with Menninger that, 'Tally sticks were Universal', meaning that each and every culture since, and perhaps including, prehistoric times have used a tally of some form, (Menninger 1969:224). Yet the evidence for tallying, that is a running total recorded by cutting notches on bone or wood, or occasionally by marking another surface such as stone or paper, or knotting string to create essentially the same effect, is present in so many societies that the case is not so overstated as it may at first appear. Zaslavsky (1973) records, in a discussion of their use in Africa, that the Sundi of Zaire record the payment of bridewealth by both the donor and the recipient families making a knot on a piece of string, and the Kamba of Kenya have a similar system using notched sticks. There are certain reports from Mozambique during the nineteenth century, of tax collectors for the Portuguese recording the individuals on knotted string, and the use of a specific medium such as string to record quantities amounts to the use of 'symbolic messages' for some societies from Togo to the Loango Coast, (Lagercrantz, 1968:121).

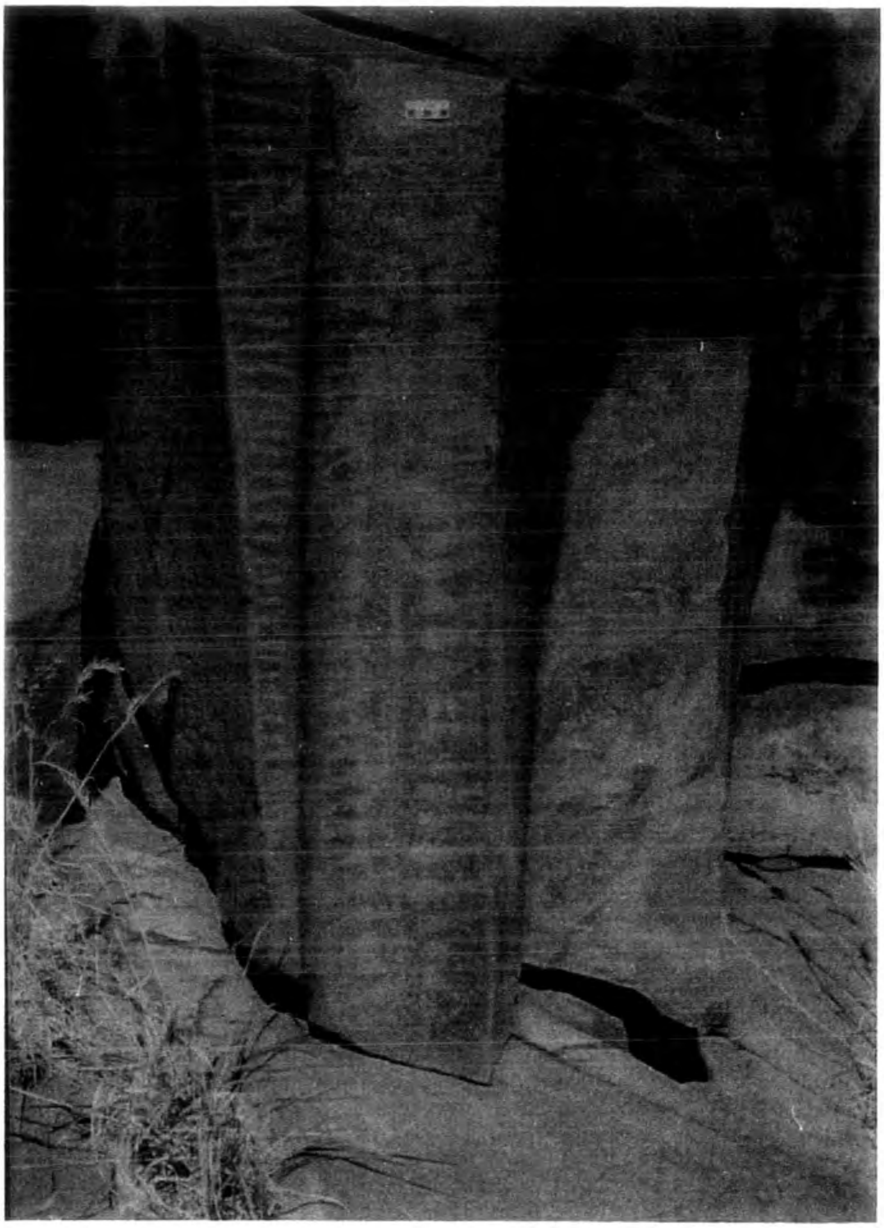
From the wider ethnographic record the evidence suggests that the many tallies are used in these ways to record quantity as the result of economic transactions, most notably the payment of tribute, barter, bridewealth or dowry. Plate 3.1 represents the marks made on a rock in the Upper Gascoyne River area of N.W. Australia to record the number of initiates who had participated in a ceremony. Each participant is represented by a vertical engraved line, each mark made roughly parallel to the next to form 'rows'. Although the *total* number of initiates would never be calculated, the *quantity* could be assessed, and the makers and observers knew that it represented the total, without having to know an exact number.

The following artefacts are taken together as examples of tallies functioning within essentially non-literate cultures. However this refers on the micro-level to the place where they were made and used, as it is likely in some instances that there is a literary tradition within the wider cultural sphere. This differentiation is to illustrate the probability that these initial examples represent tallying in its purest form – that is a complete record used to summarise and store information without the use or knowledge of a numerical or arithmetic system. The examples from within a literate culture are presumed to have been constructed by persons who probably knew how to count (although not necessarily literate themselves) as they operated within a monetised economic system, and therefore would be familiar also with the rudimentary forms of arithmetic.

3.4.1 Two Tallies: Naga Hills, Sakhai, Assam.

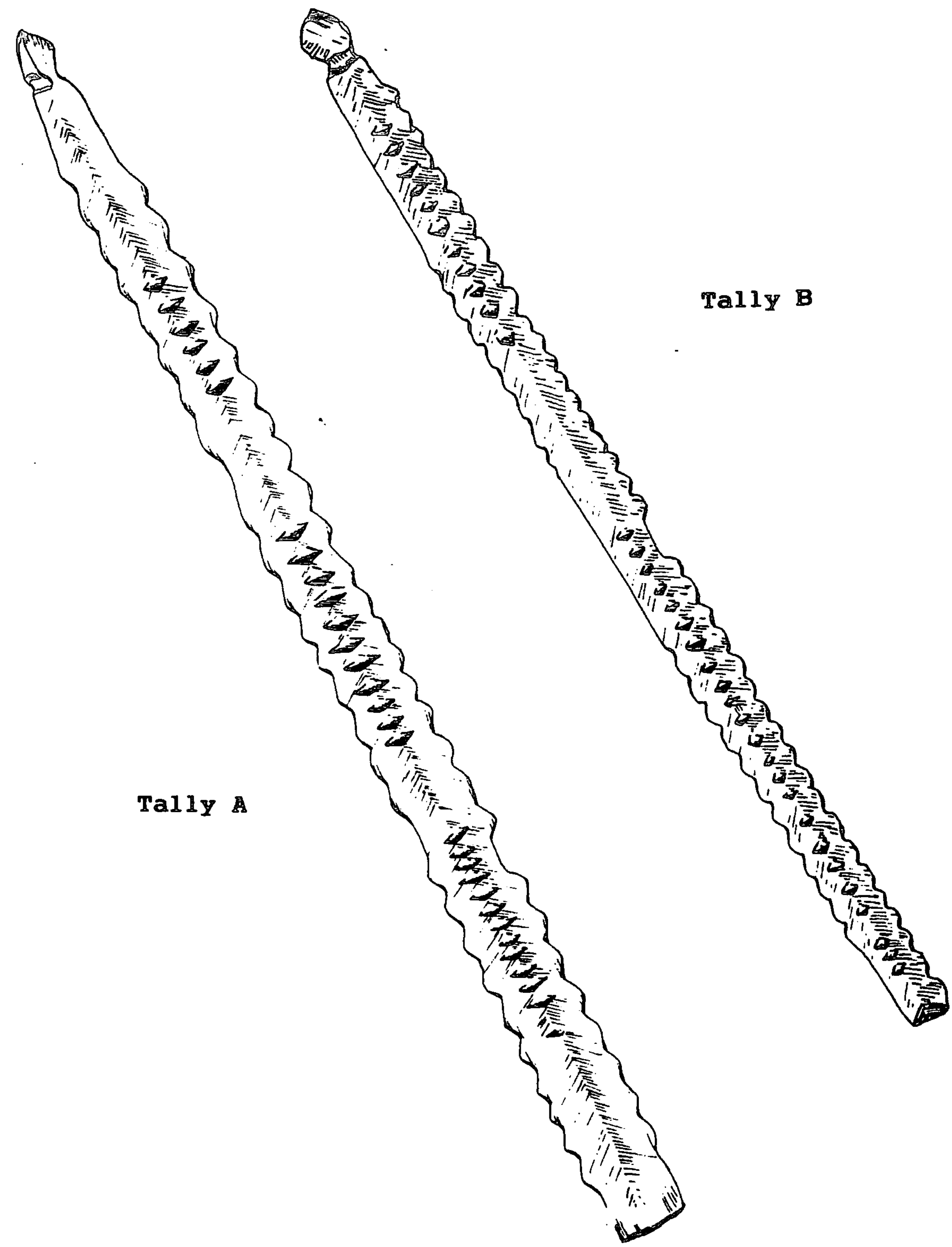
These are two notched tallies made of bamboo, recording the number of baskets of rice lent, and were donated to the Pitt-Rivers Museum in 1937. This implies that the precise form of the tally was not idiosyncratic to the maker, as for honesty's sake it is advantageous if both the recipient, donor and the rest of the village is aware of the nature of the record made. This is borne out by the fact that the two tallies are so similar, suggesting an accepted form was in use at the time. They are of a similar size and form, both worked with carefully prepared surfaces and ends. The notches cut into the worked ridge of one side of the tally are made in the same manner, forming deep elliptical holes. The fact that the two ends of each stick are different in form suggests that there was only one way of 'reading ' the tally. Each of the notches is clearly definable and the spacing is even between each marks, other than where the distance is distinctly wide. For 'Tally A' this occurs twice, and the distance between the two 'groups' is over 8 times the distance between the other marks. For 'Tally B' there is one distinct break over 10 times the average distance, and there is possibly another at the 'cut' end of the stick, but as this is only approximately twice the average distance, then it is impossible to verify.

Plate 3.1 — Tally of Initiates, Upper Gascoyne River, N.W. Australia.



Photograph supplied by R. Layton.

Figure 3.6 — Tallies from the Naga Hills, Sakhai, Sema, Assam.



There is apparently no variation in the form of the notches except for 'Tally A' where there is one notch that has not been cut as deeply as the others, and neither does it span the ridge, and so it appears as a $\frac{1}{2}$, or though whether this is the intention of the maker is debatable. Other than the one $\frac{1}{2}$ mark already referred to, there is no evidence of cipherisation.

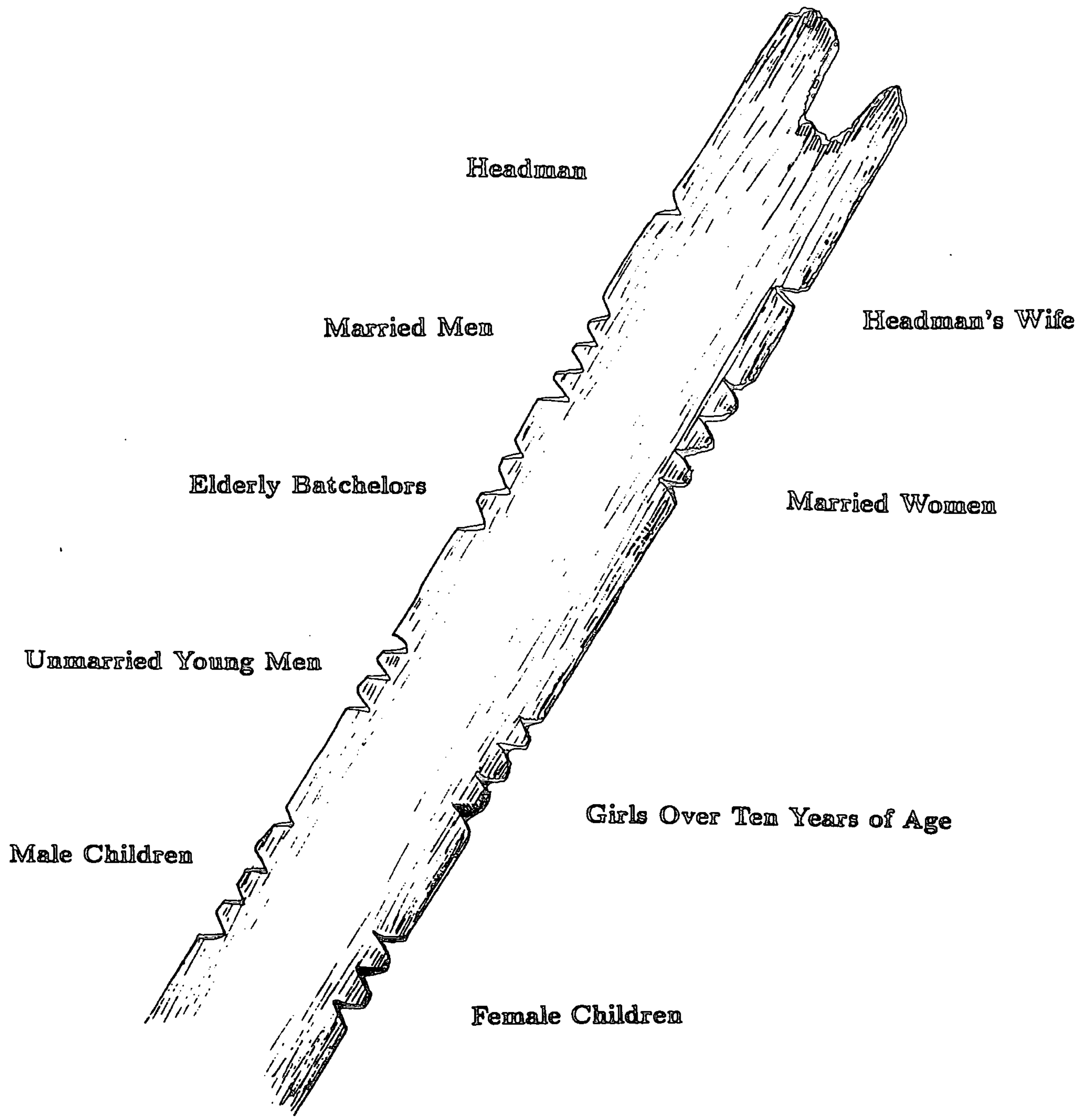
3.4.2 A Tally from Pokokku, Chin Hills, Burma.

'This tally is made of a flat strip of bamboo, notched at the edges into groups to enumerate and classify the members of a community'. Donated by Mrs. Leslie Milne, 1932.

Although the full length of the tally is not shown in the drawing, it can still be appreciated that it represents quite a substantial artefact, and was worked to its present form. The 'v' shape cut into the side is the basic design element, each representing one individual, regardless of their age or sex. In flattening the piece of bamboo, the maker ensured that there were two flat sides, with the marks being cut at the two straightened side edges, thus cutting into **both** of the broad sides. Each mark is clearly separated from the next by a principle of minimal spacing, with the cutting of the next notch contributing to the triangular form of the dividing space. The longer spacings between the marks are intended to delineate the groups, and these are further distinguished from the 'minimal spaces' as they form 'trapezia' as there is a straight line against the angle of the next cut. The division of the cuts to the two sides is based on sex, although there is an attempt to group the individuals by their age across the stick.

There is no real variation in the form of the cuts, although one in the group of male children is more of a 'trapezium' rather than a 'triangle' which might represent a separation from the group, although this is discounted as non-pertinent variation in my analysis. Furthermore, the space between the elderly batchelors and the married men is comparatively small, due to the fact that the former represents an additional group with no corresponding group of females. There is therefore the idea of positional notation, as one side of the bamboo is male, and the other female, and there is also concept of age being strongly correlated to status, as the closer to the forked edge, the higher the prestige – the exception being the headman and his wife, who are not necessarily the oldest members of the community, and the elderly

Figure 3.7 — Tally from Pokokku, Chin Hills, Burma.



batchelors, who are ranked close to, though 'below' the married men. Despite the variations of age, status and sex encoded, there is no evidence of cipherisation and the same design element is used throughout.

3.4.3 Tally from the Santa Cruz Reef Islands, Oceania.

SS = Shoreditch Stores, for the reserve collection of the British Museum.

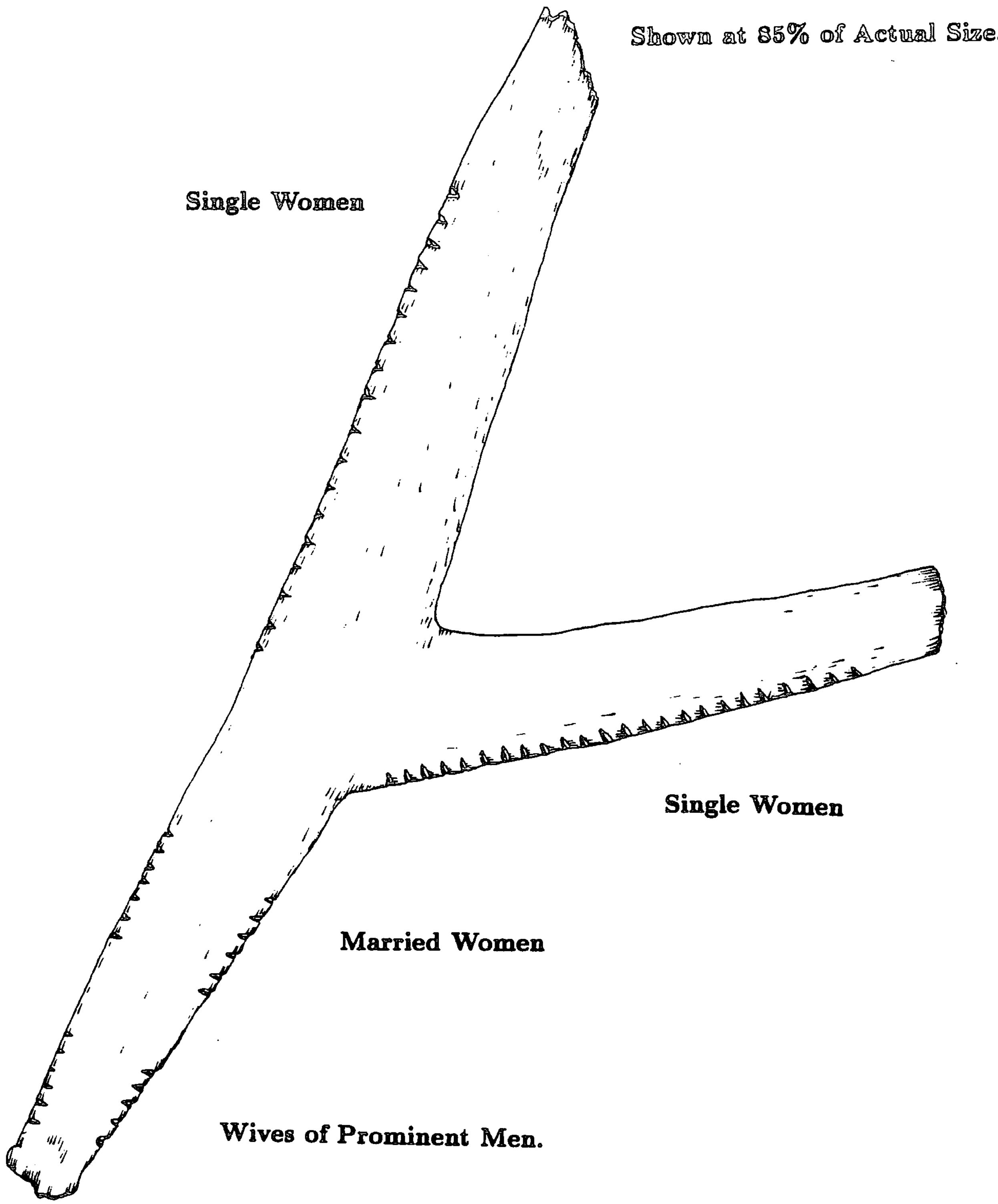
This tally was donated to the museum in 1944, and is comparable to the Burmese tally from Pokokku as it too enumerates the members of a community, but this time only the women. The tally is of an interesting form, made of a forked stick, which although worked smooth and the bark removed, retains its characteristic shape. The way in which the marks are placed on the tally furthermore implies that the form of the tally stick itself could have been deliberately chosen. The basic design element is a notch, rows of which are cut into the sides, and these are evenly spaced (within sets) with larger spaces delineating the designated groups. Interestingly, the age and status also relates *across* the stick as in the Burmese example, even though here this is within the same sex. The other similarity is that status is again in ascending order, and it is the position relative to the ends of the stick that is all important, and therefore an element of positional notation is evident. As for the previous example, despite the differences in age and status there is no evidence of cipherisation to indicate this.

3.5 An Analysis of Tallies from Europe.

The widespread use of tallies is well documented back to the germanic tribes of the Franci and the Allemanni, where under Salic law a *festuca* was used in all legal transactions. This involved the debtor giving the recipient a stick marked with an owner symbol and the amount involved. The tradition carried on late into Europe's history, perhaps for convenience, but also because there was a substantial proportion of the population that could not read or write, but could count.

It is these tallies that occur within an ostensibly *literate* culture, that is, from countries where the majority of state and larger business transactions will have been conducted by writing, that will be examined in the first section. However there is evidence to suggest that use of tallies was continued in certain contexts, and

Figure 3.8 — Tally from Santa Cruz Reef Islands, Oceania.



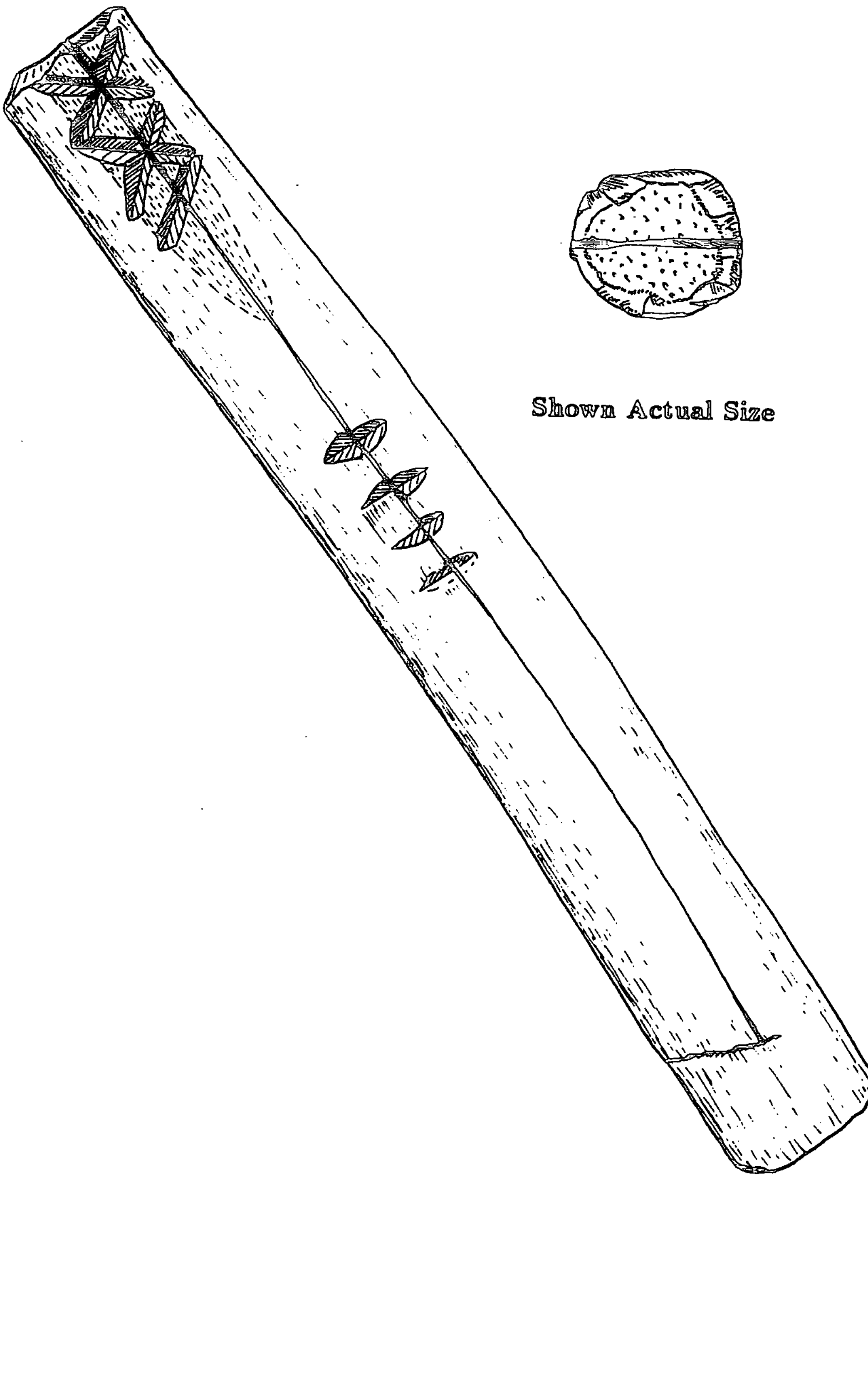
preferred even by those who could read and write. The Court of the Exchequer in England employed its sheriffs collect the taxes from the local officials, which were then paid to the government. This procedure was discontinued after an Act of Parliament in 1783, but tallies continued to be used until 1826. Menninger illustrates the general procedure using a hypothetical debt of £40,

> 'In testimony of this a tally for £40 would be carved, of which the official retained the stock (or stipe), as a receipt for his payment and the court of audit kept the inset piece (the foil) for its own records. The name of the payer and the nature and amount of the payment were incised on both pieces'. Menninger 1969:237

The collection of tallies from the Pitt-Rivers Museum in Oxford is quite exceptional, as not only are there many documented examples, explicitly collected for this reason, but there are a substantial number from Europe, thus demonstrating their continuing use in a literate society, though possibly made by people who could not count. It is these examples that will now be considered, to identify their various properties according to the criteria applied to the other tallies. As the context of these examples is documented, it is considered unnecessary to present this information as a series of points relating to the criteria, although this information will be encoded elsewhere. Instead there will be a paragraph that briefly describes the artefact and then the criteria to establish whether it is 'decoration' or 'notation' will be discussed.

The first two tallies described in this section were donated by H Balfour in 1887 and March 1897 respectively, and are both described as "Baker's Tally Sticks", the first having having "Livres de Pain" written on the side (Figure 3.9). This example is from the city of Lyon, and consists of, '... a split stick, notched to enumerate pounds of bread", and the second is from Royat in the French Auvergne (Figure 3.10). Another tally stick in the Pitt-Rivers is also from Auvergne, (Figure 3.12) which was collected in 1917 and, '... still in use at that date', and a further example (Figure 3.11) is described as, 'A café counter tally ... of unhacked stick'. These examples will be analysed in turn to investigate their principles of construction in relation to their use.

Figure 3.9 — An Illustration of A Baker's Tally.



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3.5.1 The Identification of Decoration versus Notation.

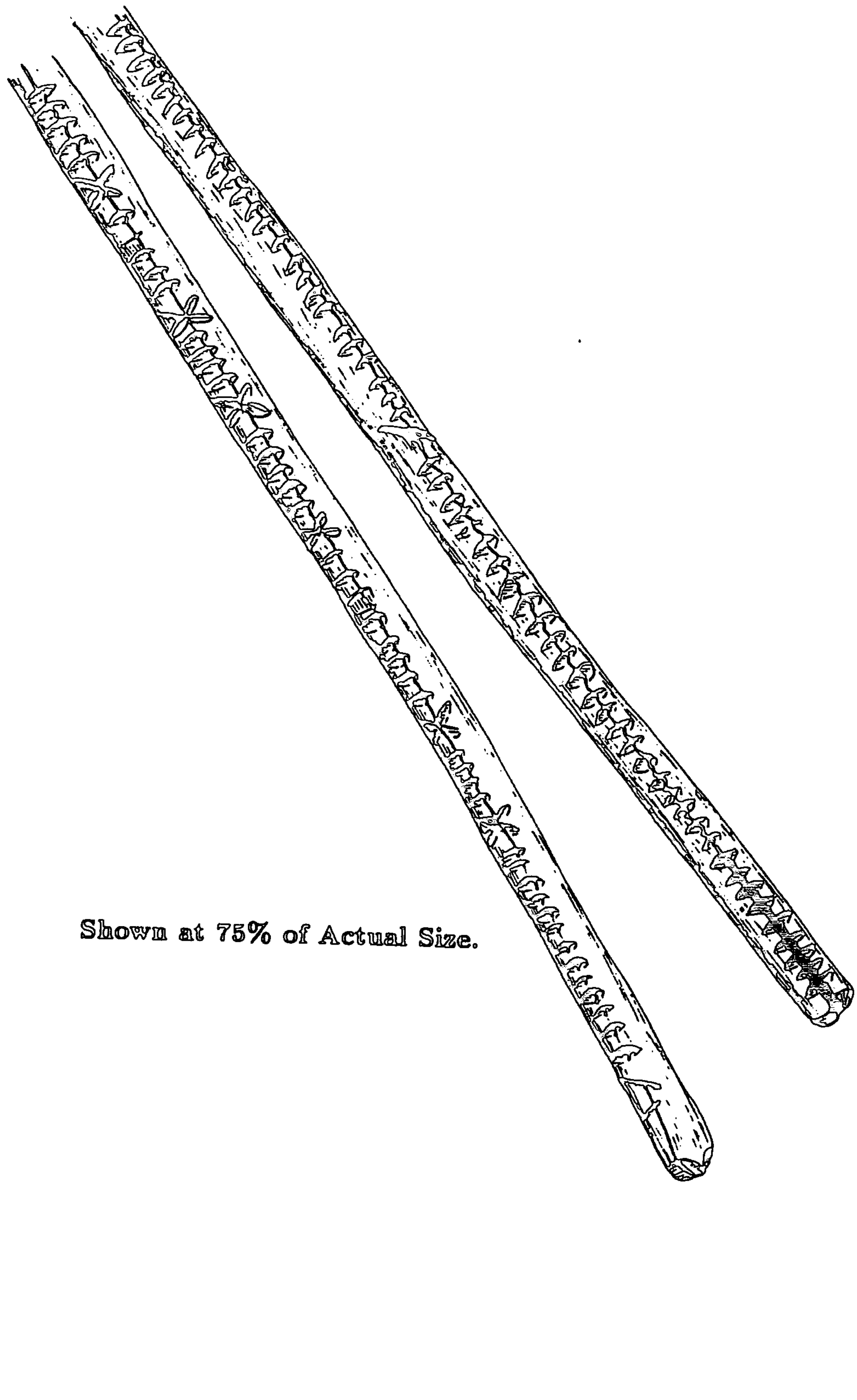
This example is a substantial artefact, the 'stick' having apparently been worked smooth, and the ends cut. The marks are deep grooves, possibly requiring two cuts to give the angle present, and the split through the length of the stick serves to bisect each of the marks. It is not known whether the stick was intentionally split or not. The other physical feature is the large 'nick' at one end of the stick which forms a plane, in effect a 'prepared' surface, for the crossing marks that cover it.

From Figure 3.9. it can be seen that there is a basic element, namely a single engraved mark, that appears to have been made with a sharp cutting tool, possibly a knife, causing a considerable angle to the indentation of each mark. This is repeated along the long axis of the stick, totalling 9 marks. The principle of symmetry this follows is partially translational, and partially rotational, which can lead to the identification of two groups.

The first group is confined to the prepared 'nick', and here the element is at 45° to the long axis, and then rotated through 90°. This dual process is repeated once more, forming a second 'cross', and then there is just one mark in the same 45° alignment. The second 'group' is separated from these by a space, over the length of the first 'group', and these marks are aligned horizontally to the long axis, and repeated exactly to the principles of translational symmetry. There are two possible anomalies in this 'group', namely the lack of completion of three of the elements, as they do not form the 'elliptical' shape of the others. This might be revealing about the principles of construction, as there could be a deliberate omission, or simply the result of a certain kind of cut. This variability of the marks could be the reason for the lateral split along the tally, as it may act as a point of division, designating 'halves' and 'quarters', particularly as the other 7 elements all conform to a possibly more standardised pattern. If this were the case, then the 'second group' would represent 1 - $\frac{3}{4}$ - $\frac{3}{4}$ - $\frac{1}{2}$.

The relationship of the two groups is difficult to determine, as there is variation in the position, and the symmetry of the elements in both 'groups'. The fact that they both occur along the same vertical alignment, delineated by the split is significant, and implies a relationship that their apparent separation at the same time denies. A likely explanation is that the two are related, but refer to

Figure 3.10 — A Baker's Tally Stick, Royat, Auvergne.



Shown at 75% of Actual Size.

different aspects or objects of a related phenomenon, in this case, bread. The presence of the translation of a single element, with some rotational symmetry on this known example of notation is consistent with the earlier findings from the Australian message sticks, and therefore further corroborates the hypothesis that translational symmetry is a recurring characteristic of notation.

3.5.2 A Baker's Tally Stick, Royat, Auvergne.

This baker's tally is an actual stick, as its naturally rough surface has not been in any way prepared, and the ends are simply cut. Again there is the repetition of a single deeply 'notched' element along the long axis, with some rotational symmetry as apparently pertinent points – although these are never adjacent, and are always separated by at least three of the other 'single' marks, see Figure 3.10. Taking account of this dual nature of the marks by **number**, and lettering it after Boas,

```
32 -1 -30 -1 -4 -1 -4 -1 -5 -1 -7/8 -1 -4 -1 -13
--------------------------------------------------
a  b   c  a  d  a  d  a  e  a   f   a  d  a   g
```

But lettering according to **form** shows the pattern of

```
a  b  a  b  a  b  a  b  a  b  a  b  a  b  a
```

Thus there is a pattern, but the rhythm that it implies is not related to an equal repetition of the elements according to number, but rather a constant adherence to alternating two design elements.

If the form of the marks is considered with regard to notation, then they are, as supposed, consistent with my criteria, see Figure 1. There is a constant repetition of two specific and standardised elements, namely the single 'elliptical' nick, and the 'cross', composed of two such nicks. The 'path' of the marks follows the long axis of the stick, and as the marks conform to the principle of translational symmetry and are parallel to the short axis, there is a continuous alignment. As there is a space between each mark, and by eye, this is a regulated phenomenon, all are clearly definable. The subdivisions occur as the result of the change in form of the basic element, or rather its transformation, as the nick rotates through 45° and another is superimposed at 90° to the first. It is worth noting that the lines for the 'cross' are longer than other lines, by almost half as much again, and this, combined with the change of form, is sufficient to 'order and structure' the marks.

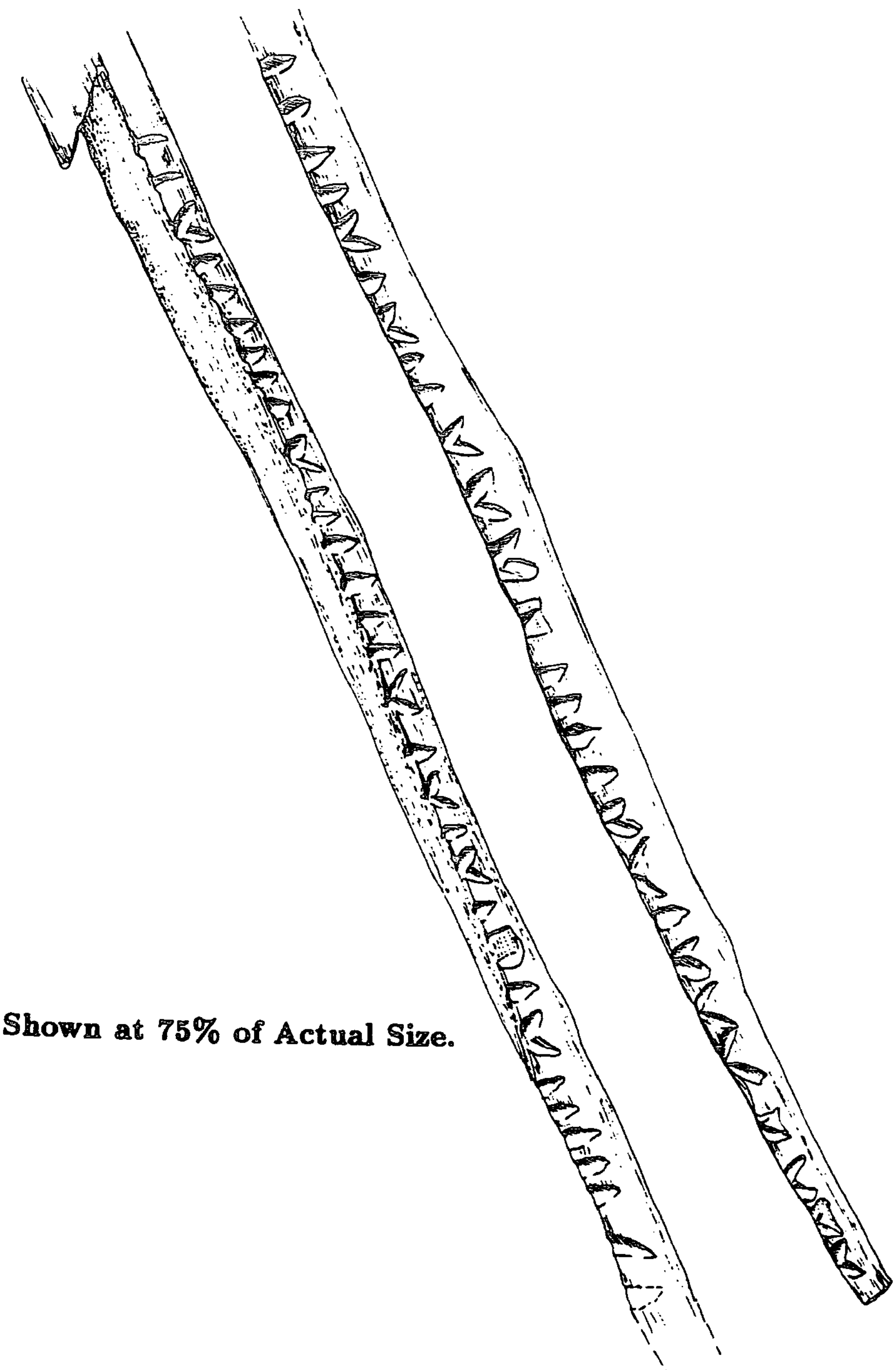
That there is pertinent variation has already been discussed and demonstrated by Boas' technique of lettering. There could very easily be a system of positional notation, in operation, but without knowing exactly to what the marks refer, it is impossible to state conclusively that this is the case. It could be that the 'crosses' exist only to divide the elements, perhaps as they are for bread, by day, or customer, and this would conform well to the marks, as the two elements always alternate with one another, and so are unlikely to refer simply to say, a type of loaf, as then it would be expected that the two crosses would at some point be juxtaposed. It could be that the composite 'cross' acts as a cipher, and refers to 'double the value' or amount, or that it acts as a structuring element, as implied before. Therefore for this example, as for the previous examples, the presence of translational symmetry further supports the hypothesis that this is a key indication of a tally.

3.5.3 A Café Counter Tally, Auvergne.

This example closely resembles the previous example as this is also of 'unhacked' stick. The other common features are the elements that are used, namely 'single' and 'double' marks, although they are not precisely similar. This is due to the fact that a large section of the stick, cut down the long axis, is missing presumably prior to its use as a tally, see Figure 3.11. Thus whereas the marks for the last tally were evidently complete where they appeared as single cuts or as 'crosses', the marks here are perhaps not. The 'double' mark here appears as a 'half-cross' of two marks angled at 90° to one another and at 45° to the other marks, and they occur, as do all the marks, along the line of the break giving rise to the possibility that they could have been 'crosses' at some stage. Whether the break occurred before the tally was made or not will be discussed later, as the following analysis identifies only the existing marks.

The presence of the two elements can be shown, both by the number of the elements as they appear consecutively, and by Boasian lettering as:

Figure 3.11 — A Café Counter Tally, Auvergne .



Shown at 75% of Actual Size.

3 1 1 1 2 3 ? 4 2 1 3 ? 3 2 1 6 1 6 1 1 1 1 1 1 1 ? 1 1 5 ?

----

a b a b a b ? a b a b ? b a b a b a b a b a b a b ? a b a ?

Where a = the 'single' element, b = the 'half-cross' and ? = an unidentifiable variant.

Thus there is essentially an 'a - b - a' patterning as for the tally of Figure 3.10, although this is composed of both single and multiple occurrences of each element. Thus it is easy to discount the marks as 'decoration', as although there is evidently translational symmetry, and the minor rotation through 45° and then 90° for the 'half-cross', shown in Figure 3.11, this is not truly regulated into a pattern that is repeated with regard to the overall idea of a composition. With regards to notation, the marks conform well, as there are the two basic and standardised elements, translated along the long axis of the stick, also aligned with the lateral break. The marks are definable, as they are regular in both their form and spacing, and the former also contributes to the existing divisions, which do visually contribute to the order of the elements. There is considerable standardisation in the elements, although there are three marks, (perhaps mistakes?) that cannot either be said to constitute another design element, or be classified as belonging to the other two 'groups'.

It is possible that the differentiation in the form between the 'half-cross' and the 'single stroke' relates to a system of reckoning based on the relative positions of the marks. That is, the juxtapositions of crosses and marks could refer to the quantity recorded, and three single consecutive marks could in theory represent 111, (if in base 10), or simply three, and three 'half-crosses', 30, or 300, or perhaps just 6, (each representing two of the 'single marks'). As the 'half-cross' is a composite mark it could be a cipher representing something other than a simple quantity to differentiate itself form the 'single' mark. In the context of a café tally, the two marks could represent different saleable items, or the simple alternation of the elements could signify different customers and their related purchases, the principle function of the change being to differentiate form one to another. Thus this example conforms, as expected, to the criteria for the identification of notation.

3.5.4 A Baker's Tally Stick, Auvergne

This example, also from Auvergne, is engraved on two opposing sides of its surface, worked into a four-sided elongated rectangle with a 'hooked' head at one end. The nature of the marks differs from all the previous examples, as they are relatively lightly engraved, and appear as lines rather than 'elliptical' nicks. These lines can be divided into two elements: a straight line running directly parallel to the short axis of the stick; and a slightly rotated (and therefore longer) example of the same. This latter is always followed by a similar mark, although angled in the opposite direction, and as they often meet at a point they will be considered both as separate lines, and as a composite mark of two elements.

The numerical sequence from the head of the stick to its tip on one side runs as follows:-

i. Where a = 'single line', and b = 'slanted' line. The latter are treated as individual marks

Side 1

```
4- 2- 10- 2- 1- 2- 2- 1- 6- 4- 5- 2- 1- 8- 6- 2- 24- 2- 11
-----------------------------------------------------------
 a  b  a   b  a  b  a  b  a  b  a  b  a  b  a  b  a   b  a
```

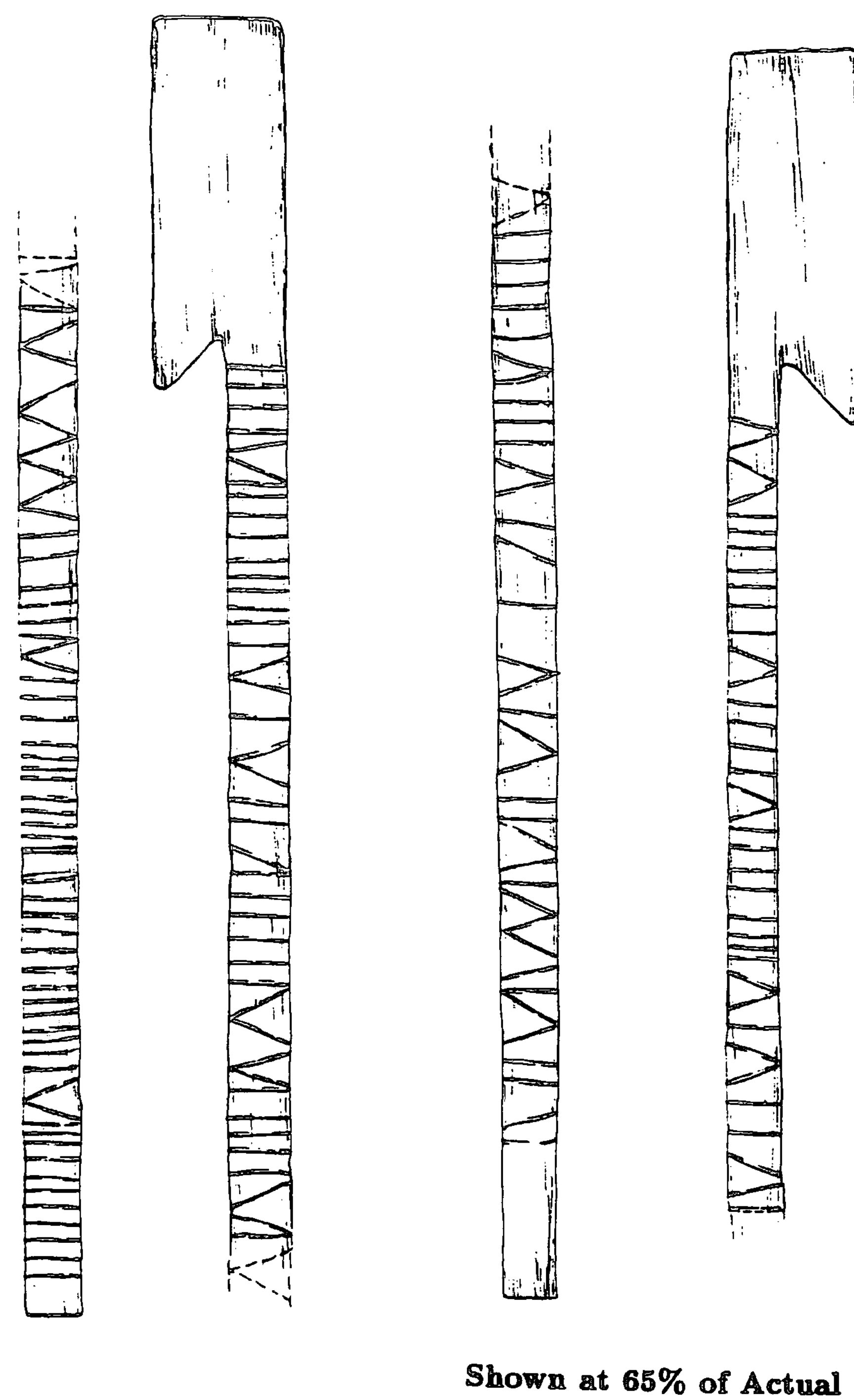
Side 2

```
4- 7- 2- 4- 2- 8- 2- 1- 2- 2- 2- 5- 2- 3- 2- 1- 1- 1- 2- 1- 2-
--------------------------------------------------------------
 b  a  b  a  b  a  b  a  b  a  b  a  b  a  b  a  b  a  b  a  b

  2- 2- 1- 4- 1- 2- 2- 1
  ----------------------
   a  b  a  b  a  b  a  b
```

ii. And with the slanted line element at 'b', being counted as 'one', rather than two the following pattern is generated:

Figure 3.12 — A Café Counter Tally, Auvergne .



Shown at 65% of Actual Size.

Side 1

```
4- 1- 10- 1- 1- 1- 2- 1/2- 6- 2- 5- 1- 1- 4- 6- 1- 24- 1- 11
--------------------------------------------------------------
 a b a  b a b a  b  a b a b a b a b a  b  a
```

Side 2

```
2- 7- 1- 4- 1- 8- 1- 1- 1- 2- 1- 5- 1- 3- 1- 1- 1/2- 1- 1- 1- 1-

-------------------------------------------------------------------

 b a b a b a b a b a b a b a b a  b  a b a b

  2- 1- 1- 2- 1- 1- 2- 1
  ----------------------
   a b a b a b a b
```

From this analysis it is apparent that there are two single 'slanted' strokes, that appear as a 'half' in the second analysis, leading to the conclusion that they were intended to be read as a single element rather than as part of a larger element, and therefore the first of the two readings is preferred. It remains that the straight 'a' element and the 'b' element are considered separate, their alignment deliberately varied from one another, and thus it can be inferred that they refer to,

i. Different *quantities* of the same material, i.e. 'positional notation', or

ii. Different materials, each represented in a characteristic way.

3.5.5 A Lamb Tally, South Downs, Sussex.

This example is a carefully prepared piece of wood, worked so as to produce four sides. One side refers to the dams, and the other to the lambs, with the two corresponding to one another. The method of recording was probably as straight forward as a ewe lambing, represented by one cut on the dam's side of the tally, and then the number of lambs marked on the other, and then on to the next ewe, and so on. However, as all the ewes with triplets are together, this might indicate that it was made once all 20 ewes had lambed, and therefore is not so much as a running total as a final score. Unless the ewes were numbered subsequently to their lambing, there seems to be no way of indicating which ewe had which specific number of lambs, although as a tally it remains a valid record of the total quantity, whilst effect effectively dividing the lambs between the ewes.

Ewes	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
No. of Lambs	3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3

There is basically a single unit of notation, although there is variation in the meaning as on one side a single line refers to the lambs, and another to the ewes. The 'path' of the sequence is regulated firstly by the sides of the stick, and this also dictates the alignment of the marks parallel to the short axis. The position of the marks for the ewes appears to be dictated by the number of lambs of the previous ewe, with a roughly even spacing adopted for the lambs. The division between one side and another is clear, particularly as the wood was prepared to present distinct sides, and other than their position, there is no variation in the form of the marks.

As mentioned previously, there is 'positional notation', as to whether the mark is referring to a lamb or a ewe is dependent on which side the mark occurs, the two sides also differentiated by the pattern of spacing between the marks. Even though the two 'sets' of marks refer to different aspects of a shepherd's flock they are not really ciphers, as it is only their position on the two sides and the spacing which distinguishes them from one another, whereas a cipher is supposed to denote by a characteristic of form the 'set' to which it should be assigned.

3.5.6 A Bird Bone Tally, England : PR/9.

This was purchased in 1933 and forms part of the E. Lovett collection, and is simply record as being a 'bird bone tally' in the museum records. It is an interesting example as there is nothing about this bone to suggest that it was specially prepared for use.

Figure 3.13 — A Lamb Tally, England.

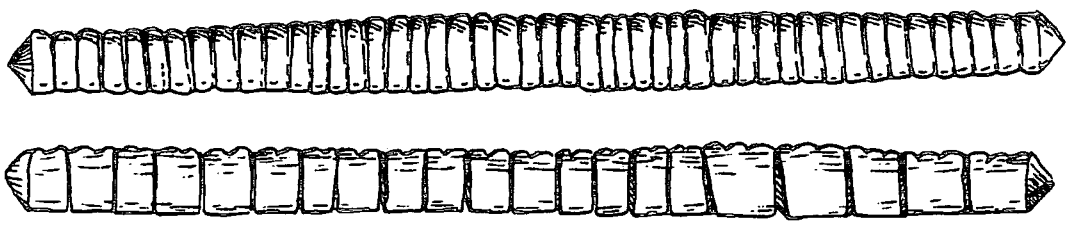


Figure 3.14 — A Bird Bone Tally, England.

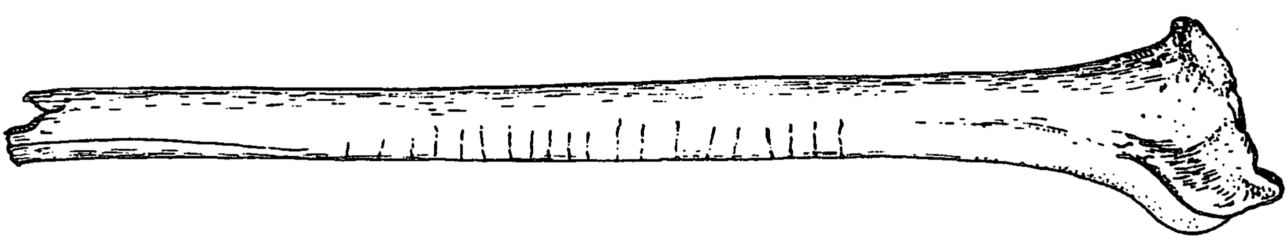
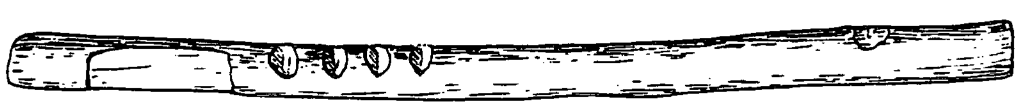


Figure 3.15 — A Gardener's Tally, England.



Shown at 85% of Actual Size.

Firstly the twenty marks are standardised as they are of an even pressure, all straight, and roughly parallel to one another. The 'path' follows the long axis of the bone, and is central between the head of the bone and the other end, which could have been broken after the marks were made. Each mark is clearly definable as all are separated by regular spaces. There are no real divisions, although there is possibly some pertinent variation in the varying length of the marks, as those at the broken end are slightly shorter. As they are grouped, it is possible that this is evidence of positional notation, although this would be more convincing if the regularity of the spacing was also varied at this point. There are other marks that vary in the alignment (a), but as these are not really grouped, and the spacing remains consistent, this is unlikely to be a deliberate variation and there is no deviation in the form that would suggest cipherisation.

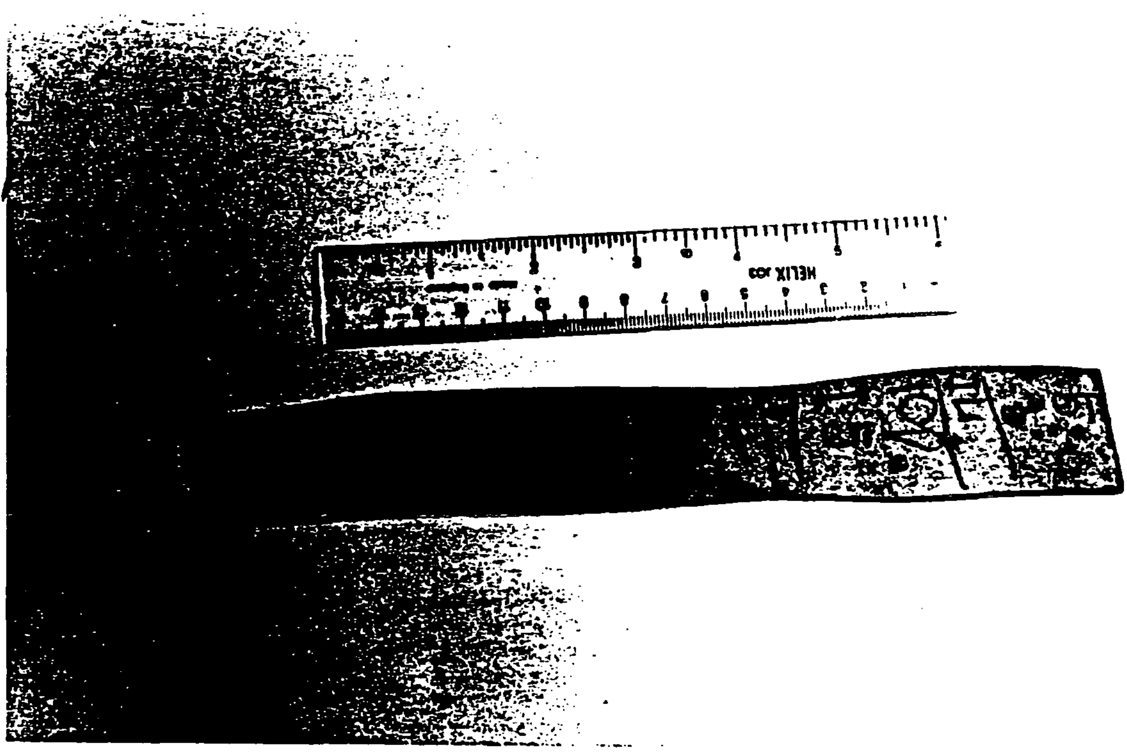
3.5.7 A Gardener's Tally, Buckinghamshire, England.

> 'One of four models of obsolete gardener's tallies made by Mr. Scott, donor's gardener, who said that such tallies were used by his father and himself thirty years before in Buckinghamshire where they were in general use. Signs are used to indicate the various kinds of vegetables and the months are shown by notches, e.g., April has four notches, February two etc.
> Donated by E. Lovett of Croyden, July, 1909.' Card entry, Pitt-Rivers Museum, Oxford.

This example is a stick, cut to a certain length, and then notched and cut to create a record. As there are four distinct notches, each of the same length, the same form (deep ellipses), and evenly spaced parallel from one another, along the long axis of the stick, they can be inferred to form a 'group' that from the above information, tells us that as there are four, this refers to the month of April. There is another cut made on the same alignment to the four notches, but of a different nature, being both wider and longer and not possessing the same elliptical shape. This is taken to be the 'sign' of the vegetable that is referred to, although as it is not an iconic representation, the actual identity of the vegetable is presumably known only to the tally maker. It is possible that there was an accepted convention to symbolise the garden produce if more than one tally was made by more than one individual. It is worth mentioning, that although the sign of the vegetable is very different to the notches that indicate the month, as it only occurs once, without the knowledge that this is a sign from the museum card, I would be unable to conclude from a single example that this was the case.

3.5.8 Delivery Tally, England : PR/15.

Plate 3.2 — A Tally of Delivered Vegetables.



This a record of the vegetables delivered to the kitchen of Mr. J. Myers of 'The Copse', Hinckley Hill, by his gardener, Mr. R. Smith, and was donated in 1942. It is made from a strip of card cut and torn from a cardboard packet, with the painted design still evident on the reverse side. The marks are drawn and written in pencil, and indicate that the maker could both count and write the appropriate numerals. There is the use of an iconic sign, as the conventional English way of designating a carrot – a tapering form to represent the outline, and shorter vertical lines at the broader end to designate the leaves – is shown next to the number '10', thus indicating ten carrots in the delivery. There are also shaded dots adjacent to other numbers that might also signify other vegetables, such as potatoes perhaps, as this is the outline of their form and they possess no real characterising details, but this is only inferred. There are also lines drawn across the short axis of the card strip, with the 'dots' occurring close enough for an association, but this could be to divide the information conveyed, (another English convention), or to signify another vegetable.

3.5.9 Exchequer Tally, Oxford.

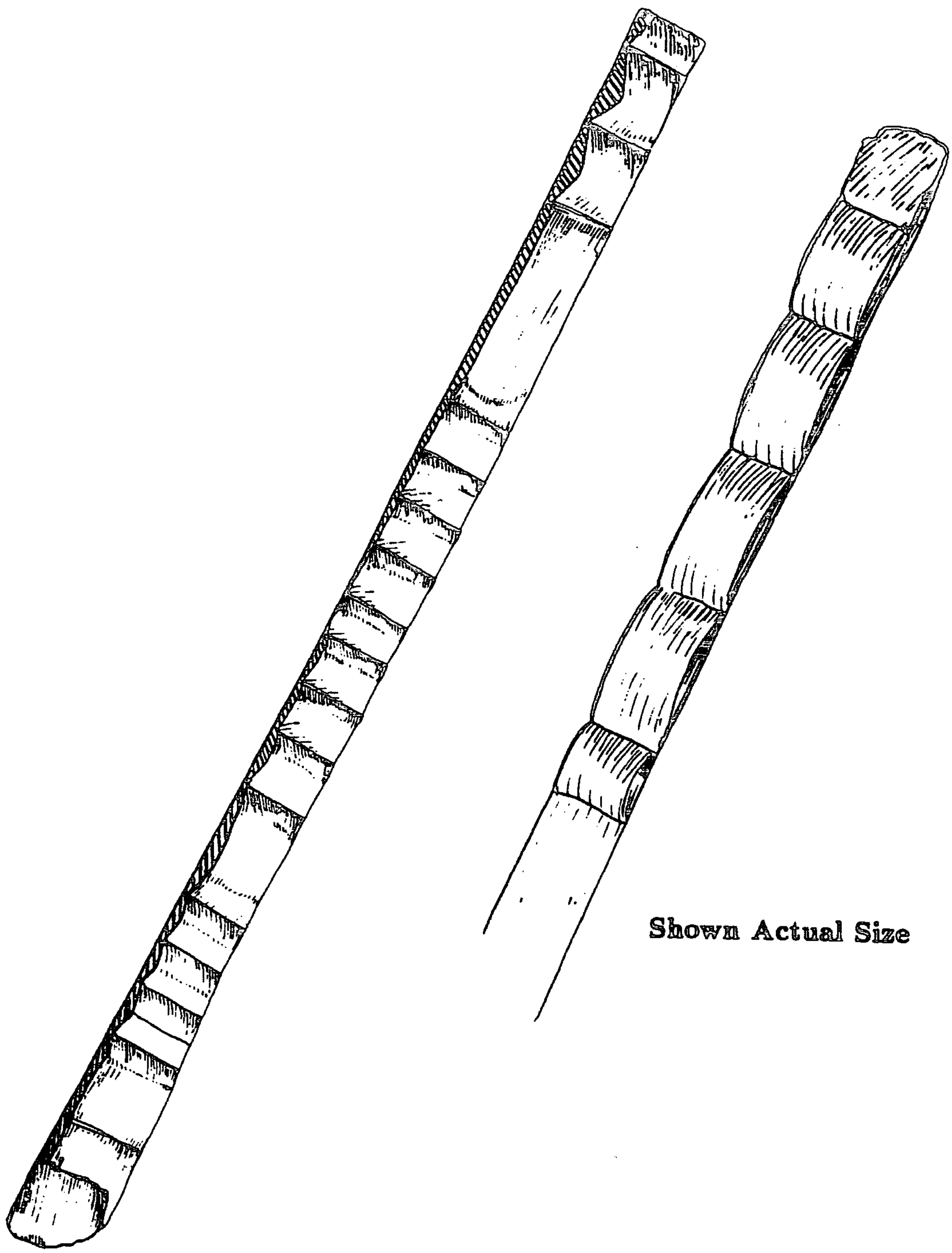
The function of the tallies so far described has been varied; either to keep an idiosyncratic running total to 'balance the books' or to present a record of quantity to another concerned individual, or of unknown significance, as in the case of the bird bone tally. This example represents a slightly unusual class of objects, as such tallies were kept by *two* individuals to keep a record of payments made, and the two halves would have to tally to avoid suspicion of fraud on the part of either keeper, that is the *stock* and the *foil.* This example was kept,

> ' In account with James Haughton, Langston of Oxford, on the 18th July, 1820.'

and came from Hartwell House, also in Oxford. The tally is made of wood, shaped to form four sides at right angles to one another, and then this 'base' has been worked to form either 'dips' or 'bumps' depending on how one wishes to interpret the form, (see the extract from the *Dialogue* below). There appear to be different forms of the same basic technique – differentiated by their length. The 'path' of the sequence is evident, as it follows the long axis of the stick on only one of the possible our sides. Each mark is definable – consisting of a groove and curved surface. The only divisions are either in the nature of the engraved forms themselves, or in the two sections of unworked wood between, which appears to form a useful device in separating the information to prevent it forming one long continuum. Whether these possible divisions are functional in simply separating the information, or whether they are part of a system of positional notation is impossible to determine, with either or both options remaining plausible. There is no evidence of cipherisation.

The convention of marking exchequer tallies is recorded in an account of 1186 by Richard, Royal Treasurer and Bishop of London, in his *Dialogus de Scaccario,*

Figure 3.16 — An Exchequer Tally, Oxford.



Shown Actual Size

'... the notch for £1000 is placed at the end and is as large as the hand is wide
for £100 the notch is as large as the thickness of a thumb, and to distinguish it form that for £1000 it is not straight but curved
for £20 it is as large as the thickness of the little finger
for £1 it has the breadth of a ripe barleycorn
for 1 shilling it is smaller but still large enough to be seen as a notch
for 1 penny only a cut is made, with no wood being removed
for a half of any of these units a notch or cut half the length is carved: one cut slantwise, one perpendicular to the edge.' Van der Waerden and Flegg, 1975.

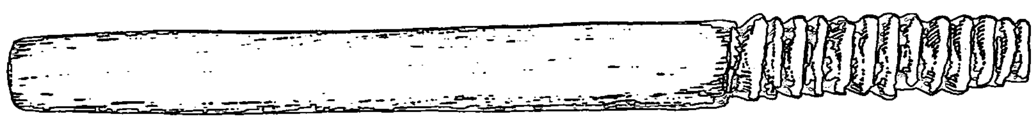
3.6 Tallies of Time.

There is evidence to suggest that many tallies were made to record the passing of time, again using pieces of string and wood as the most appropriate media. In southern Zimbabwe the construction of a tally marking the passage of each day is delegated to one man, who records each lunar month on a separate piece of wood. The Chagga who live in the land around the foot of Kilimanjaro have a system that accounts for the days which a husband may spend away from the village – before his journey he makes a number of knots on a piece of string and gives it to his wife to untie one for each day of absence. The Chagga also are thought to use the 'Swahili Calendar' which is based on a ten day week. A piece of cord is strung between two poles on which there are thirty wooden counters divided into groups of ten by two white beads, and each day a bead is simply moved over to the other side, when finally the process is repeated for the next month. Lagercrantz claims that the 'weekly' and 'monthly' tally string calendars of West Africa were influenced by their contact with Arabs and Europeans, although the Tanala calendar of a stick with seven or twenty eight holes and a moveable peg was not (Lagercrantz 1968:126).

3.6.1 The Lengua Stick.

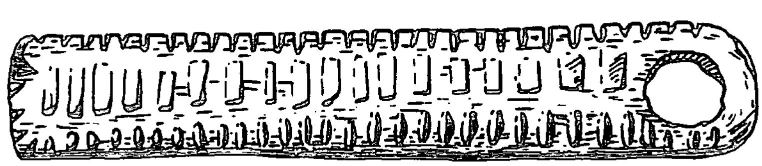
Calendar stick used on long journeys to keep account of the days. Returning home, the traveller will recount accurately and minutely the events of each recorded day. Source: Card index, Pitt-Rivers, Oxford.

Figure 3.17 — The Lengua Calendar Stick.



Shown at 75% of Actual Size.

Figure 3.18 — The Bushman's Cattle Tally.



Shown at 75% of Actual Size.

This example was donated in 1903 by A. Pride, and is provenanced to the Lengua Indians, Gran Chaco, Chaco Boreal in South America. The form is simple, with 13 grooved rings around the circumference of the stick. It is unclear whether it is the grooves or the wood between the grooves that indicates the actual day, but from the description it seems clear that the 'count' was mnemonic, as although the nature of the marks could be culturally standardised, only the maker would be able to recall the significant events associated with them.

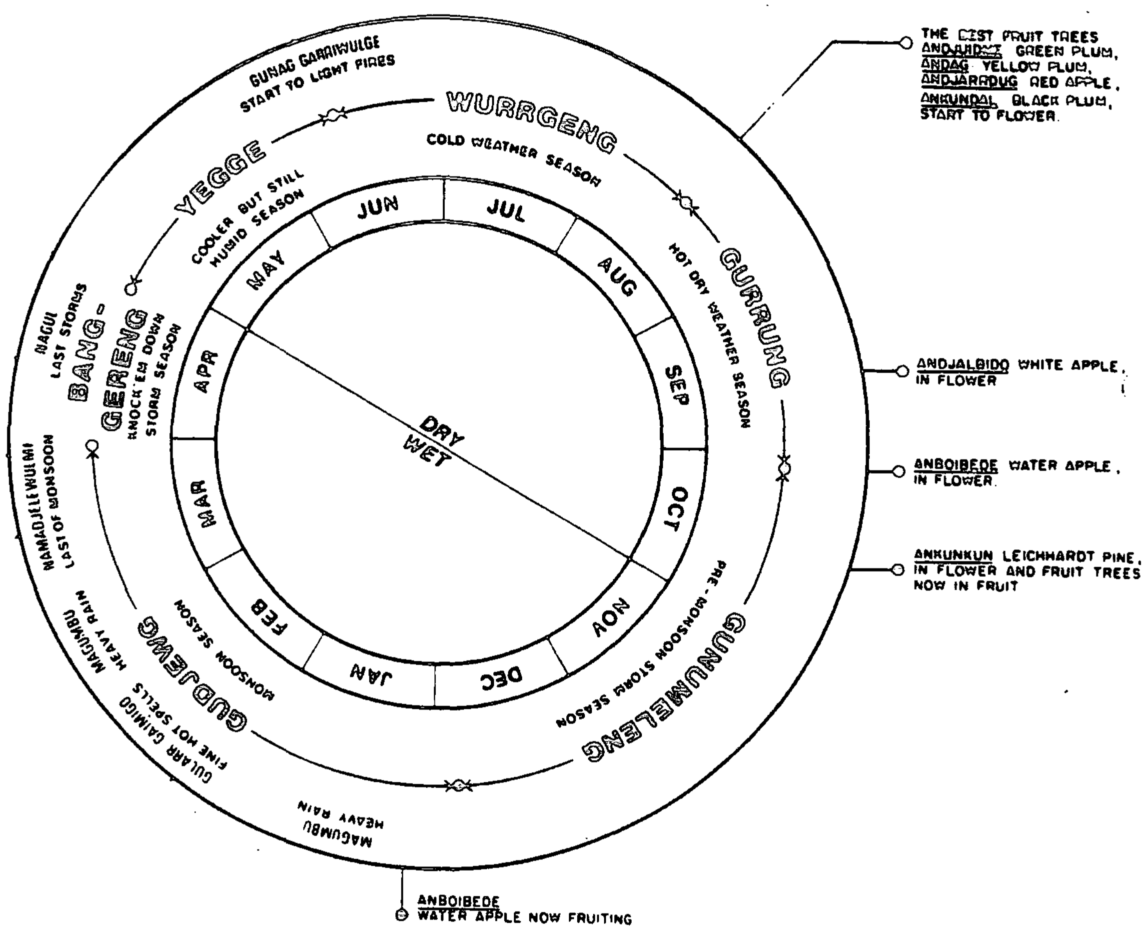
3.6.2 Bushman Cattle Tally.

Obtained in 1872 from Griqualand West, Cape Colony in South Africa, this tally was used by Bushmen employed to guard two small herds of cattle, and the notches indicate the days spent in this employment. The hole at the top of the tally was designed to thread it to a belt, or round the neck, but all the other marks are presumed to relate to the tally of the days. There are basically three elements – the notch cut into the edge at (a), a broad flat cut into centre of the longaxis of the side illustrated (b), and a smaller elliptical notch at (c), all parallel to the long axis of the stick.

Whether this variation in form was made to differentiate months or any other discrete periods of time – such as time at different water holes etc. is not known. It is perhaps worth noting that the number of notches at (a) totals 30, and on the other side at (c), if those at the bottom are discounted, 31 – which could be months, however at (b) there are only 18, or 21 if the bottom three are included (which seems unlikely) which is not a full month, although this centre 'group' could have been made last, as there is no indication of the order in which the marks were made.

It seems more likely that it is the groups of elements, all parallel to the long axis and one another, which are differentiated to facilitate a reading, and to further distinguish them from one another. I would therefore identify the *path* of the sequence to be the longaxis, and the variation to be in the form of the elements I have noted, although probably not pertinent to meaning. I would stress however that there need be no reason other than space which dictates where one group starts, and

Figure 3.19 — Seasonal Aboriginal Calendar, Kakadu, Australia.



Alderson, Gangali and Haynes, 1979, adapted from 'Seasonal Calendar of N.E. Arnhemland', Morris, 1978.

another finishes. There is thus no evidence of positional notation, or cipherisation, as the form of the marks is believed to be irrelevant to the information transmitted.

3.7 Calendars from the Ethnographic Collections.

The calendars have been isolated as a separate class of artefacts as they manifestly deal, as a record or a predictive account, with the passage of time with full knowledge of its essentially 'cyclical' nature. As an abstract phenomenon, time is necessarily quantifiable, and although the sophistication of the units of time vary from culture to culture, the passage of days and nights, and the movements of the moon and sun, and the other stars and planets across the sky provide constant and universal points of reference, which Nilsson describes as 'time indicators', (1920:9). In societies where the passing of the seasons is particularly marked, by a change in temperature, by the movements of fauna and the ripening of food plants, or by the coming of the rains or snow, then additional divisions often apply, or exist solely as a system *pars pro toto* , (1920:10). Such events, although acting as valid markers, are not entirely time-specific, thus the Chinhwan of Formosa (Taiwan), greet the new year with the blooming of a specific flower, rather than the date of January 1st from the Julian Calendar.

One of the earliest known examples was made by the Egyptians to mark the rise and fall of the flood waters of the Nile. The cenotaph of Seti I has a text on the ceiling which includes references to 'sun', 'shadow' and 'hour', which has lead some to deduce that the Egyptians had 24 hours in their day, but each of an unspecified duration. Aveni uses examples from Classical Greece, Babylon and the Bible to demonstrate the existence of an oral reckoning of time which hypothetically would be the original form of recognising the relative passage of the years with particular reference to specific events (Aveni, 1989).

The inference that cultures that make no such specific records of the passing of the days do not understand the yearly cycle is contradicted by accounts taken from the Australian aborigines in the Kakadu Region, in Gundjeidmi, (Maili) language. Here the year is divided up in the wet and dry seasons, but these are further broken down into six seasons, which in turn are related to certain subsistence activities connected with the seasonal availability of certain resources (Ovington, 1980).

Figure 3.20 — Seasonal Food Availability, Belcher Islands.

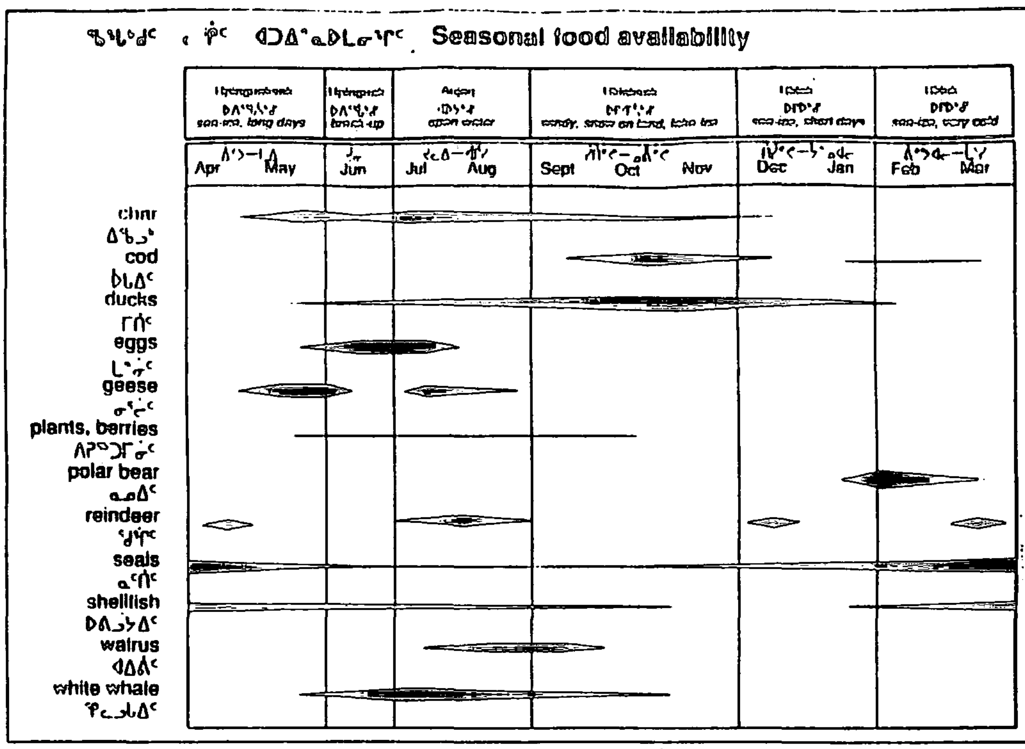
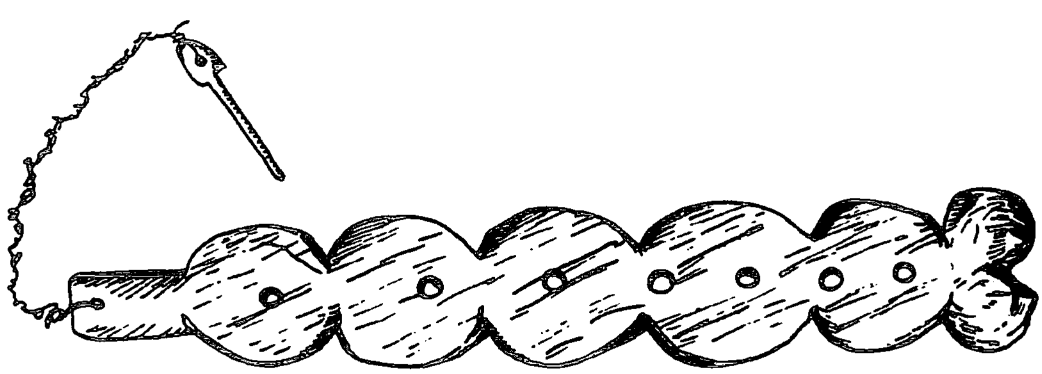


Figure 3.21 — The Innuit Calendar, Godhavn, Bisko.



3.7.1 The 'Eskimo' Calendar.

Recovered in 1919 from Godhavn on Bisko Island, Greenland, this rare example demonstrates how the Inuit marked the days of the week by moving the peg (this supplied by the Pitt-Rivers Museum, Oxford) up and down the seven holes. The form of the artefact does not appear to be functional, although the length and the differentiation of the proximal ends does allow a linear progression of the holes which gives direction to the movement of the peg.

The Eskimo, or Inuit, are known to use the moon to structure their year into thirteen months, the specific names of which vary from area to area and according to latitude.

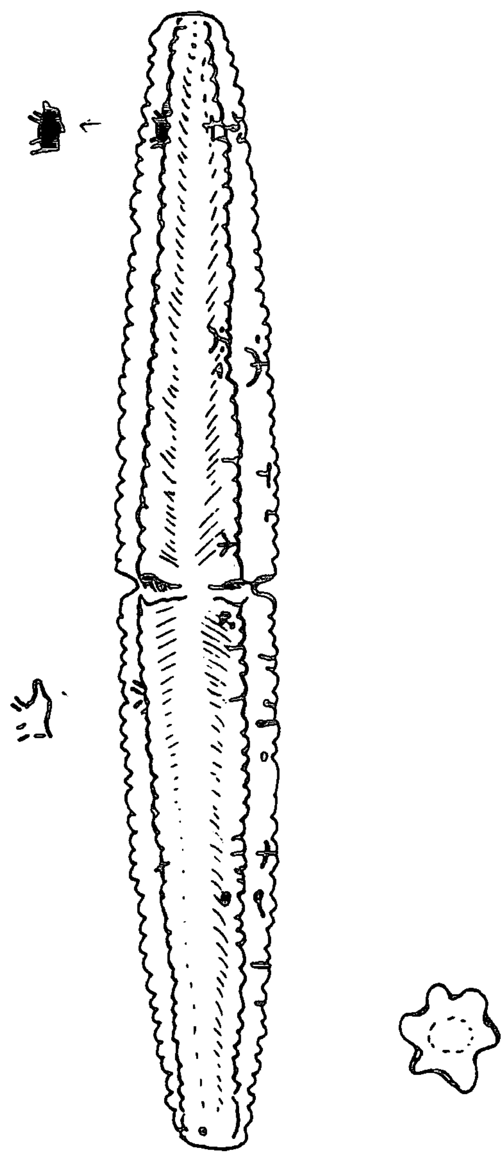
> 'One month, siringilang, 'without sun' – the name covers the whole period of the year in which the sun does not rise – is of indeterminate length (sic!), and thereby serves to equalise the length of the year.' Nilsson 1920:183.

Such a calendar would probably have been used to calculate the passing of the days before a specific event, as Nilsson records that the dates of certain ceremonies and festivals were set well in advance, (1920:182). Figure 3.19 shows the divisions of the year recognised by the Inuit of Belcher Island, Alaska, relating to twelve seasonal resources which occur over the yearly cycle. Such models serve to illustrate the known predictability of certain resources at specific times of the year, *without* the need for a written calendrical record of the days of the year.

3.7.2 Siberian Calendar.

This beautifully carved example was recovered from Karasinsk Tukous, near Dudinka, Siberia, and was donated to the Pitt-Rivers Museum in 1915. It is made of mammoth ivory, and carved into six concave 'sides', which are characteristic of such calendars. The 'edges' where these 'sides' meet are covered in notches, each representing one day. There are minimal icons etched in black that indicate the specific month to which the notches refer. In order to know *exactly* what each lunar month is termed it is necessary to know the group from which this calendar was recovered. Nilsson records the various names ascribed by a number of groups to each month,

Figure 3.22 — The Siberian Calendar, Karasinsk Tukous, Siberia.



Shown Actual Size

(Nilsson, 1920:173–182). The majority of these names refer to specific natural phenomena, or to hunting activities, for example,

> 'The Ugric Ostiaks have 13 months: – 1, spawning month, about April; 2, pine sapwood month; 3, birch sapwood month; 4, salmon-weir month; 5, month of hay-harvest; 6, ducks-and-geese-go-away month; 7, naked tree month; (falling of the leaves); 8, pedestrian month, since men go home on foot while the ice still remains; 9, month in which men go on horseback; 10, great, 11, little winter ridge month; 12, wind month; 13, month of crows.' 1920:175.

> 'The Buriats, from the New Year: – 1, month in which the brooks freeze; 2, when the winter stores are seen to; 3, roe moon; 4, deer moon; 5, sheep moon; 6, when the ice breaks; 7, spring moon; 8, grass moon; 9, bulb moon; 10, milk moon; 11, milch moon; 12, when aftermath comes; 13, when it ripens.' 1920:177.

Not all of the Siberian groups have thirteen months, as the Nishne-Udinsk Buriats and the Tunkinsk Buriats have twelve. Despite the precise reckoning of the lunar months and knowledge of the phases of the moon over the year, those Siberians with a thirteen month year overcome the difficulty of precise synchrony with the solar year by simply adjusting the 'months' to correlate with the phenomena that they describe. For example, if the ducks arrive at roughly the same time each year this will signal the start of the new month, and so on. Nilsson comments that the evidence he presents does not state whether the terms 'month' and 'moon' are synonymous, although he concludes this is probably the case, (1920:181).

3.7.3 The Battak Calendar, Sumatra.

This calendar comes from the National Museum of Scotland, and was donated in 1911, accompanied by 'documents'. The calendar of the Battak's originated in India and this explains why they use corrupted Sanskrit names for each of the months. Based on the structure of a 'lunar' month, Nilsson records that the Battak are known to,

> '.. describe their days by the names of the planets (borrowed from the Sanskrit), repeated four times. To distinguish one from another they make use of additions some of which may probably be referred to original Battak terms.' Nilsson, 1920:160.

Figure 3.23 — The Battak Calendar.

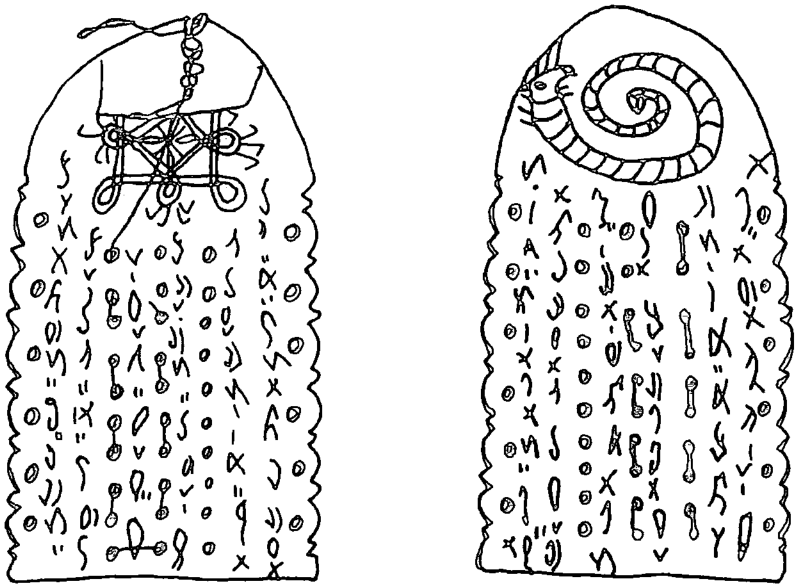


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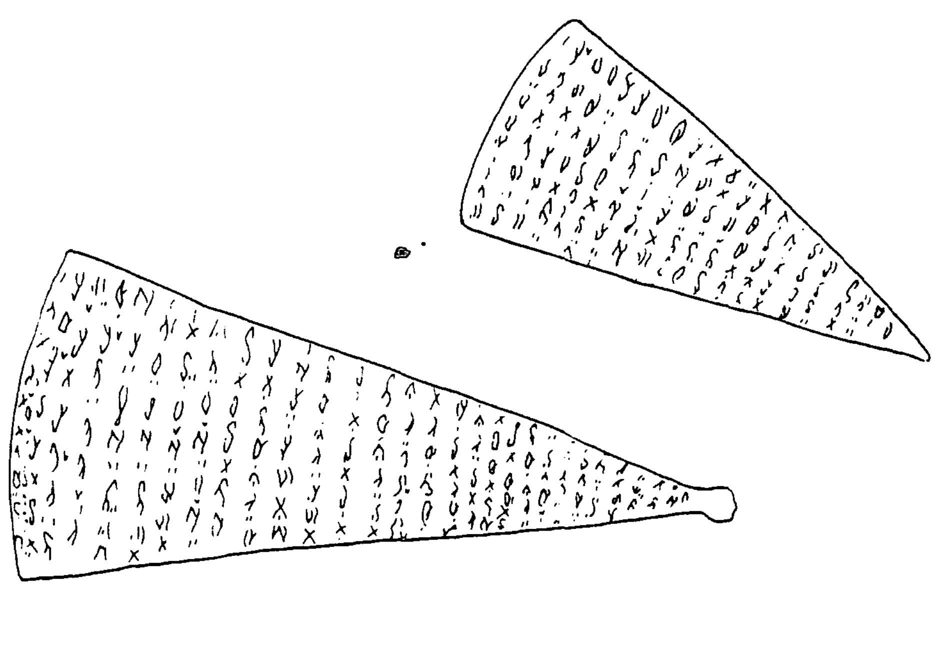
Figure 3.24 — The Battak 'Documents'.



Only the 28th and 29th, or the 29th and 30th days have specific names, as these are used to correlate the lunar observations with the position of Antares, the largest star in Scorpio. Their year begins with the new moon at the setting of Orion, and morning rise of Scorpio in May, (1920:250). This means that the next full moon stands directly in Scorpio, and then for 6 months moves further and further away to finally return by the next new year. Therefore this particular calendar follows the pattern of the moon, but breaks the month into shorter periods. By the use of complex ciphering/ language Sanskrit, the Battak are able to use their knowledge of the stars and planets to predict the yearly cycle.

Nilsson goes on to record the use of the calendar, often made of a buffalo rib, with 12 x 30 holes. By drawing a string through the hole a soothsayer is able to keep account of the days. However as there are invariably thirty holes, but anything from 28 and 30 days in the month he must always refer to the presence of natural phenomena, specifically in the third month a particular flying-ant arrives, and a certain bird of prey the *lali piuan* in the sixth, and the silence of turtle doves in the eighth, (1920:242). A thirteenth month is use for extra days at the end of the year, but not in a consistent or regulated way and Nilsson concludes that the prime purpose of the calendar is its use in divination rather than pinpointing accurately the annual cycle day by day.

3.7.4 The Winter Count of North America.

The account form which all the following information is derived comes from a study by James Howard of the Winter Count of the British Museum, which in 1990 was in store at Shoreditch, London. Winter Counts are known to have been made by the Prairie and High Plains Indians, although there is documentary evidence from the seventeenth century that suggests that Virginian Groups also kept a Count, so the practice could have been more widespread. There are about sixty known Counts with 47 published. Although originally made from Elk or Bison hides the later examples are made on canvas or cloth as the traditional materials became increasingly rare. The British Museum Count uses white cotton cloth measuring 122 cms by 88 cms.

The British Museum Winter Count was thought to have been made by 'Blue Thunder' a Yankatonai Sioux known to be a 'Keeper of the Count' in America during the latter half of the last century. However there are four other counts attributed to him all of which identify closely with one another, whereas stylistically speaking the British Museum example does not. On further analysis, Howard claims that the essential 'sequence' is the same between all these examples and concludes that the British Museum Count is from the same group, although probably not drawn by Blue Thunder.

The actual Count consists of 119 'pictographs', each one representing a significant event experienced by the group that year. 'Winter' begins with the first snowfall, and ends with the first snowfall after the following summer. The event selected for depiction is decided on by the Keeper of the Count and the elders, and refers not necessarily to the most dramatic or devastating event, but to the single event that characterised the year, and would serve to differentiate from other years in the collective memory of the group. For example, the year 1809-10 is defined by,

> 'We found many blue feathers in Winter'.

3.7.5 Winnebago Calendar Stick, America.

This example has been discussed in a number of articles published by Alexander Marshack, 1985, 1988. From a painting commissioned in 1828 of Tshi-zun-hau-kau, Chief of the Winnebago Indians, Marshack identified that he is portrayed carrying both an axe and a wooden calendar stick as symbols of his status. The same stick is thought to form part of the collection at the Cranbrook Institute of Science, Michegan, measuring 132 cms long, and 13 x 13 mm in section. The marks along the long axis of the stick record two years: each year is divided into two six 'month' periods of 28 –32 days; each 'month' is broken down into 3 parts. These latter divisions are made up of two periods of 'ten', with a third part of variable length, 7 – 11 days. The lunar phases of each month are marked by a 'cueing' convention, best summarised by Breen Murray, which indicates the beginning of each the three phases, ' ◡ ' = first phase, ' ○ ' = second phase, and ' ☾ '= third phase. Each day is marked by a ' ❙ ', and a day that is used to correlate with a solar period is marked by ' ❙ '.

3.8 Conclusions.

The aim of this chapter was to test the criteria that I devised from first principles in Chapter II. By stating a number of set properties relating to iconicity, decoration, notation and lunar notation I hoped to be able to identify artefacts that conformed to these groups. The selection of known examples of tallies taken from the ethnographic collection of museums acted as a 'control' for my criteria, to see whether or not they were appropriate measures to classify such artefacts. Had my criteria proved to be incapable of distinguishing between examples of notation and decoration, and more critically unable to identify examples of notation, then it would have been necessary to revise or discard them.

The group of artefacts examined in the first section were Australian Message Sticks, taken from Mountford's account and a collection in Manchester Museum. The accounts made on the use of these sticks describe them as 'mnemonical aides' to the bearer of a message, as they are delivered as a token of good faith and the actual message is given verbally. However there is some evidence to suggest that certain conventions of engraving specific marks with assigned meaning existed in limited geographical areas, and so the form of a particular engraving could relate structurally to the message being transmitted. At no point is it suggested that these sticks are 'tallies', although they may represent a quantity to the bearer. Interestingly the tallies supplied by Mountford were elaborate, with mirror symmetry, rotational symmetry and some translational symmetry, and were classed by my criteria as decorative. The message Sticks from Manchester Museum showed evidence of translational symmetry with some rotational symmetry, which along with certain other specific properties made them possibly decoration, possibly notational by my criteria.

The use of translational symmetry in the examples of tallies is notable, and this proved to be a common feature of tallies from both literate cultures, and societies without a literary tradition. In in each case the criteria for notation appeared to provide an appropriate measures of the structural principles in operation, concentrating in a recognisable 'path', the use of a single standardised element with pertinent variation, and using spaces to structure and organise the information. There was some use of rotational symmetry, in the instance of the french baker's tallies, although this was used in combination with translational symmetry. The 'tallies of time' shared the same principles of organisation, that is the use of translational symmetry represented by a single design element.

The tallies of time, whether days or weeks, were separated from the calendars as the latter represent predictive rather than actual or respective measures of time. This distinction proved to represent a structural as well as a conceptual difference, as although some of these examples also used translational symmetry, they used imagery to order the information. This came in the form of iconic imagery (Winter Count and Siberian Calendar), and symbolism (same and Winnebago Calendar Stick, and Battak Calendar), and only the Inuit day count used a simple repetitive structure. Perhaps the reason for the use of symbols and iconicity in calendars is that as intentionally created models they exist within cultures with a complex symbolling system with elaborate divisions and meanings to various days and months. However the examples of the yearly cycles taken from accounts of the Aboriginal and Inuit cultures, already shown as Figures 3.18 and 3.19, illustrate that such divisions and full understanding of the year might exist *without* the need to actual to construct a calendar.

An alternative explanation is that as these calendars represent the entire year of roughly 365 days, then this information needs to be broken up, and so the elaborate use of symbols is a necessary by-product of representing the whole year at a time, and is therefore not by itself a measure of complexity. The whole year in the Siberian and Winnebago Calendar sticks is broken up into lunar 'months', which in turn are corroborated by more accurate solar references to ensure the yearly cycle corresponds to the same natural seasons each year. Even this would be insufficient to indicate a precise place in the year, which might be important to mark a ceremony, or the onset of a hunting season, hence the need for additional symbols to indicate the months, and even the 'weeks'. The former explanation is perhaps more convincing, as surely hunters *without* calendars can predict the seasons, and the need to move in advance to locate / exploit a particular food resource.

A more likely explanation for the use of calendars is perhaps concerned with social needs to mark a particular event such as the solstices, the appearance of stars, or a particular day of significance, such as a ceremony etc. Certainly the Winter Count represents a need for a history of the years, as the emphasis is not on minute divisions, but the need to distinguish the years, and remember the principle events. The emphasis is on chronology and continuity, which perhaps represents an essentially progressive rather than cyclical view of time? Therefore the use of signs, symbols, and pictographs in calendrical representations is to make it easier to pinpoint a place in time and so are not measures of complexity of structure, but rather of quantity of information needed to be ordered, a necessary function rather than a 'development.'

In conclusion the consideration of the documented examples of tallies was extremely useful. Firstly as a test for my criteria, but secondly as an indication of the variability in the *form* of tallies. The principle of translational symmetry has emerged as perhaps the critical measure of recording quantities, which confirms the validity of my criteria. These tallies also illustrate the ability of comparatively simple representations to supply the needs of complex subsistence strategies. This perhaps underlines the fact that unless a researcher knows what is represented in *advance*, then they are unlikely to discover what exactly has been recorded, unless of course they have some knowledge of the particular systems of the culture. However it is possible to locate the common *structure* of these representations, and so in the next chapter I will examine material from the Upper Palaeolithic. Although the societies from which these examples were taken are not thought to be identical to those in the Upper Palaeolithic it is possible to extract certain structural principles to form the basis for comparison.

Chapter IV

Notation: The Sun, the Moon and the Stars.

4.1 Sources of Data.

4.1.1 Introduction.

In Chapter II, I discussed some of the methods that are commonly used to classify the visual representations of the Upper Palaeolithic. The broad categories of iconic representation, decoration and notation were isolated as the most appropriate and constructive means of classifying the known data. For each of these categories certain properties were identified and summarised as a list of criteria on Table 1.

As these criteria were logically deduced from first principles, they were tested against documented examples from the near present. From this practical experiment certain principles emerged. Firstly, the identification of translational symmetry as a key component of the tallies that I worked on, whereas rotational symmetry, mirror and slide reflection appeared only in examples of decoration, except in some of the message sticks suppled by Mountford (1958). Secondly, the use of ciphers and pictographs in these examples are confined to calendars, which are classified as predictive tabulations of time rather than tallies, which are on going records. Thus the identification of certain key criteria provided a useful classificatory device, which in this preliminary test not only concurred with the documentary classification, but also enabled the identification of certain structural properties. As these properties relate to tallies (records functioning within numerate and sometimes literate cultures), this chapter goes on to examine whether the same structure can be found in any artefacts in the European Upper Palaeolithic, which would be classified by my criteria as notations (records made by non-literate and possibly non-numerate peoples).

The following discussion concentrates on the question of whether there can ever be convincing evidence that notation was practised during the Upper Palaeolithic in

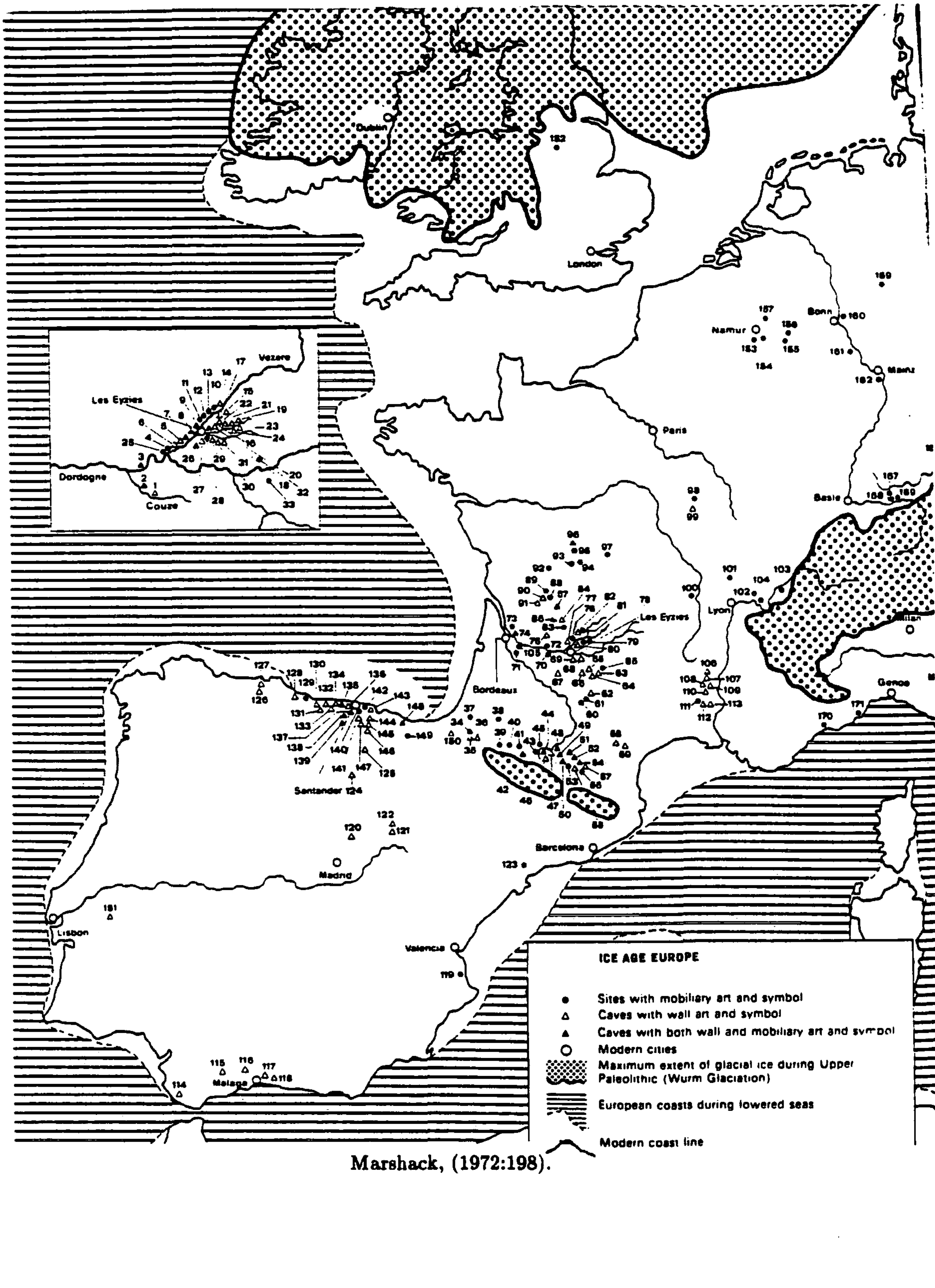
Europe. The social and physical environment of the Upper Palaeolithic has been the subject of research for over a hundred years, with contributions principally from the field of archaeology, palaeontology, and geology. Using the physical evidence and ethnographic material, a convincing profile has been created of the lives of these 'cave men', although this continues to be modified, and subject to a number of different interpretations. An understanding of both the environmental conditions and the subsistence strategy is necessary to provide the context within which notation would have been used. The first section of this chapter presents a concise description of the ecological conditions over the timescale of the Upper Palaeolithic, as well as the probable lives of the people who existed within it.

There is one school of thought that the existence of notation *can* be demonstrated by material from the archaeological record, which is discussed later in this chapter. It is worth remembering Wolpoff's (1975) caution that the data are not always as forthcoming as one might wish, and in this chapter I will compare the results of the various attempts to investigate the presence of notation, and to present a critical summary of the results. As the discussions about the presence or absence of a developed system of notation is particularly contentious, material is taken from a number of researchers who have also been concerned with the identification of possible notational systems during this period. By testing my own criteria against documented examples of engraved mobiliary artefacts, I hope to isolate those examples that are non-decorative and non-iconic, and non-random.

4.1.2 The Ecological Context of Notation.

The following discussion focuses on the need to provide an adequate context for the archaeological material under consideration. Historians and ethnographers recognise the need to include a description of not only the aspect of culture or behaviour selected for study but also of the wider environment within which it occurs. The extent of this will vary: its brevity generally is in an inverse ratio to the reader's unfamiliarity with what is described. As many people are surprised to find that humans existed during the last ice age, it is often necessary to give quite a lengthy account of the nature of human morphology and social organisation from this time. Although popularly characterised as inarticulate, hairy, spear-wielding

Figure 4.1 — Map of Western Europe with Sites.



Marshack, (1972:198).

Figure 4.2 — The Key to the Sites.

MAP NUMBER

FRANCE

1 TERME PIALAT
2 JEAN-BLANCS
3 LALINDE (LA ROCHE, LE SOUCY)
4 LIMEUIL
5 BARABAO
6 SAINT-CIRQ (NOËL BROUSSE CAVE)
7 FERRASSIE (LA)
8 GORGE D'ENFER (ABRI LARTET)
9 LAUGERIE BASSE, LAUGERIE HAUTE
10 RUTH (LE) (ABRI CELLIER)
11 EYZIES (LES)
12 VILLEPIN
13 MADELEINE (LA)
14 DELCAYRE
15 REVERDIT
16 CASTANET
17 BLANCHARD
18 LABATUT
19 LAUSSEL
20 CROZE À GONTRAN (LA)
21 CAP BLANC
22 GRÈZE (LA)
23 COMMARQUE
24 BEYSSAC, NANCY
25 SIREUIL
26 MOUTHE (LA)
27 FONT-DE-GAUME
28 REY
29 COMBARELLES (LES)
30 CALÉVIE (LA)
31 BERNIFAL
32 PECH DE LA BOISSIÈRE
33 PÈCHIALET
34 ISTURITZ

MAP NUMBER

35 JASISILOAGA
36 ETCHEBERRIKO-KHARBIA
37 DURUTHY
38 BRASSEMPOUY
39 ARUDY
40 LOURDES (ESPELUGUES)
41 LORTHET
42 LABASTIDE
43 GOURDAN
44 GARGAS
45 LESPUGUE
46 TIBIRAN
47 MONTESPAN
48 MARSOULAS
49 TUC D'AUDOUBERT (LE)
50 TROIS FRÈRES (LES)
51 MAS D'AZIL (LE)
52 PORTEL (LE)
53 MASSAT
54 BÉDEILHAC
55 NIAUX
56 VACHE (LA)
57 USSAT (LES ÉGLISES)
58 SALLÈLES-CABARDÈS (GAZEL)
59 ALDÈNE
60 BRUNIQUEL
61 FONTALÈS
62 PERGOUSET
63 SAINTE-EULALIE
64 MARCENAC
65 CANTAL
66 PECH-MERLE
67 MAGDELAINE (LA)
68 ROCAMADOUR: LES MERVEILLES, ABRI MURAT

MAP NUMBER

69 COUGNAC
70 GARE DE COUZE
71 FONTARNAUD À LUGASSON
72 MOULIN (LE)
73 FÉES (LES)
74 PAIR-NON-PAIR
75 GABILLOU (LE)
76 BADEGOULE
77 ROUFFIGNAC
78 BLANCHARD
79 LACHAUD
80 LASCAUX
81 PUY-DE-LACAN
82 SUDRIE (LA)
83 RAYMONDEN
84 VILLARS
85 REBIERES
86 FOURNEAU DU DIABLE (LE)
87 TEYJAT: LA MAIRIE, ABRI MÈGE
88 MONTGAUDIER
89 PLACARD (LE) (ROCHEBERTIER)
90 ROC DE SERS (LE)
91 CHAIRE À CALVIN (LA)
92 CHAUFFAUD
93 MARCHE (LA)
94 LOUBRESSAC
95 LARAUX
96 ANGLES-SUR-L'ANGLIN
97 SAINT-MARCEL
98 TRILOBITE (LE)
99 ARCY-SUR-CURE (GROTTE DU CHEVAL)
100 SAUT-DU-PERRON
101 SOLUTRÉ
102 COLOMBIÈRE (LA)
103 VETRIER (LE)
104 HOTEAUX (LES)
105 ROND DU BARRY
106 EBBOU
107 COLOMBIER (LE)
108 OULLINS
109 FIGUIER (LE)
110 CHABOT
111 PONT-DU-GARD
112 BAUME LATRONE (LA)
113 BAYOL

SPAIN

114 PALOMAS (LAS)
115 PILETA (LA)
116 ARDALES
117 CALA (LA)
118 NERJA
119 PARPALLÓ (EL)
120 REGUERILLO (EL)
121 HOZ (LA)
122 CASARES (LOS)
123 SANT GREGORI
124 ATAPUERCA
125 PENCHES
126 MESTAS (LAS)
127 PEÑA DE CANDAMO (LA)
128 BUXU (EL)
129 CUETO DE LA MINA (EL)
130 PINDAL
131 LOJA (LA)
132 MEAZA (LA)
133 AGUAS DE NOVALES (LAS)
134 CLOTILDE DE SANTA ISABEL (LA)
135 ALTAMIRA
136 SANTIAN
137 PENDO (EL)
138 MONTE CASTILLO: PASIEGA (LA), CASTILLO (EL), CHIMENEAS (LAS), MONEDAS (LAS)
139 HORNOS DE LA PEÑA
140 RASCAÑO
141 SALITRE
142 VALLE (EL)
143 COVALANAS
144 VENTÍS DE LA PERRA (LA)
145 SOTARRIZA
146 CULLALVERA (LA)
147 HAZA (LA)
148 SANTIMAMIÑE
149 BOLINKOBA
150 BERROBERRIA

PORTUGAL

151 ESCOURAL

ENGLAND

152 CRESWELL CRAGS

BELGIUM

153 TROU MAGRITE, TROU DE CHALEUX
154 FURFOOZ, TROU DU FRONTAL
155 ST-VERLAINE
156 JUZAINE (COLÉOPTÈRE)
157 MARCHE LES DAMES, GOYET

ITALY

170 BALZI ROSSI: BARMA GRANDE (GROTTE DE MENTON)
171 ARENE CANDIDE
172 CHIOZZA
173 SA[illegible]GNANO
174 RIPARO TAGLIENTE
175 TRASIMENO
176 TIVOLI
177 PAGLICCI
178 MONOPOLI
179 ROMANELLI
180 PARABITA (VENERI)
181 LEVANZO
182 MONTE PELLEGRINO (ADDAURA, NISCEMI)

AUSTRIA

183 WILLENDORF

GERMANY

158 AHRENSBURG
159 BALVER HOHLE
160 OBERKASSEL
161 ANDERNACH
162 MAINZ
163 KLAUSE
164 NEUBURG
165 HOHLENSTEIN
166 VOGELHERD
167 PETERSFELS

hunters of mammoths, or sometimes even dinosaurs, living at the mercy of nature and each other, the reality is a little different.

Certainly the evidence suggests that the landscape of Europe during the Upper Palaeolithic was subject to change, primarily as a result of the glacial cycle and the associated changes caused by the severe impact on the environment. From 128 Kyr there was a short interglacial period, and deciduous forests were able to establish themselves over lowland areas as a result of the rise in temperature and the increase in precipitation. After about 118 Kyr the temperatures dropped and the forests began to diminish, and by 75 Kyr were present only in the Mediterranean steppes. The full glacial period lasted from 32 Kyr to 13 Kyr, with the icecaps from Northern Europe and the Alps advancing to cover much of the lowland areas in their path. The sea level is thought to have fallen between 100 – 150 m which resulted in mainland Britain being joined by an extensive plain to the rest of Europe. Although these conditions prevailed over much of Europe, there were inevitably variations from region to region. Different habitats subjected to this cyclical change would be affected in different ways, promoting different vegetal growth.

Although northern Europe formed effectively a 'polar desert', conditions were not as severe for humans as the phrase suggests, and it was more temperate elsewhere in Europe. In the Southeastern region there was some woodland in the most sheltered valley regions, and the southwest did not suffer from continuous ice cover. In the southwestern region the climate was characterised by cool summers but, for the ice age, relatively mild winters with comparatively slight snow cover. For the Perigord this meant a range of temperatures of 12 -15 degrees in summer, and around 0 degrees in winter, which was sufficient to promote the growth not only of birch, pine and juniper but also oak, alder and hazel in sheltered areas.

Even in the deciduous forests of the interglacial 128 – 118 Kyr, plant resources for human consumption are thought to have been limited. Nuts and berries must be stored as they are produced only for short seasons, and are labour consuming to gather and process. On the basis of this, and owing to the quantity of projectile points recovered from the various sites, the prevalent view is that the people of the Upper Palaeolithic relied on hunting animals as their primary mode of subsistence.

The vegetation of grasses and lichens seems to have been sufficient to maintain a number of animal species. Gamble describes a wealth of species that flourished over the timescale:

> 'The mammal community of the Pleistocene was unique in its combination of present day arctic species (musk ox, reindeer, wolverine, arctic fox) with sub-tropical carnivores (hyena, leopard, lion), mid latitude temperate herbivores (red deer, roe deer, aurochs, pigs), steppe (saiga antelope, ass) and mountain species (chamois, ibex, lynx) and open grassland grazers (bison, horse).' (1990:103)

There were the now extinct species of megafauna, including the woolly rhino, mammoth, elephants, hippopotami, rhinos and giant deer, and also the particularly widespread wolf and bear, as well as rabbits, hares and other small mammals over the timescale. Animal species are adaptable and can tolerate a wide range of conditions, and it is thought that only in the northern regions would there have been severe stress on their food resources. Large quantities of animal bones have been recovered from the excavated sites. Reindeer tends to predominate, with horse, bovides and red deer, whilst roe deer, giant deer, boar, ibex, chamoix, rhino and mammoth are variously present in lesser concentrations (Delpech, 1983, Mellars, 1973).

This broad faunal base supports the recent claim by Mellars (1985) that potentially there would have been a plentiful supply of meat available to Palaeolithic populations during this glacial period, and that should the environmental pressure cause the decline of one species there would be others for consumption. Of course certain conditions would affect all species adversely and there is some indirect evidence to suggest that this was the case. The intensification of the exploitation of red deer and reindeer towards the end of the Magdalenian has been linked to a growth in the human population at this time, (Clark and Straus, 1983, Mithen, 1990), but equally it could have resulted from a decline in other species. If the people of this time had a relatively dependable source of food on which to establish a stable economic strategy, with only minor fluctuations in the supply, then long term settlements or predictable seasonal patterns of residence would be possible.

Based on recent work on the migratory patterns of reindeer herds over northern latitudes, it has been suggested that the herds of the Upper Palaeolithic may have ranged from the Dordogne to the Pyrénées as part of their annual movements (Gordon, 1988). As Inuit societies follow the herds for great distances (Burch, 1972) it has idea has been forwarded that the same populations may have used and decorated the cave sites in both the Dordogne and the Pyrénées, (Bahn, 1977). Bouchud (1986) maintains that contrary to the known patterns of long distant animal migrations across tundra environments, the reindeer of the Upper Palaeolithic needed to travel only 80 – 100 Km between their winter and summer grazing. If this was the case, then this too would favour a relatively sedentary pattern of residence for their hunters.

Deglaciation was underway in 16 Kyr, and by 8 Kyr most of the northern icecaps have melted, with corresponding eustatic adjustment. The implication is that this broadly based ecological strategy with predictable resources made it possible for people to aggregate at certain times of the year to exploit seasonal concentrations of food (Conkey, 1980, Mellars, 1985, Bahn, 1982). Mellars proposes that this would be accompanied by examples of instituted social behaviour, possibly linked to the presence of high status individuals, in order to coordinate and maximise the effectiveness of the hunt. Bailey (1983) discuses possible patterns of animal exploitation, namely 'opportunistic' or 'indirect'. The former deals with prey on an encounter basis, although it is not necessarily random or haphazard, whereas the latter involves an investment of time and resources, in tool manufacture or provision of food for animals in winter for example, that can ultimately give a higher rate of return yet include the risk of failure.

4.2 Notation: The Great Debate.

In Chapter I, I included a brief summary of the previous work on notation, dating back to the recognition of *"marques de chasse"* in the reports of an excavation published in the 1860s by Eduard Lartet and Henry Christy. This first attribution was followed by Breuil's (1952) interpretation of similar marks being representative of the number of participants in a ceremony, and Leroi-Gourhan's influential view that the engraved marks found on engraved pieces of bone from the Upper Palaeolithic could represent the earliest forms of rulers and calendars, (Leroi-Gourhan, 1965:40).

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As more data have been recovered, and ideas about the complexity of the social organisation of the populatations of the Upper Palaeolithic has been reviewed, so have these particular views been challenged. Interestingly the interpretations have moved away from the initial theory of simple tallies recording the day's hunting towards a more detailed examination of the structure of the marks on the bones, plaquettes, or pebbles. Broadly speaking, two patterns of research have emerged: firstly the identification of repetitive, structured 'groupings' thought to indicate a base system and therefore rudimentary counting (De Heinzelin, 1962, Frolov, 1965, 1970, Couraud & Lorblanchet, 1986); and secondly, certain regular patterns have been linked to records of the passing of time, specifically thought to represent the phases of the moon (Marshack, 1972). The following section outlines the arguments forwarded by researchers in favour of these two interpretations.

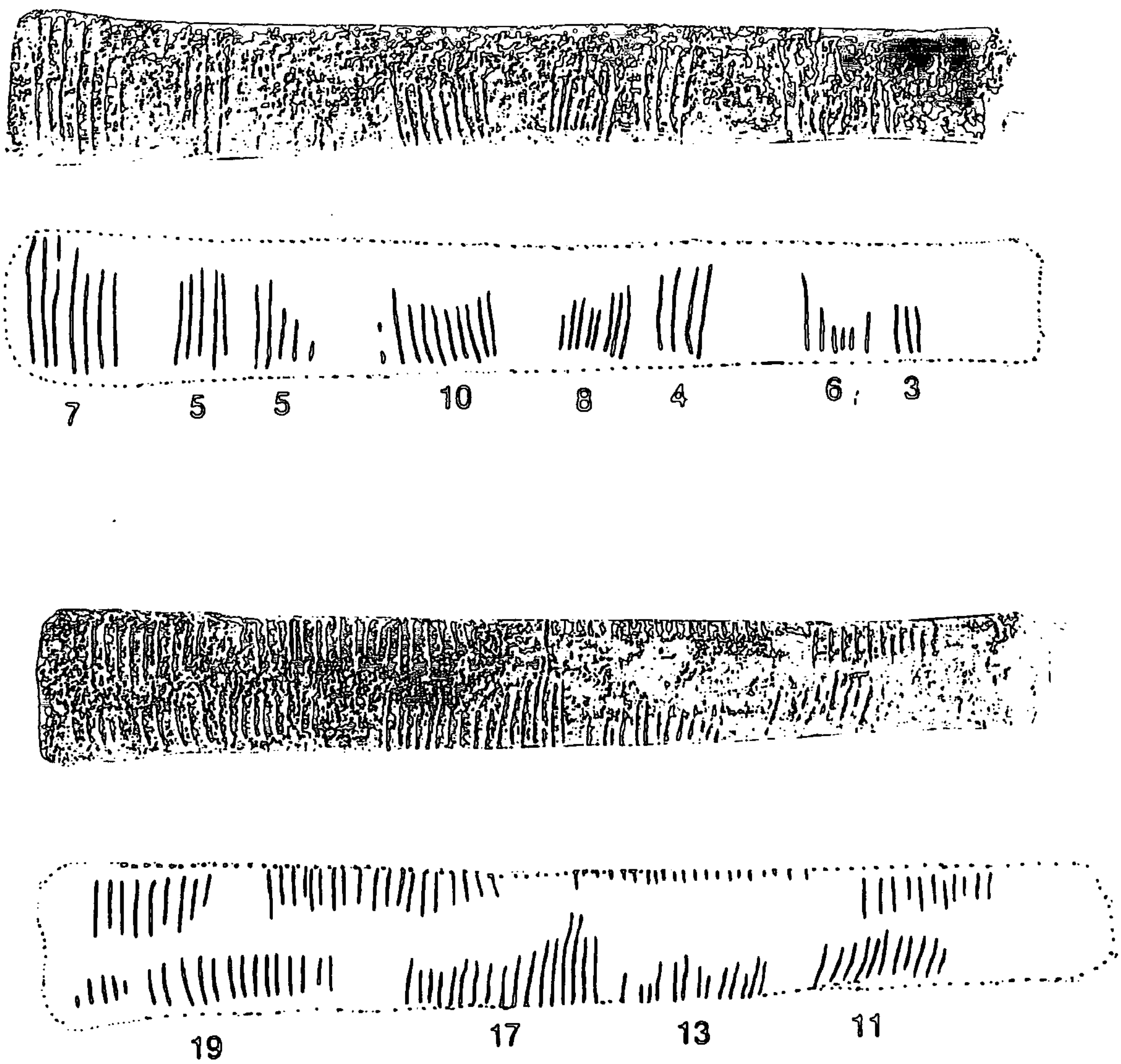
4.2.1 Playing with Numbers.

One of the first researchers to analyse the possible mathematical properties of an artefact was the Belgian archaeologist Jean De Heinzelin. His contribution centred around a find from the site of Ishango on the shores of Lake Rutanzige, once Lake Edward, in Zaire (De Heinzelin, 1962). Although the geological evidence indicated a date of less than 10 000 years for the remains, placing the material in the pre-pottery Mesolithic, a more recent survey of the site dates the artefacts to between 20 000 - 25 000, (A.S. Brooks, and C.C. Smith, 1987). The item of particular interest is a small bone tipped with a small fragment of quartz. As there were traces of wear on the tip De Heinzelin hypothesised it could have been used for,

> 'engraving or tattooing, or even for writing of some kind' (1962:109).

The most remarkable feature of this artefact is the series of engraved lines along the short axis of the bone. De Heinzelin identifies a number of groups running down the long axis in three columns, illustrated in Figure 4.3. As the number of marks in each column are not grouped in the same way, De Heinzelin believes they are unlikely to be a form of decoration, yet their arrangement into groups and their parallel alignment suggests that they are non random. By counting the notches in each 'group' on the three columns, he presented the following results.

Figure 4.3 — Ishango: De Heinzelin's Interpretation of the Lines.



De Heinzelin, 1962:113.

Column 1 in his analysis is made up of four groups consisting of 11, 13, 17 and 19 individual notches. Significantly they are all the prime numbers between ten and twenty, placed in ascending order. Column 2 consists of eight groups of 3, 6, 4, 8, 10, 5, 5 and 7 . Although there does not appear to an immediate order to this sequence, if these groups are seen as 3 and 6, then 4 and 8, and 10, 5, 5, and finally 7, De Heinzelin believes there is a pattern of multiplication, or rather duplication at work. The third column has four groups of marks, seen as 11, 21, 19 and 9. The significance of this final example is that the totals can be broken down into 10+1, 20+1, 20−1 and 10−1. De Heinzelin concludes,

> '... they may represent an arithmetical game of some sort, devised by a people who had a number system based on 10 as well as a knowledge of duplication and of prime numbers.' (1962:112).

He tentatively relates this to the later well documented evidence of mathematical observation and calculations of dynastic Egypt, and suggests that by a process of diffusion the properties he attributes to the Ishango bone could be a precursor to these later developments. Such a hypothesis cannot be sustained in the light of the new evidence, moving the date for the bone from 6 500 BC. to over 20 000. However it serves to illustrate the tendency for archaeologists to link what are possibly the earliest records made by man, to the classical calendrical systems that have survived to the present.

In a paper given at the Valcamonica symposium, Boris Frolov presented the results of his work on the apparent numerical basis of much of Palaeolithic ornamentation (Frolov 1965, 1970). From statistical analyses conducted in the USSR on the geometric representations on both wall and portable art, he claims to have discovered the repeated use of the groupings of five, ten and fourteen, and most significantly the grouping of seven. To support this latter assertion he cites a number of examples from all over Europe, including the fact that in the cave of Lascaux there are groups of five horses, five red deer, and further away a single horse pierced by seven arrows, (1970:476). Frolov briefly refers to the possible links between the use of the number seven and the lunar phases, which he believes makes this 'magic number' a prime subject for inclusion into the systems of visual representations. As the lunar cycle is the basis for our seven day week, with a lunar month lasting approximately twenty eight days, the number seven is plausibly associated with the passing of time. Frolov asks whether the spirals and crescents in the wall and portable art are really stars, or the depictions of the moon.

The work of Frolov has interesting parallels with the earlier work of Marcel Baudouin (1916) as he too identified the number seven as being of prime significance throughout later prehistory. Baudouin had already published papers on the repeated presence of the constellation of Taurus, or the Plough, in the visual representations of the Neolithic, Bronze Age and Iron Age cultures. From this he hypothesised that this knowledge came from earlier observations possibly extending as far back as the Aurignacian. In examining documented artefacts from the prehistoric sites of Lourdes, Arudy, Gourdan and Mas d'Azil in the Pyrénées and other sites around the Vézère and the Charente he claims to have discovered evidence that these seven stars were represented.

From looking at the relative position and number of circles and spirals on mobiliary artefacts Baudouin identified the shape of the plough. Some examples he believed, show the four major stars and the three minor stars as well as the pole star, and this constellation is represented not only on portable artefacts, but also in the paintings on the cave walls. The use of chevrons and horseshoe motifs in his view confirm this, and he sees the tectiforms as the medial lines and the equinox. As many of the iconic representations are found in conjunction with the chevrons and horseshoe signs, he concludes that they are in fact zoomorphic representations of other constellations, ancestral to the moderm Zodiac.

4.2.2 Playing with Time.

The later work of C. Couraud and M. Lorblanchet (1986) focuses on one of the thirty eight known Azilian sites in Europe, namely L'Abri Pages in the commune of Rocamadour in the Lot. The material from the shelter was first recovered by A. Niederlander in 1929-30, but not published until 1956 (A. Niederlander, R. Lacam and De Sonneville-Bordes). Most of this material was deposited in the Museum of Amedée Lemozi at Cabrerets in the Lot, and the remainder was recovered from the private collection of Niederlander after his death. Both Lorblanchet and Couraud were interested in an enigmatic group of Azilian artefacts that they were unable to interpret using the conventional categories for the period. These bones and pebbles are all engraved with 'sets' of nearly parallel lines. On further analysis these groups of lines on each artefact seemed to be more or less numerically precise, that is, their totals tended to be consistent.

As a result, they introduce the hypothesis that the marks could be meaningful, possibly as a method of counting or reckoning and therefore by my definition, a tally of some form. The results of this exercise are presented as a table, after work by A. Thévenin, (1983), initially using nine almost complete pebbles (8) and one bone. What they found from these nine artefacts was, briefly, that those with one or more groups containing 1 – 12 marks totalled 7; groups of 13 – 24 marks occurred 7 – 8 times; and those with groups of 25 – 37 marks also occurred 7 – 8 times. Therefore these three groups all occurred 7 or eight times on the total number of artefacts presented here. Specifically, 14 +/– 2 appears five times, 21 +/– 2 four times, and 31 +/– 2 four times. For the whole sample of marks, the majority of groups total 15, 21/22 and 23 or their multiples, which are 60, 61/62, or 67/71. These results suggest to the researchers a count in base 7.

Thévenin (1983) examined twenty two Azilian pebbles from the site of Rochedan and recorded that 16 pebbles had 8 – 10 marks, and all twenty two had 27 – 33. As a result of this apparently corroborative evidence, Lorblanchet and Couraud looked at all the available Azilian pebbles, which totalled eighty nine. From the examples from Rochedan, on 15 pebbles there are 6 groups totalling 28 +/– 1, and 15 groups of 22 +/– 1. Three other pieces have 59 marks, or 60 +/– 1. The analysis continues to lists other caves, including the sloe pebble from Espelugues (Haute Pyrénées) which has two groups of 27 – 31 marks, and a pebble from Rochereil which has 180 marks (6 x 30).

Lorblanchet and Couraud discuss the context of Azilian portable artefacts, most notably that their number increases during the later Magdalenian on sites all over Europe. The nature of the engravings also changes as the iconic representations become more and more stylised and the number with geometric representations increases. This period of apparent stylistic transition continues, and so by the Azilian the majority of artefacts are engraved with non-iconic forms of representation. The Azilian is known to be a time of major climatic change over the whole of Europe which had a profound affect on the food procurement strategies for the people of that time. The archaeological record testifies to a number of rapid changes in their economy, marked by a change in the faunal remains from red deer to reindeer as the temperatures dropped. However there is no corresponding shift in the cultural material, as the art objects do not appear to undergo the same radical change. Lorblanchet and Couraud infer from this that systems of belief, possibly religious, do not change as rapidly as mundane food procurement strategies, or at least not in response to climatic factors.

Although Lorblanchet and Couraud acknowledge a debt to the pioneering work of Alexander Marshack who also showed that some Palaeolithic objects could be grouped into units of 7, 28, 29, 30, 31 and 32, and their multiples (Marshack, 1972), they stress that they observed certain methodological restrictions which Marshack did not. Firstly they limited the time scale to one archaeological period, the Azilian, which spanned the comparatively brief period of 2 500 years. Secondly their study attempts to look at all the available material in order to provide their conclusion with a sure base, although this is still only a sample of the total assemblage.

4.2.3 Summary.

In the arguments above various themes have been emerging, with various degress of analytical rigour and independent testing. the work of De Heinzelin was based on the recovery of a single artefact, and although his observations are very interesting, the very lack of continuity, from base 10 to prime numbers to number games on a single bone lead to the conclusion that such claims cannot be made without further research and finds of comparable artefacts. Baudouin's pioneering work did incorporate many examples, but although findings interesting (and correlated to the later work of C & L) as findings of seven, to relate this to stars, and then to the Eurocentric view of the Zodiavc complete with zoomorphic representations shows danger of simply projecting ideas of the present back to the past. Work by Frolov and c & L far more convincing, as looking at single sites. Cannot dismiss validity of findings, although must be cautious about interpretation, and be aware of possible alternatives.

4.3 Portable Artefacts and Lunar Notation.

Despite Lorblanchet and Couraud's identification of the possible significance of seven and its multiples, and groups of around thirty, they stop short of associating this directly with a system of lunar notation. Alexander Marshack, (1969, 1972) claimed that he had recovered suggestive evidence that the people of the Upper Palaeolithic may have understood the lunar cycle sufficiently to construct notations based on the moons phases over a lunar 'month'.

4.3.1 'Cracking The Code.'

The following section concentrates on the contribution of Alexander Marshack to the work on notation in the Upper Palaeolithic. After examining 'many hundreds' of engraved mobiliary artefacts in the museums of Europe, Marshack remains convinced that there was a developed system of notation in existence at this time. Furthermore he believes many of the possible notations are related to the phases of the moon and has published a number of articles over the past twenty years documenting these finds and explaining the facts that lead to these conclusions. Marshack has presented a number of accounts of his theoretical and practical methodology, but the most detailed explanations occur in **The Roots of Civilisation**, (1972, 2nd Edition 1991). The following discussion focuses on three aspects of his work: the identification of notation and lunar 'phrasing'; a description of micro analysis and its use; and the identification of 'seasonality' combined with lunar notation.

4.3.2 The Identification of Lunar Notation.

Having read the article by De Heinzelin on the bone from Ishango then dated to the Mesolithic, Marshack believed that he had found a solution that explained not only the presence of this bone and the form of its singular markings, but also the basis for his own enquiry. By adding the numbers in the first of the 'sets' isolated by De Heinzelin, and then the third, they both total sixty, that is,

$11 + 13 + 17 + 19 = 60$ and $11 + 21 + 19 + 9 = 60.$

Marshack instantly linked the total with the sum of two months, or rather the four that he believed were represented here, despite the fact that he asked at the time, 'But how does one check such an assumption, particularly since the series is broken down so strangely? Besides 2 months do not give 60, and 4 months do *not* give 120.' (1991:28).

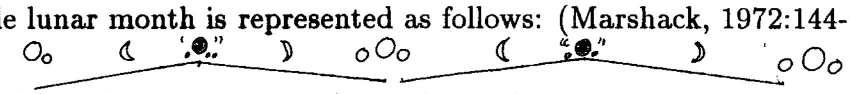
There are certain difficulties inherent in recording the appearances of the moon at night, such as making correct lunar observations during the period of invisibility when the moon disappears from our skies for up to three days, even allowing for bad weather and poor visibility, and the fact that a lunar month lasts for 29 $\frac{1}{2}$ days. By breaking down the various columns and sets of the Ishango bone into what he terms 'lunar phrases' Marshack discovers an underlying consistency. These phrases relate to the significant points of the lunar month, namely the period of the full moon, the waxing, waning and invisibility. As these are conceptual divisions imposed on the observation of the actual phenomenon, there will not necessarily be the same number of marks in each phrase. Instead a general pattern should be evident, and Marshack includes certain variations in the length of the marks to illustrate the correspondence to his representation of the lunar pattern. Thus Marshack retains his initial conviction that this is a possible example of lunar notation, and goes on to examine the archaeological record for possible corroborative data.

The Lunar Cycle.

The model that Marshack uses throughout the **Roots of Civilization** is based on the phases of the moon in one lunar month, including the days when the moon is not visible. The choice of a lunar scale over a solar scale is related to the visible waxing and waning of the moon over the course of a *month*, as opposed to the less distinctive movements the earth relative to the sun over a *year*.

Marshack's Representation of the Lunar Month.

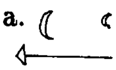
The whole lunar month is represented as follows: (Marshack, 1972:144-6).



7 – – 7 – 1 - 2 - 5 – 7 – – 7 – – 7 – 1 - 2 - 5 – 8 – – 7

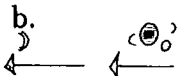
The month is divided into waxing and waning periods, and as can be seen from the diagram, the actual duration of a 'month' is 29 $\frac{1}{2}$ days which requires the 'addition' of an extra day over a two month period – hence the '8' rather than the '7'. There is a period of invisibility which is represented by the black moon and associated crescents.

The other ways that Marshack illustrates the phases of the moon are;

a. 

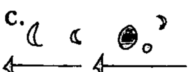
8 First crescent to the half moon.

In terms of an observational record this represents the number of days from the very first sighting of the new moon to the half moon.

b. 

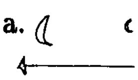
7 4 Invisibility to the crescent.

The period of invisibility lasts from 3 - 4 days, marked by the non-appearance, and this is followed by the new moon then the half moon over 11 days.

c. 

7 8 Last quarter to the half moon.

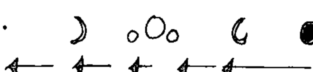
As one of the most 'natural' ways to count or calculate is thought to be using parts of the body as a source of reference, particularly the hands, Marshack gives an illustration of how a lunar notation might have been represented using this method.

a. 

10 Last crescent to the half moon.

b. 

3 5 10 Invisibility to the half moon

c. 

5 5 3 5 10 Invisibility from the half moon, to the full moon.

4.3.3 Tracking the Hunter...

Having established these possible lunar periods, Marshack uses mobiliary artefacts to illustrate possible lunar sequences. Although the ways in which this is done varies from example to example, some principles that approach a methodology emerge. The following outline uses the example of Ishango and two further examples from France and Russia to describe this.

Firstly the marks are translated from the three dimensions of the artefact to a two dimensional diagram. This representation of the artefact is orientated in a certain way, and the marks interpreted from right to left. As the marks on the example from Ishango are made parallel to the short axis of the bone, they can be read perpendicularly to the long axis. The engraved tusk from the site of Gonzi in the Ukraine was 'unrolled' as the marks followed the long axis and continued around the tapered end to the other 'side' (1991:29), whereas the baton from Isturitz is divided into two 'sides' (1991:107). Marshack assesses the most 'logical' way in which the marks might have been intended to be 'read'. For example, from the quartz point of the Ishango bone, he reads along the long axis to the left, then turns through 180 degrees, and then reads again towards the left, and the same for the final sequence. For Gonzi, he starts at one end and 'reads' to the other, but for Isturitz Marshack distinguishes 'bands' around the circular section of the bone, arranged into eight groups for one side. The second side is thought to represent twelve groups, divided on stylistic grounds.

By identifying a group of five marks as a possible key period on the Ishango bone, Marshack interprets this as most likely referring to the full moon period, and so the two models are matched. Although the sequence on the tusk from Gonzi is thought to be complete, Marshack admits certain problems in beginning to correlate this with his lunar scale. From the structure of the marks and the use of 'signs' he finally identifies an acceptable interpretation. The Isturitz baton is presented as a tally for five months, beginning at the period of invisibility. From these results, amongst others, Marshack is able to conclude,

> 'If these analyses and interpretations are correct, then there was a common, basic tradition of notation in all the European Upper Palaeolithic cultures, and this notation was cumulative, "time-factored," and possibly lunar.' (1972:108).

4.3.4 Criticisms of Marshack's Lunar Scale.

'We have a number of controls or checks on the tests: the invariant precision of the lunar phases themselves, the invariant sums of the different groups of marks, and the possibility of aid (sic) from the visual differences within each group and from one group to the next. We can also assume that the groups on each line were made in order, no matter from which direction.' (Marshack, 1991:29).

The principle limitation of this lunar scale is that it rapidly becomes a problem to identify the criteria by which a supposed notational sequence does fit. Marshack isolates just some of the considerations that must be borne in mind before an acceptable correlation can be made between engraved lines and his lunar phrases. The first difficulty arises with the lunar model itself, as the actual lunar cycle numbers 29 $\frac{1}{2}$ days, and two months 59 days, and not the 60 days as represented. To counter this, Marshack's model loses a day over the two months, indicated by an arrow.

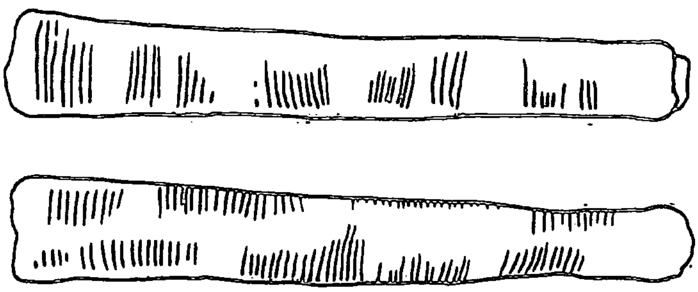
The ways in which the marks on the bones are 'read' is based on Marshack's claim that this can be decided by a process of deduction.

'Once more I had to make an assumption, based again on the feeling that the Ishango brain functioned as ours. I assumed that, if this were notation, there was probably a 'logical' order to the making' (1991:29).

Marshack's theoretical perspective is based on the original purpose of his enquiry, namely a search for the 'origins' of man's desire to explore and rationalise the world around him. In a number of later articles Marshack relies on the claims of many researchers that the brains of these human populations was fully evolved by the Upper Palaeolithic, *c.* 40 000 – 30 000 BP, coincidentally at precisely the time we know modern first appeared in Europe.

Although the functions of the brain of Palaeolithic *Homo sapiens* could have been comparable to individuals from present populations, it is not possible to assert that the thoughts produced are identical to Marshack's own. Even apparently straightforward assumptions must be explained and qualified. Figure 4.4 illustrates a number of the possible ways in which the three columns of Ishango could be read,

Figure 4.4 — 'Reading' the Ishango Bone.



This example can be 'read' on three faces, either from left to right, or from right to left.

From the illustration above, the reading is Column 1 - 1R or 1L

Column 2 - 2R or 2L

Column 3 - 3R or 3L

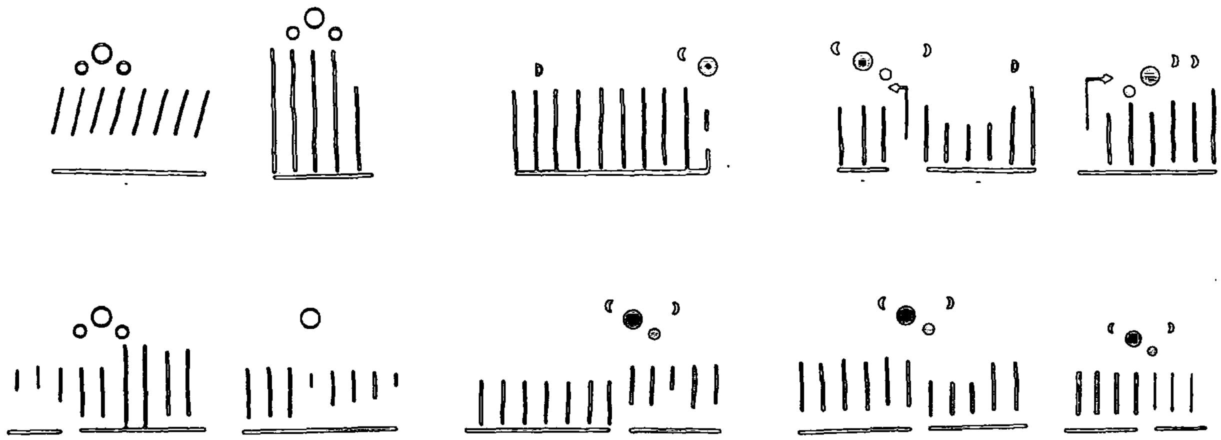
The obvious limitation to the number of possible ways by which the baton may be read is that each column can only be read in one or other direction at any one time.

R - L			L - R			R-L, R-L, L-R			L-R, L-R, R-L		
1R	2R	3R	1L	2L	3L	1R	2R	3L	1L	2L	3R
1R	3R	2R	1L	3L	2L	1R	3R	2L	1L	3L	2R
3R	2R	1R	3L	2L	1L	2R	3R	2L	2L	1L	3R
3R	1R	2R	3L	1L	2L	2R	1R	3L	2L	3L	1R
2R	1R	3R	2L	1L	3L	3R	2R	1L	3L	2L	1R
2R	3R	1R	2L	3L	1L	3R	1R	2L	3L	1L	2R

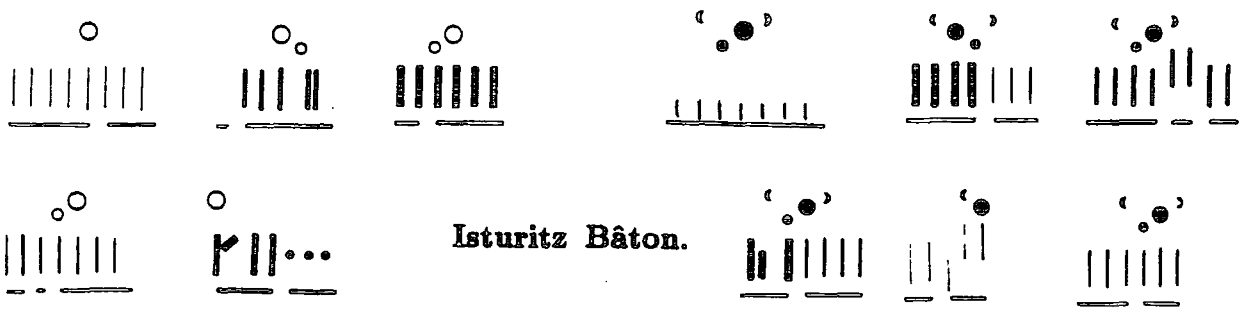
R-L, L-R, R-L			L-R, R-L, L-R			R-L, R-L, L-R			L-R, L-R, R-L		
1R	2L	3R	1L	2R	3L	1R	2R	3L	IL	2L	3R
1R	3L	2R	1L	3R	2L	1R	3R	2L	1L	3L	1R
3R	1L	2R	2L	1R	3L	2R	1R	3L	2L	1L	3R
3R	2L	1R	2L	3R	1L	2R	3R	1L	2L	3L	1R
2R	1L	3R	3L	1R	2L	3R	2R	1L	3L	2L	1R
2R	3L	1R	3L	2R	1L	3R	1R	2L	3L	1L	2R

Thus there are 48 different ways in which the baton from Ishango can be read.

Figure 4.5 — 'Waxing' and 'Wanings': Comparing Three Bones.



The Bone from Ishango.



Isturitz Bâton.

The Gonzi Tusk.

providing of course it is even appropriate to see the marks as forming the three columns, and not 'bands' as for the baton from Isturitz.

In placing the chosen readings against the lunar scale further complications arise. Can it always be assumed that the lunar recordings of prehistory started after a full moon, or a period of invisibility? Marshack identifies a group of five marks that he believes represents a period of the full moon in the Ishango sequence, and so orientates the lunar scale accordingly. However he notes,

> 'The tests, however, could not be certain, for a lunar 'phrasing', a short series of 4 – 5 different counts might easily be accidental... A consistent lunar phrasing in a long series of 15 or 16 different apparently random numbers would be rare.' (1991:29).

If the groups of marks that represented the full moon were not all of the same number, perhaps they are represented in the same way. However when these lunar 'phases' are isolated from Ishango, Gonzi and Isturitz, none of the waxings or wanings are consistent, see Figure 4.5. Furthermore, the imposition of these marks against the lunar scale retains the relative lengths of the marks, but not the spaces between them. In what sense can an assessment be made as to whether spacing is non-pertinent variation, and relative length is pertinent variation?

Marshack claims that the system of counting for these notations is non-arithmetic. That is,

> 'They are always read and used positionally, never arithmetically' (1991:60).

In this view minor discrepancies in the *number* do not matter so, whether the marks total 27 or 32, it can be equated with a 'month'; with or without the period of invisibility. Equally the period of the full moon can be represented as 1 day, or two, three, four or five, depending on the conventions used, a week is seven or eight days, or even ten if the count is made in base five (1991:144). After this there is the problem of grouping these periods, that is, 11 consecutive marks could be interpreted as representing firstly the full moon, 4 marks, followed by a period including the half moon of 7 marks. It is therefore apparent that the invariant regularity of the moon's phases can allegedly be represented in many different sequences of marks.

4.3.5 Time-Factoring.

In accepting that the thought processes and patterns of modern and past populations were essentially comparable Marshack was able to examine artefacts from throughout the timescale of the Upper Palaeolithic, and from sites all over Europe. As Marshack was searching for a progressive and evolving sequence of artefacts, he did not chose to confine his investigation to one specific time period. In fact Marshack was particularly eclectic in the choice of examples that he selected to illustrate his analysis, ranging over a thirty thousand year timescale, and coming from major sites all over Europe, (Marshack, 1969, 1972, 1985).

The material Marshack sought was that which would support his idea of what he calls 'time -factoring', defined as,

> '... processes of cognition and recognition, of planning, research, analysis, comparison and interpretation, [which] are also sequential, interrelated, developmental and cumulative.' (1972:14).

According to Marshack, one of the major time-factored activities engaged in by human populations is food procurement. Agriculture in common with other subsistence strategies requires planning and foresight, and needs what Marshack would term, 'storied' information to anticipate the varying demands in terms of tools and labour for the different times of the year. Again Marshack argues that this being the case, the use of 'stories' related to subsistence strategies must have been in existence for thousands of years in order for agriculture to have been 'invented' as, without foresight, it would be impossible adequately to anticipate the specific needs for a successful harvest.

It is the recognition of the different weather cycles, or 'seasons' that occur each year that is to Marshack the most crucial factor to any subsistence strategy, whether it means travelling to the coast for a maritime harvest, moving to a summer crop of berries, or following a herd of reindeer to their autumn rutting grounds. This argument is repeated in his recently published article on the Tai Plaque. He argues,

> 'That a non-arithmetical observational astronomical skill and lore existed in Europe before the Neolithic suggests that the adoption of a farming way of life was prepared for or assisted by the seasonal economic and ritual calendar of the Palaeolithic hunter-gatherers. The alignment

astronomy of the Western European Neolithic suggests that an observational lunar/solar 'calendar' such as that represented in the Taïnotation may have provided the base for the observational lunar/solar 'calendars' of the megalithic cultures.' (1991:35).

In fact Marshack believes that a tradition of recording the movements of the moon can be traced back to the Aurignacian (1991:20) and can be followed over 20 000 years to the late Magdalenian, and that the Tai plaque represents,

'... the end-product of a long tradition of non-arithmetical astronomical observation and record keeping.' (1991:35).

Yet Marshack asserts that,

'There can be no leeway in the tally, except for that small margin of variation offered by observation and notation of the moon.' (1991:29).

Thus, although Marshack claims to have looked at hundreds of examples (1972) and performed one and the same analysis over twenty years no two examples ever 'fit' in the same way. The process is an 'unravelling' and imposition on the scale – if there are 45 marks, for example, that is one and a half lunar months – 57 is two months – 73 two lunar months and to next full moon, and so it goes on.

4.4 Micro-Analysis: The Definitive Test?

The previous account of Marshack's work details both his theory and method, with particular reference to the identification of lunar notation by a correspondence to his lunar scale. However a rigorous examination of the artefacts in question leads Marshack to include 'micro analysis' as a crucial part of his analysis. Marshack uses the microscope in an attempt to determine in what order the marks were made and the number of tools used to make them. The tool changes are held to mark the different lunar period or phases, and from this he builds up a picture of how they were intended to be 'read'.

This method has come to form an integral part of Marshack's methodology, as he uses it to break down apparently continuous sequences into smaller units. If the alleged lunar notations are tallies which accumulated throughout the month, then it is essential for Marshack to demonstrate that the sequence of lines was made, not all at once, but over a period. Interestingly the second edition of **The Roots of Civilisation** includes the identification of a tally on a piece of mammoth ivory from 'the Russian plain', referred to as the Gonzi Tusk.

> 'Microscopic analysis indicated that it had been marked with a tally or score perhaps made during an evening of gaming or gambling.' (1991:42).

Yet this example had been marked by a number of tools in a variety of styles exactly in the manner of the notational sequences that according to Marshack had been accumulated over months.

All the artefacts in the **Roots of Civilisation** are analysed under the microscope, and the results are used to validate Marshack's claim that they represent lunar tallies. To illustrate this more fully, an account is given of the analysis of an artefact by 'microanalysis.'

4.4.1 Micro-Analysis: L'Abri Blanchard.

This example is a bone from the rock shelter of Blanchard in the Périgord region of France, 11 cms long and smoothed into two flat faces. Each of these two sides are engraved, but Marshack focuses on an area of 5.2 cms covered by,

> '... seemingly chaotic, haphazard pitting, obviously made by man.' (1991:44).

The first stage in this analysis was the identification of three types of mark,

a. 'hooked or arced stroke', that varies according to the direction and starting point, and the sharpness of the tool.

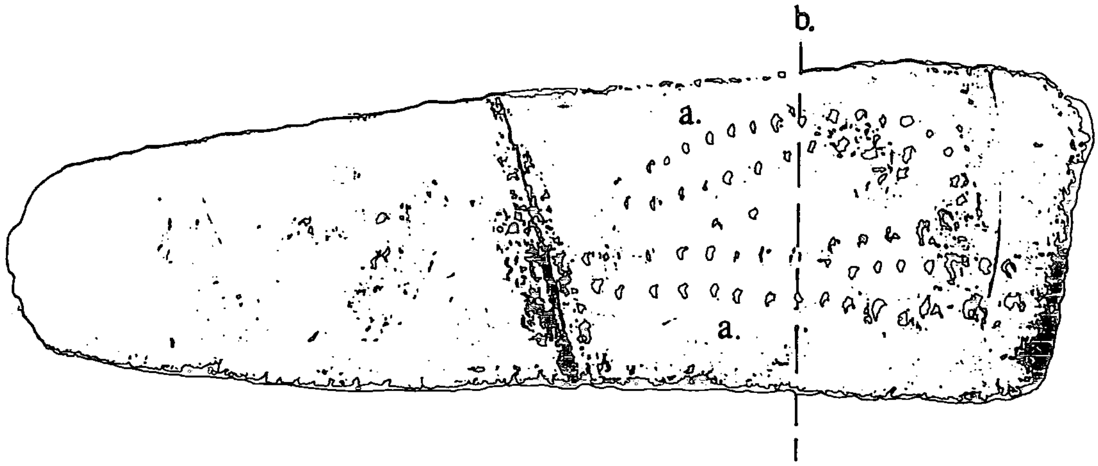
b. Marks that are made by a limited 'half-turn'.

c. Marks that are 'punched' by a tool.

The recognition of these tool changes gave Marshack the assurance that this was in all probability a notation of some sort,

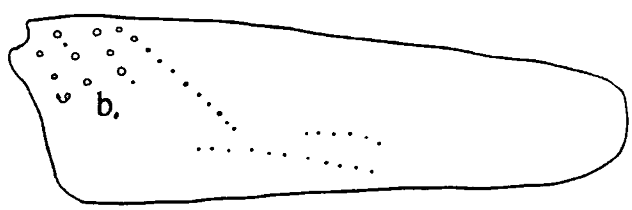
> 'I knew it could not be ornament or decoration, for any man making an ornamental composition 1 $\frac{3}{4}$ inches in size would not have used 24 changes of point to make 69 close marks.' (1991:48).

Figure 4.6 — The Bone from Abri Blanchard.



Marshack 1991:48, fig.9.

Abri Blanchard: 'Side Two'.



Marshack, 1991:45, fig.7a.

The recognition of these types did immediately provide an order, but the isolation of four marks made by a single tool in the shape of a square gave Marshack the 'key',

'Since the marks to the right of the square were arranged horizontally, these four marks must represent a 'turn", two heading in one direction, two in the other.' (1991:45).

This statement is questionable, as just why this 'must' be the sole interpretation of these marks by Marshack is not immediately apparent. However this need to isolate the form is explained later in the discussion as,

'I had, on my own, begun to call the waxing and waning the 'turning of the moon'.' (1991:48)

Thus when the lunar model is applied to this example, starting on the assumption that a 'crescent-shaped mark' in the middle of these marks represented the period before invisibility, the correlation is considered convincing, as the turns match the full moon periods and the periods of invisibility. Marshack claims that the gradual accumulation of marks meant that,

'The image must, therefore, have been in his mind before he began'. (1991:48).

He concludes that for this example,

'If lunar, we had a visual, kinesthetic, and symbolic representation of the waxing and waning which at any point indicated to the maker where in the month he was, and it did this non-arithmetically'. (1991:49)

However the other marks on the artefact do not appear to have undergone the same level of analysis. The 63 marks around the edge of the lunar 'turns' were made by 40 points, but are not ordered into a 'serpentine' figure, and the marks on the other side are merely totalled to forty, without being broken down into separate tools at all. Yet in Marshack's final analysis of this bone he totals up all the marks from these three areas to 172, and concludes that this is close to six months ($29 \frac{1}{2} \times 6 = 177$). Why the elaborate analysis of the structure of the first 'group' of marks was necessary is not clear, as it appears that the total number of marks is the only necessary criteria.

4.4.2 A Critical Assessment of the use of Micro Analysis.

D'Errico (1991) criticises the fact that Marshack does not attempt to establish his work experimentally, that is, to conduct practical tests on bone, which are then analysed under the microscope. In addition he notes the lack of explicit criteria relied on to support or reject an item, and so it is difficult to follow Marshack's argument, or recreate it. In order to effectively challenge Marshack's claims, D'Errico decided to make nitrocellulose replicas of test incisions created by different tools and techniques on limestone pebbles. After examining these test pieces using SEM and transmitted light microscopes, D'Errico claims to be able identify:

1. 'The direction of movement of the point.
2. Whether the lines were engraved by the same tool.
3. The order in which lines were made.
4. The time required for engraving the lines.' (1991:1).

The basic characteristics of the different recognisable types of marks produced are described, and specified.

> 'We have also shown experimentally that these microscopic signs are not a constant feature. In addition, they apply only to incisions made in rapid succession' (1989:117).

D'Errico tested criteria against a group of 122 Azilian pebbles, material already analysed by Couraud and Lorblanchet (1986). He discovered rapid repeated tool movements, and concluded that the majority were made by the same tool. On the basis of this, D'Errico believes that he has conclusively rejected the possibility that they were cumulative lunar tallies. Interestingly Marshack reiterates, in a reply to this, his belief that the pebbles were not notational;

> '... they failed the primary test for the presence of notation, i.e., that they be carefully made and accumulated linearly and sequentially.... a close-up ... clearly indicates the irregular, non-notational manner in which the sets were incised.' (1989:491).

but concludes:

'The main point of interest is that the actions that produced them seem to be the expression of a repeated pattern'. (1989:117).

4.5 Lunar Notation and 'Seasonality'.

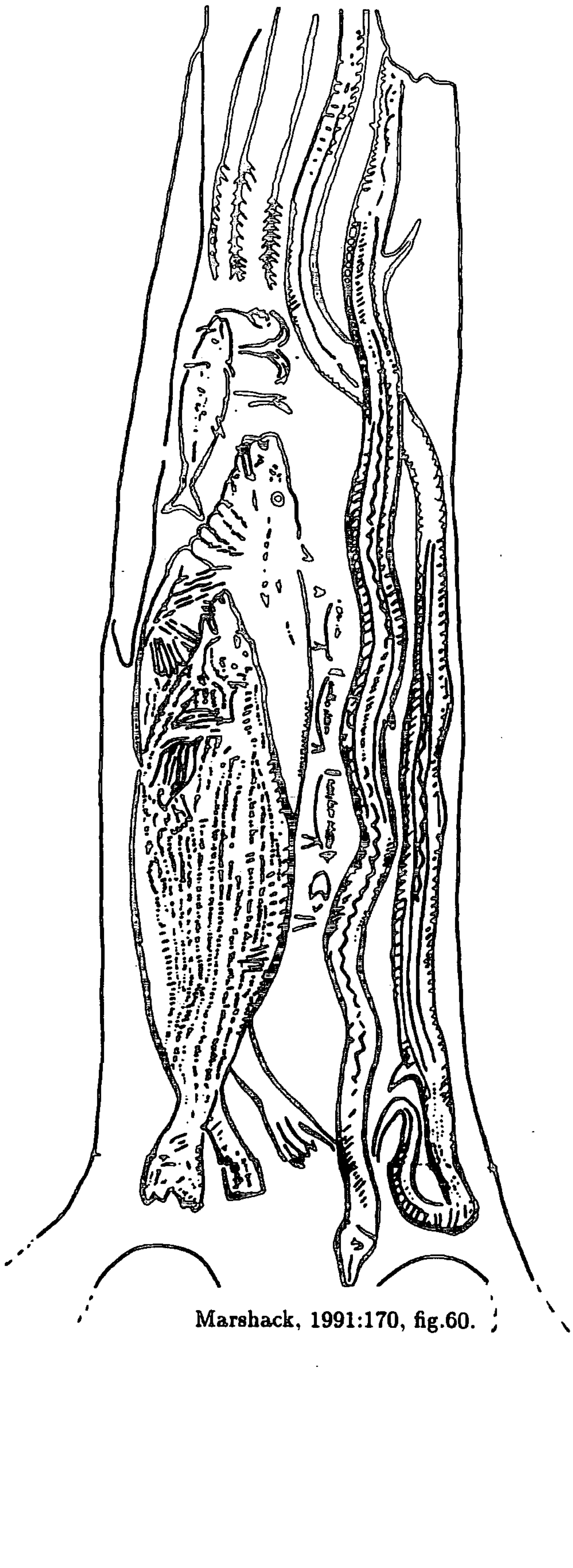
In the examples analysed so far, Marshack has focused on the theoretical plausibility of the existence of lunar notation, and the structure that he believes that he has managed to abstract. In the following section Marshack extends his basic argument to incorporate the iconic representations on the portable art of the Upper Palaeolithic. His conclusions are based on the results of microanalysis in addition to his evolutionary and cognitive perspective. The microscope can reveal the presence of new lines in a composition for a more accurate rendition, and also help to reconstruct the way in which the image was built up.

4.5.1 The Use of Minimal Icons.

Marshack's work highlights the difficulties inherent in the interpretation of certain groups of lines, particularly as he identifies some of the abstract signs as actually representing more or less schematised plants. These are distinguishable by their form and association with other images and thus could represent an important class in the schema of representational images. Marshack devotes considerable time to a discussion of the criteria he relies on to recognise 'plant-like' forms on both the mobiliary and the parietal examples of graphic representation.

The Montgaudier Bâton is a bone fragment which is engraved on two sides and is used by Marshack as an example of 'seasonal imagery' (Marshack, 1972:172). There are two iconic engravings of seals on side (a), and the resemblance between the figure and subject is the result of both their form and in the characterising details of eyes, mouth and flippers. There is possibly some evidence of sexual diamorphism as one of the seals is larger and thus may be the 'male'. Marshack identifies 'serpentine forms', although there are no real characterising details except waving horizontal lines along the form, and short vertical dashes along the outline. There is possibly an 'eye' or a 'mouth', but it is not clearly rendered compared with the careful attention to details evidenced in the engravings of the seals. Therefore if these lines are described as 'serpentine', this must be preceded by an 'x' to denote an inferred meaning.

Figure 4.7 — The Montgaudier Bâton 'Un-Rolled'.



Marshack, 1991:170, fig.60.

Also on the Montgaudier Bâton are 'minor signs' which are little more than outlines with no real characterising elements. Thus any attempts at an interpretation must rely on their association with the other images on the baton. To Marshack they suggest the schematised head of an ibex, a 'sprout', flowers, plants, and what Marshack describes as 'creatures of the damp soil'. Marshack records that,

> 'As one followed the strokes through the microscope, recreating the sequence in which they were made, the flower became certain.' (1991:173)

From the association of these images Marshack conjectures that these iconic images were intended to represent something other than a purely formal arrangement.

> '...seal and salmon together were dramatic 'signs" of the coming of spring, 'first fruits" in a sense, after the thaw.' (1991:172).

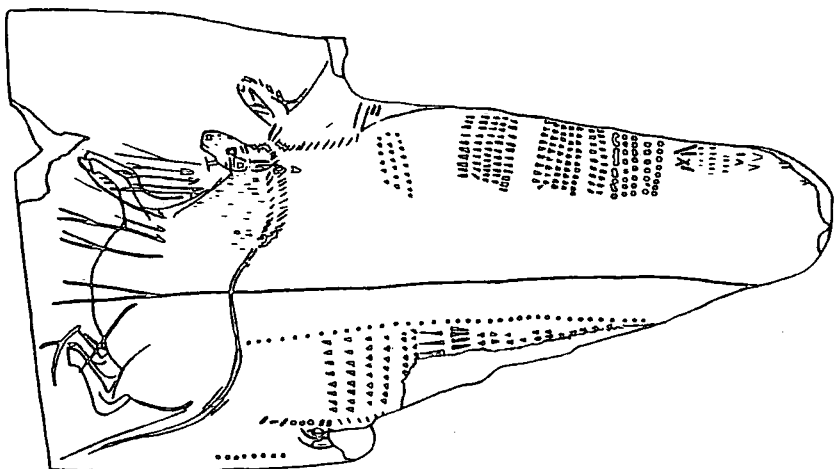
The previous interpretations of the lines had been to call them 'barbed signs', with Leroi-Gourhan identifying them as 'masculine'. Yet as Marshack observes, if this is a harpoon the barbs point in the wrong direction from the sharpened end.

> ' However, they were perfect plants or branches, growing at the proper angle and in the proper way at the top of a long stem.' (1991:173).

Therefore Marshack identifies the image as an iconic representation of a plant both by its form and the characterising details of the 'leaves', thus apparently making his methodology explicit. Yet in his subsequent identification of further examples of plant imagery, these two requisite properties of form and details are not always present. How is a collection of lines identified as representing a plant rather than any other rudimentary form? Thus Marshack interprets certain iconic representations as 'seasonal', that is, there is a deliberate association of certain animals, plants and natural features, such as water, that indicate to Marshack the creation of a deliberate record to either keep account of or predict the cyclical patterns of nature.

Marshack then proceeds to identify examples where there is both 'seasonal' imagery and notation, using an engraved stone from La Marche to demonstrate the way in which the two are possibly juxtaposed, (see Fig 4.8).

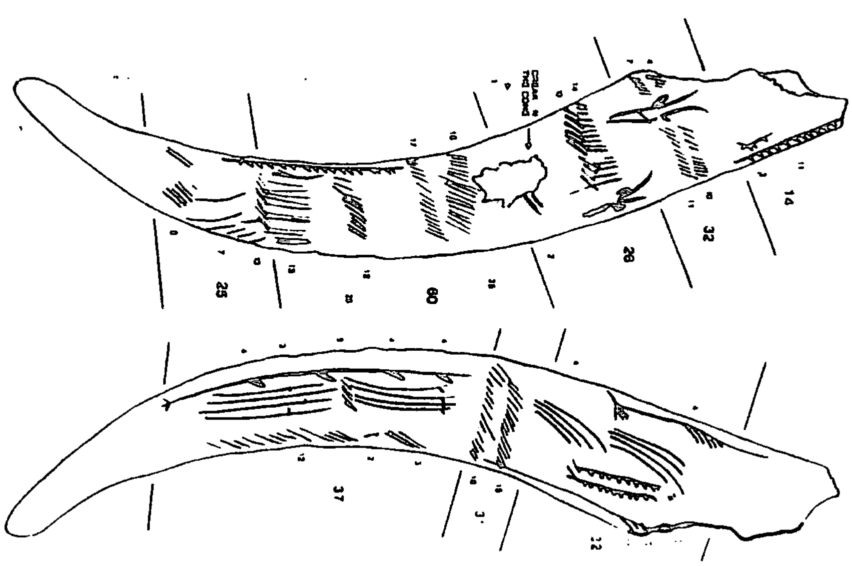
Figure 4.8 — 'Seasonal Imagery: La Marche.



The La Marche Bâton 'Unrolled'

Marshack, 1972:193, fig.88.

Figure 4.9 — 'The Rosetta Stone': Cueta de la Mina.



Marshack, 1991:214, fig.103a,b.

'The combination of naturalistic "art", sequences of darts and signs, and a lunar notation hints at a complex time-factored symbolism and mythology.' (1991:195).

From this it is obvious that Marshack has moved away from mere 'tallies' and is speculating that 'lunar notations' were part of a much wider understanding of the structure and the repetitive nature of time. It is the baton from Cueta de la Mina, (see Fig 4.9), that Marshack describes as a '"Rosetta Stone"' for 'the notational-symbolic complexity of Upper Palaeolithic marking', as an example,

' ... indicating the integrated beginnings of arithmetic, astronomy, writing, abstracted symbolism, and notation. There is also the implication that these cultural skills were related to the economic and ritual-religious life of the hunting groups.' (1991:218).

The iconic images of two ibex heads and four plants, '...each of which is made in a different style, pattern, or rhythm', are thus interpreted as 'seasonal' notations.

The baton from Cueta de la Mina shows,

'... at least three plant forms, each so different as to seem indicative of either species or seasonal variation.' (1991:213).

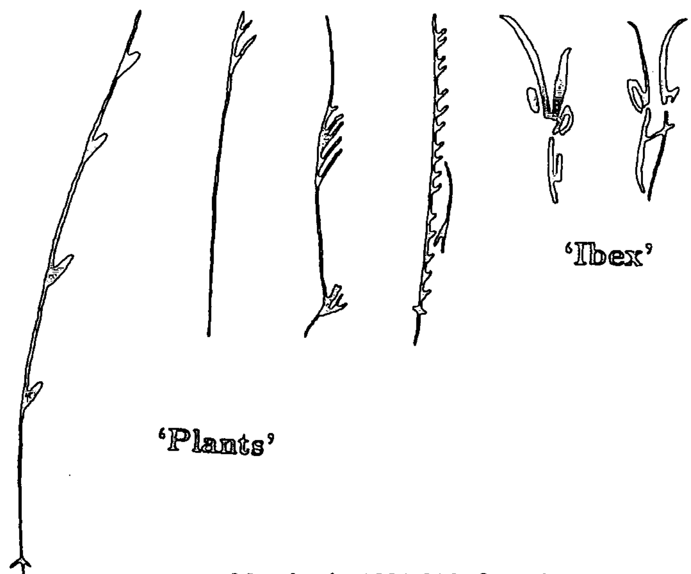
Yet one form that Marshack identifies as *notational* consists of a

'.. long containing line that serves as an "edge" and makes a sequence look a plant.' (1991:216).

Marshack compares this to the engraving on the tusk from Gonzi where there is a similar pattern in that there is a long 'containing' line with shorter lines appended. Yet the examples are actually very different. Firstly the engraving from Gonzi follows the curve of the tusk, and this forms the only lines on the artefact. In his own assessment of the markings, Marshack dismisses the possibility that the marks were decorative, but never mentions the possibility that they are in any way iconic. The marks on the bâton from Cueta de la Mina are associated with iconic images, and in this context it is perhaps necessary to consider whether they are decorative, or iconic, or non-iconic representations.

Yet to assume, merely because they are obviously not iconic, that they were in fact notational, and to corroborate this with a comparison to the tusk from Gonzi

Figure 4.10 — Plant Imagery on the Bone from Cueta de la Mina.



Marshack, 1991:216, fig.103,c

Figure 4.11 — The Gonzi Tusk.

Marshack 1991:39, fig.5a,b.

that is totally unrelated in space and time, is to make far too many unjustifiable assumptions. The association of the marks with the iconic images perhaps clearly indicates that they are non-iconic, as if the assumption is made that had the engraver intended to represent iconic images, it seems plausible to assume from the evidence that he would have done so more convincingly. However to describe them as notational seems to be totally unjustified. Even if there are other examples of Palaeolithic mobiliary art that appear to combine notation with iconic representation there can be no reason to assume that all non-iconic lines can be described as notational. Each example should be considered individually, and only when it is demonstrated in the specific cases that there is a possible combination of iconic representation and notation, can two such examples be compared. Notation is not a residual category, and the term should be applied specifically.

It is not the characterising details that are the crucial factor in distinguishing a notational stroke with appended lines from a plant with branches, as 'winter branches' do not have them. In addition, how is a sparse autumnal branch to be distinguished from one that is simply not covered in leaves, as a system of minimal iconicity not necessarily requiring a profusion of leaves. The difficulty of assigning a specific season to the images associated with such 'plants' is considered by Marshack to be due to the fact that,

> ' ...these plant-like signs are badly and inaccurately drawn, whereas the animal art is comparatively superb.' (1991).

As the graphic representations can safely assumed to be the result of intentional actions on the part of the artists, can it not be assumed that had a plant form been depicted it would have been done so convincingly, and the fact that it was not, imply that the image was either minor, or not a plant?

The problem of identifying ambiguous images is discussed by Clottes (1988) and Lorblanchet (1988), and it is concluded that only on the basis of the evidence of the information present on a given image can an identification be made. Lorblanchet in particular discusses the manner in which fragments have been 'completed' in error. Great significance is attached by Marshack to the way in which these forms are rendered, for example whether or not they appear to be in leaf, for example on the bâton from La Marche, and yet in most of the examples that are illustrated this is impossible to verify. The possible interpretations of this are;

i. That we cannot understand the iconic conventions in operation, or

ii. That the state of the plants was not intended to be of significance and the main imagery was that of the animal figures, and thus they were rendered in less detail, or

iii. That the skill in rendering these images was deficient.

From my reassessment of these examples it is evident that Marshack describes certain images as being conclusive examples of iconic representations, where the basis for such an assumption is rather tenuous. Marshack's identification of the 'the creatures of the damp soil' on the Montgaudier baton as iconic, merely because they appear to resemble worms and beetles is misleading. The salmon and the seals on the same bone can be justifiably classed as iconic as there is a convincing likeness in their form and in their characterising details. However given that there is this level of skill in engraving, and it is plausible that the same engraver made all the images and thus can observe and render natural forms in a skilful and convincing way, surely it can be assumed that all the natural iconic forms would have been treated in the same way. Thus the assumption can be forwarded, that if the lines were engraved they were intentional, and therefore meaningful. Although there could be the use of subsidiary images perhaps as a 'background', then the following interpretations are possible,

i. They were not significant in themselves, but simply provided a background for the other images. or

ii. They are significant, in which case it is difficult to reason why they were not conveyed using the conventions used for the other images. Notably their size is not necessarily the reason for their sketchy appearance – as the salmon is clearly the same size as the seals.

iii. That they are signs, and are non-iconic.

iv. They are not in fact significant.

Although Marshack's interpretation cannot be disproved, the other four explanations are equally plausible, and seem to rather outweigh Marshack's single interpretation, which cannot be accepted uncritically. Mere association of images is not a sufficient reason for an interpretation, or the presence of one identifiably iconic image reason to suppose that all other lines are iconic representations.

Thus Marshack fails to adequately address the many problems involved in the description and classifying the engraved images from the Palaeolithic. Only by specifying the circumstances in advance under which an example can be classed as either notational, iconic, non-iconic, or decorative can a satisfactory level of objectivity be achieved. Only when all the categories are defined can each example then be analysed in a consistent and appropriate way. Although it is accepted that the convention of preceding the identification of iconic images with an 'x' or a '!' can only partially compensate for the biases of individual perception, it is believed that this method involves fewer assumptions than uncritically stating a perceived resemblance.

4.5.2 Calendars, Tallies or What?

If there was a recognisable way of recording the phases of the moon, it could only have been devised as the result of careful study of its movements over a prolonged period of time. Certainly it is plausible to assume that such a distinctive phenomenon as the presence or absence of moon in the sky, and the precise regularity of its waxing and waning could have excited interest, and the precise nature of the pattern discovered, enabling the construction of a lunar 'calendar'. The anticipated result is a structure that can be imposed in advance on an on-going, empirically observed sequence (the lunar cycle). At present there is no evidence to suspect that such a structure was in existence. What is more pertinent to this study is, why would this be recorded in a permanent medium? For this practice to be as widespread as Marshack claims, then it is reasonable to hypothesise that a complex system of diffusion of information about the moon was in operation using existing communication networks, rendering the method comparable over Europe.

The alternative explanation is that the motivation that prompted the individual group to analyse and abstract this information, was a common response to a common need, invented and re-invented over time, each fresh invention commencing with observational tallies built up over the lunar month. As there is never a perfect correspondence to Marshack's lunar model, it is plausible to conclude that all the examples that he asserts are lunar, were in fact made *without* prior knowledge of the structure and organisation of the lunar month, or with regard to other models. Furthermore, if all the examples were made without prior knowledge of the phases of the moon, there can be no evolutionary tradition of such notation, such as Marshack postulates. Thus it follows that even if the examples are lunar, they do not represent the actual forerunners of the 5 later developed calendrical systems, as there is no evidence of culturally standardised communication.

Chapter V

Analysing the Data: Marshack and Paris.

5.1 Further Analysis of Lunar Notation.

The discussion in the previous chapter centred on the work to date by various researchers on notation and Palaeolithic artefacts focusing more specifically on the contribution by Alexander Marshack (1972). Having presented a critical assessment of his analytical methods, this chapter now concentrates on comparing Marshack's data to my criteria, devised and tested in the previous chapters, now summarised as Table 1. Marshack's work on notation is extensive, however the discussion in Chapter IV criticises Marshack's selection of artefacts as too wideranging as the examples come from sites all over Europe covering the entire timescale of the Upper Palaeolithic. The specific context of individual pieces is not discussed by Marshack and so his study is unconvincing as he fails to relate the various 'traditions' he claims to discover to any related finds on the same site. There is also little information about the state of preservation of the artefacts which are possibly incomplete. This last point alone seriously undermines the validity of Marshack's work, as many examples are identified on the basis of the total number of marks on the bone (Marshack, 1972, 1991).

In order to provide a control for Marshack's data the second half of this chapter includes a number of engraved bones from the Musée des Antiquitiés Nationales which are also compared to the criteria on Table 1. These examples all come from two well documented sites the Pyrénées, Isturitz and Mas D'Azil and the nature of the two sites are discussed. Details of the state of preservation of the bones are provided with each illustration. The examples presented in this chapter form only part of the material I studied and so the numbers are not consecutive. However all the examples are included in the analysis in Chapter VII.

5.2 Further Analysis of Marshack's Examples.

The following examples of possible notation are all taken from Marshack's book, **The Roots of Civilisation** which I consider to be most detailed and extensive summary of his work to date. My initial research into the question of the existence of notation in the Upper Palaeolithic used the first edition, printed in 1972 after his work on the engraved bones from the Italian site of Polesini, (Marshack, 1969). The more recent edition of 1991 includes more data, such as the fragment from the Grotte du Taï (Marshack, 1990), and excludes others, such as the pebble from Barma Grande (1972:81-86). As this analysis attempts to provide a broad look at Marshack's work, both editions of **The Roots of Civilisation** have been consulted, and the references to each edition have been cited, as appropriate. The following examples are selected as the most representative of Marshack's work on notation. For a more detailed discussion of Marshack's examples, see Robinson (1989).

5.2.1 The Bone From Ishango.

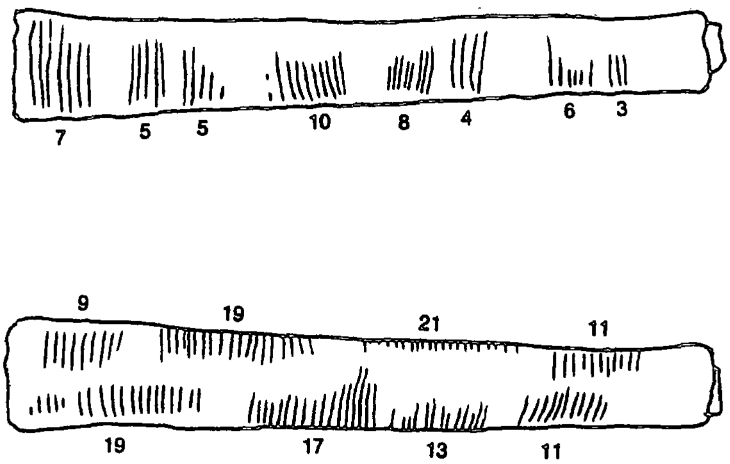
A. Establishing a Context for the Artefact.

1. This bone comes from the site of Ishango on the shores of Lake Rutanzige (formerly Lake Edward) on the northern border of Zaire in western Africa. A date of 6 500 BC. was originally given, (De Heinzelin, 1962), but a more recent assessment assigns a date of between 20 000 and 25 000 years ago, (Brooks and Smith, 1987).

2. The excavations in the early sixties discovered a mixed economy of fishing and gathering of plant resources, as well as evidence of hunting in the surrounding savannah. Bone harpoon points were recovered in the same level, as well as cranial remains of a hominid.

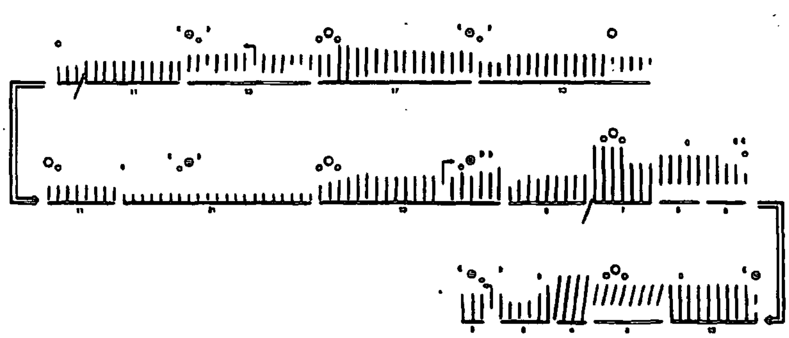
3. The artefact appears to be well preserved, and as the quartz point remains at one end, we can assume that this was the maximum extent of the engraving. The possibility of corrosion is not discussed by Marshack (1972) or De Heinzelin, (1962).

Figure 5.1 — The Bone from Ishango.



De Heinzelin, 1962:113

Figure 5.2 — 'Invisibility' and the 'Full Moon'.



4. As the artefact was recovered from a known habitation site, in conjunction with hominid remains, it is plausible to assume that such an engraved artefact is man-made.

B. Iconicity.

5. As the single strokes on this example provide the only element for analysis and there is no elaboration, this engraving does not suggest a representation of a known natural form, either by outline,

6. Or by characterising details.

C. Decoration.

7. The use of Symmetry:

i) There is translational symmetry, as all the marks are aligned parallel with the short axis of the bone.

ii) There are minor elements of slide reflection at (a).

iii) There is some evidence of mirror reflection, indicated at (b) on Figure 5.1.

iv) As all the lines are parallel to the short axis, there is no evidence of rotational symmetry.

8. On one level the composition of engraved lines is balanced, as the lines are aligned to the short axis of the bone. In addition there is evidence that they from a 'sequence' as each line is made with regard to those either side and as a result the marks form three rows along the long axis. However this translational symmetry is the only consistent feature, as the other areas of symmetry are specific only to restricted numbers of lines.

9. The alignment of the marks is consistent over the bone, and this element of repetition indicates the rhythm of their construction. However the spaces left between the marks, and the length of the marks are not equal, and therefore the engraving cannot be termed 'rhythmic'.

D.1. Notation.

10. The single element here can be identified as a single line (that is, a mark that is at least three times as long as it is wide), made parallel to the short axis of the bone.

11. The length of the lines constitutes pertinent variation, as although the orientation is standardised, the line length varies along a ratio of 1:7. There is consistency in this variation as there are a number of lines all of approximately the same length adjacent to one another, indicated on Figure 5.1.

12. As there is spacing between the marks, and they are all roughly parallel, each mark is clearly definable.

13. As the marks are parallel to the short axis, and are apparently made with regard to the position of the lines on either side, three 'paths' emerge as parallel to the long axis of the bone.

D.2. Subsidiary Characteristics of Notation.

14. Divisions can be made either i) stylistically or ii) by spacing. The length of the marks is varied, but certain groups can be identified on the basis of this pertinent variation. In addition the spaces between the lines varies along the three designated paths along the long axis, up to a ratio of 1:7, which effectively creates a number of groups.

15. De Heinzelin identifies a possible ten count (1962:110) on the basis of the number of marks in each group, which has already been discussed in more detail in the last chapter.

16. As there is no real element used other than a single stroke, there is no evidence for the use of ciphers indicating higher numbers. However if this bone represents a tally of some kind, then we can assume that the lines indicted here are signs representing a quantity of some kind.

E. Lunar Notation.

17. Despite Marshack's claim that there is a correlation between the marks and his lunar scale, certain inconsistencies are evident.

a) The marks themselves are not equally spaced, and so the enforced correlation ignores the possible intentional divisions represented on the bone.

b) In addition the varied lengths of the marks are ignored, except where they conform to a significant point in the lunar scale. The engraved marks are not standardised and repetitive, and so the apparent match to the lunar scale is unconvincing. Figure 5.2 clearly shows that there is no 'system', as short marks do not consistently indicate the period of invisibility, nor do longer marks indicate the full moon.

Summary of Ishango Bone.

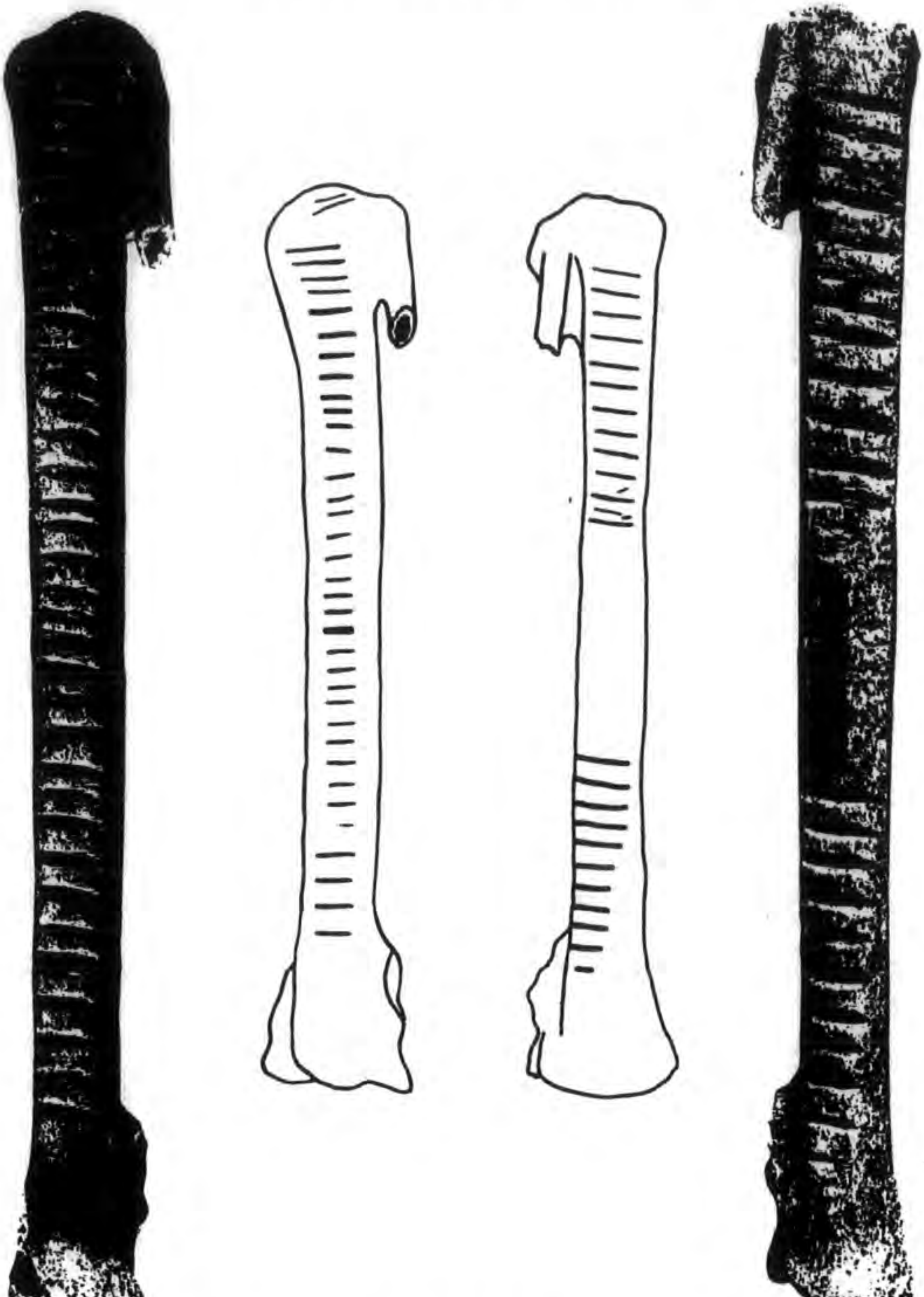
Although this bone is claimed by Marshack to be an example of lunar notation this hypothesis is rejected by my criteria. In addition the bone does not conform to the principles of decoration, as although there is some translational symmetry this is not entirely consistent and 'balanced', as the line lengths vary, as does the spacing between them. However according to my criteria, this bone could represent notation of some kind. The repetition of the single lines, with standardised and repeated variation, along the long axis of the bone is entirely consistent. The possible 'groups' of lines whose length and spaces are even but contrast with the marks surrounding them could represent conceptual and structural divisions of the quantity signified.

5.2.2 Forneau de Diable.

A. Establishing a Context for the Artefact.

1. This site of Forneau de Diable is in the Dordogne area of France, and the bone was recovered from Solutrean levels. This example is described as a small light bone, thought to be from a bird or small animal. The actual size of the bone is not mentioned, nor is the scale of the drawing which accompanies the photograph, (1991:101).

Figure 5.3 — The Bone from Forneau de Diable.



Marshack, 1991:101, fig.31a,b.

2. Any associated finds are not mentioned in Marshack's brief description.

3. The preservation of the bone appears from the photograph to be good, as the proximal ends of the bone both appear to be visible and complete.

4. As the bone was recovered from a Solutrean level of a known habitation site, there are grounds for assuming that the marks are man-made, although some knowledge of any associated finds would have been useful.

B. Iconicity.

5. There is no evidence to suggest that the engraving on this artefact was intended to be iconic. The marks do not suggest a natural form,

6. Nor are there any characterising elements.

C. Decoration.

7. The use of Symmetry:

i) Translational symmetry is evident from the repetition of a single element along the long axis of the bone, illustrated in Figure 5.3.

ii) There is no evidence of slide reflection.

iii) There is mirror reflection on both sides 'one' and 'two', along the short and the long axes of the bone as illustrated.

iv) There is no rotational symmetry.

8. The composition of both sides one and two is balanced, as there is a strong emphasis on translational symmetry, as the marks are made parallel to the short axis along the long axis of the bone.

9. The rhythm comes from the repetition of the marks at an equal distance from one another in essentially the same orientation.

D. Notation.

10. The principle design element consists of a single line made parallel to the short axis of the bone.

11. There are a number of smaller marks that Marshack has chosen to include in his sequence that could be identified as pertinent notation, indicated at (a) and (b) on Figure 5.3. However although these marks appear from Marshack's line drawing to be fainter their form is not standardised in any way. In addition they do not conform to the spacing convention in operation over the rest of the bone. In addition there is apparently a standardised decline in the length of the marks at (c). As this latter phenomena occurs over three marks, it is possibly pertinent variation, although the natural form of the bone tapers at this point. There are a number of marks that are not considered to be pertinent variation as they are faint and not standardised.

12. Each mark in the most extensive sequence is clearly definable, and as they are all parallel to the short axis they do not overlap. The fainter marks at (a) are not so clearly identifiable, and seem to be clearly visible only in Marshack's rendition of the artefact.

13. As the majority of lines are made parallel to the short axis to the bone, they follow the long axis, and so there is a clearly identifiable path.

D.2. Subsidiary Characteristics of Notation.

14. There are two possible 'groups' of marks on one of the faces of the bone, divided by a lack of marks over an area. In terms of a ratio, this space is expressed as 1:7.

15. There is no evidence of positional notation, unless the space in the centre of 'side 2' is intended to represent a quantifiable inequality between the two sides.

16. The possible stylistic division between the deeper engraved marks in the sequence and the shorter marks could represent cipherisation. However as the neither the length nor position of these latter marks are culturally standardised this is improbable.

E. Lunar Notation.

17. The sequence is consistent, but the division and order of the marks does not represent a lunar pattern. The lack of marks on one of the faces is visually

striking, but is actually ignored in Marshack's representation of these marks against the lunar scale.

Summary of Forneau de Diable.

There is convincing evidence that this example is notational according to my criteria. The possibility that the marks may be 'decorative' cannot be ignored, although the design is extremely simple, consisting of translational and mirror symmetry. Based on this regulated form of short lines parallel to the short axis of the bone, with one highly visible break in the sequence, this example can be classified as most probably an example of notation.

5.2.3 A bone from Le Placard, Charente.

A. Establishing a Context for the Artefacts.

1. This example comes from the cave site of Le Placard in Charente, France. The finds recovered from the site indicate a date of around the Middle Magdalenian.

2. Marshack identifies this example as a *bâton de commandment* and so it forms part of a known group of artefacts from the Upper Palaeolithic.

3. The artefact appears to be complete, although it is not specifically referred to as such in the text.

4. As there is apparently the engraved head of a fox on one end of the baton, there are grounds for assuming that there are man-made marks on the *bâton.*

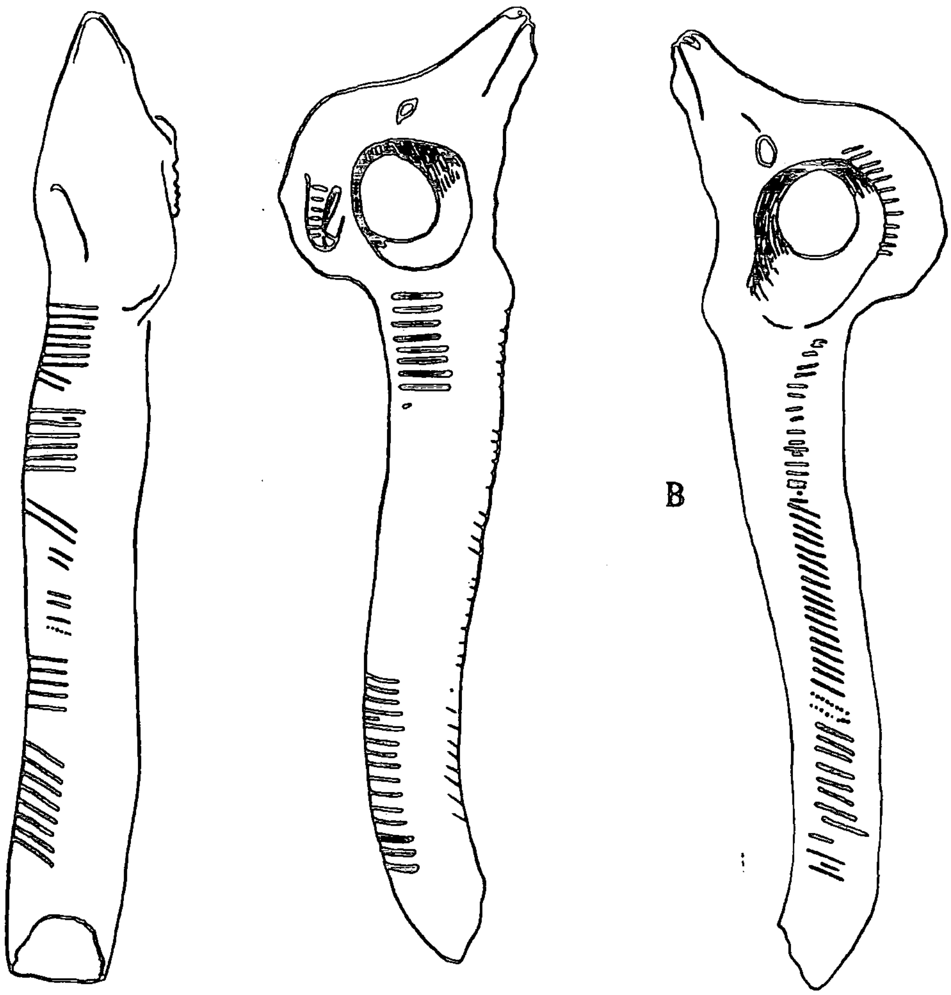
B. Iconicity.

> 'The bâton has the head of a smiling fox sculpted at one end.' (1991:88)

5. The form of the bâton at one end is pointed in a way that resembles the muzzle of a fox, or another canine, such as a dog or wolf.

6. There are a number of characterising details, including a short line at the tip that could indicate the mouth opening, and a 'v' shape that may indicate a nostril. There are lines on either side of this end that indicate 'eyes' by their form and position relative to the other marks. Some lines are thought to

Figure 5.4 — The Bone from Le Placard.



Marshack, 1991:88-89, fig.19a,b,c.

represent an 'ear' although this is more convincing on one side than another. The lines along the length of the bâton possibly represent 'fur'.

C. Decoration.

7. The use of Symmetry:

i) There is evidence of translational symmetry in the lines along the long axis of the bone. ii) There is no real evidence of slide reflection iii) There is little mirror reflection, as from Marshack's diagram the majority of lines are not perpendicular. iv) There is some evidence of rotational symmetry in (b).

8. Although the majority of lines are made more or less parallel to the short axis of the bone and follow three 'paths', there is little overall balance.

9. The marks along the long axis of the bone are made rhythmically as the orientation and length of marks, as well as their distances from one another is consistent. However this is not true for the marks as a whole, and occurs only in smaller groups.

D.1. Notation.

10. There is the single element of a line repeated along the long axis of the bone.

11. There is standardisation amongst the marks, although other than their position down the long axis, there is no single characteristic to unite them as a single group. However although there is variation it occurs within the smaller groups where the length and orientation is consistent. As these changes in line length, orientation, and spacing are repeated with these groups they represent pertinent variation.

12. Both the 'iconic' representation and other marks, all marks are clearly definable.

13. The non-iconic engraving follows three separate 'paths' down the longaxis of the bone. The iconic marks do not follow an identifiable path.

D.2. Subsidiary Characteristics of Notation.

14. There are a number of possible divisions, from spaces *also* marked by a change in length and/or orientation of the lines.

15. There is no evidence of positional notation.

16. There are no composite marks and therefore no evidence of cipherisation.

E. Lunar Notation.

17. Marshack's analysis of this bone under the microscope is said to have revealed that the marks were made by at least twenty five different points. From this he claims,

> 'The result is an extremely close lunar tally. Each change of point, stroke or grouping, and each change to a new side, occurs at a visible lunar phase.' (1991:89).

However the nature of these changes that Marshack refers to are not consistent and do not form a 'pattern'.

18. Although Marshack claims that the lunar phases are indicated there is little evidence to support this, as there is nothing remarkable or standardised about the supposed 'fit' that he illustrates.

Summary of Le Placard.

This example is particularly interesting, as it appears to combine iconic representation with a possibly notational sequence. The evidence for the iconicity is convincing, although Marshack's claim that it is certainly a fox and 'smiling' is discounted. It remains possible that the marks along the bone represent 'fur'. However the lines are not entirely consistent yet the variation is repetitive and standardised. These factors suggest that this was neither ornamental or the repeated form of a single line, which if it were 'fur' would not be expected to vary in this way.

5.2.4 The Engraved Pebble from Barma Grande.

A. Establishing a Context for the Artefact.

1. This example was recovered from the site of Barma Grande in the Grimaldi area of the maritime Alps, Italy. The site is dated to the Aurignacian through to the Perigordian, and this pebble is thought to be about 27 000 years old.

2. There is no information supplied relating to other finds on the site.

3. From the photographs provided in **The Roots of Civilisation** the pebble appears to be worn in places, and Marshack later refers to,

> '... the crumbled engraved edges of the pebble from Barma Grande.' (1991:148).

4. As the example was recovered from a known habitation site, it is possible that the marks on this example were man-made.

B. Iconicity.

5. There is no evidence to suggest that the lines covering this artefact resemble a natural form.

6. The marks do not form characterising details.

C. Decoration.

> '... the design was extremely irregular and uneven. It did not 'feel' like a balanced composition made either rhythmically or by a preconceived design.' (1972:83).

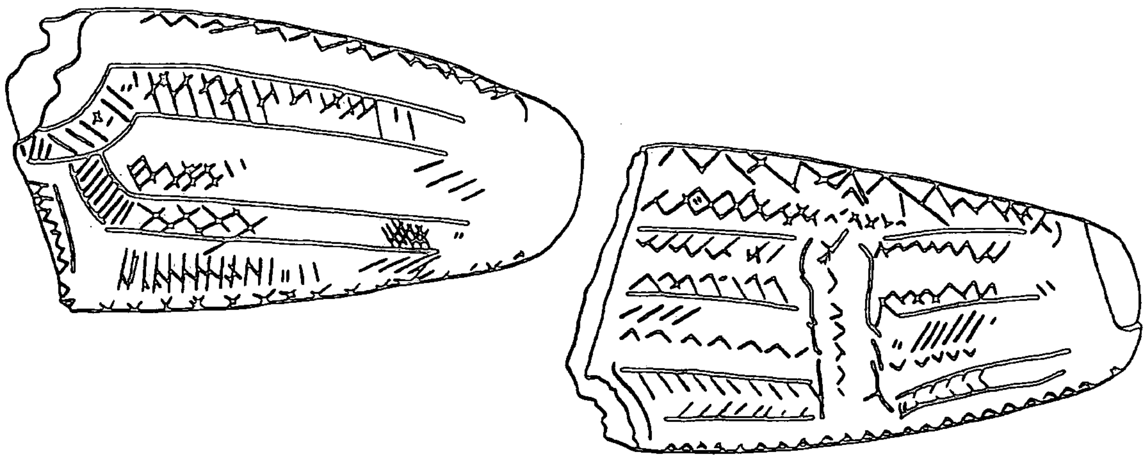
7. The use of Symmetry:

Despite Marshack's rejection of aesthetic motivation there is evidence for symmetry if the composition is broken down.

i) Translational symmetry occurs in the lateral transmission of the element across the long axis of the bone. This element forms the basis of the crosshatching as the 'crossing' is formed by the translation of the same element in opposing directions.

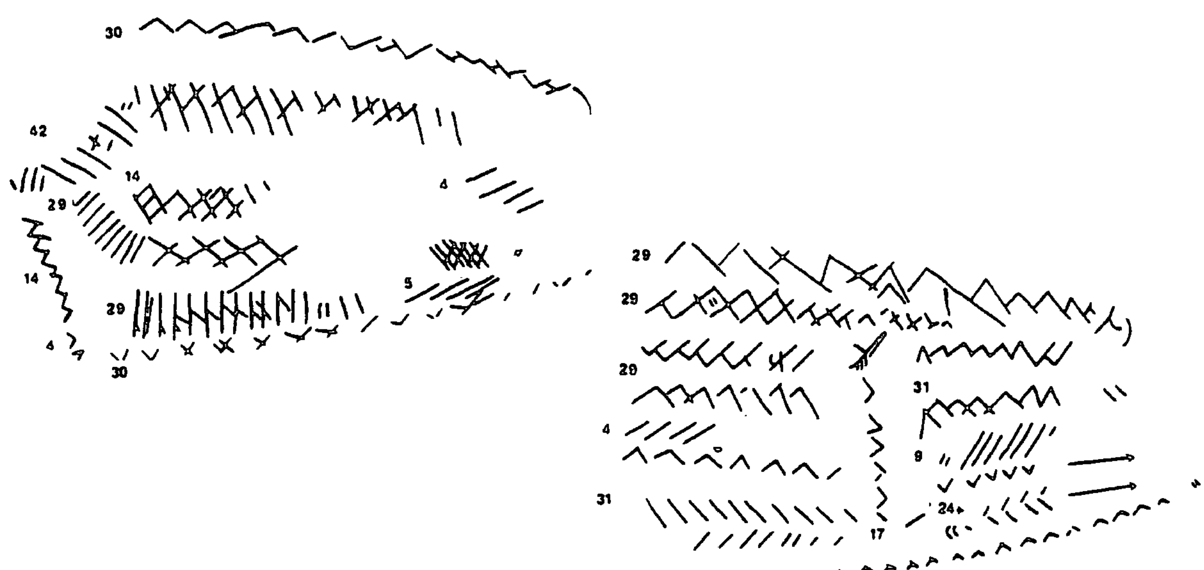
ii) There is some slide reflection, as the various 'levels' of the crosshatching could be interpreted as being the same element reflected across the bone.

Figure 5.5 — The Pebble from Barma Grande.



Marshack 1972:83, fig.16a,b.

Figure 5.6 — Barma Grande: Without 'Containing Lines'.



Marshack, 1972:85, fig.17a,b.

iii) On Marshack's 'side 1' there is mirror reflection along the long axis, and for 'side 2', there is mirror reflection along both the long and the short axes.

iv) Rotational symmetry could be identified at (a) and (b) on Figure 5.6.

8. The engravings on the two sides are balanced, particularly by the longer lines that Marshack calls 'boundary' lines. The repetition of the short lines is constant over the bone, and governed by principles of symmetry.

9. There is rhythm in the orientation and the form of the shorter lines. Again the 'boundary' lines that structure the image ensure the rhythmic repetition of the shorter lines.

D.1. Notation.

10. The repetition of the shorter line can be isolated as a single element.

11. The variation occurs in the longer 'boundary lines', which by their position relative to the shorter lines and the standardisation of their form are considered to be pertinent to the structure of the engraving. The orientation of the shorter lines is also standardised and repetitive, varies consistently through 180 degrees and therefore apparently a further example of pertinent variation.

12. The 'crosshatching' effect of the translation of the shorter lines over one another does not make it easy to isolate individual marks, although there is regulation in the spacing.

13. The 'path' is controlled by the longer lines, although this is quite complex and does not give a single orientation of the overlapping marks.

D.2. Subsidiary Characteristics.

14. The 'boundary' lines divide the representation both physically and stylistically.

15. There is no evidence to suggest positional notation.

16. Nor is there evidence of cipherisation.

E. Lunar Notation.

17. Marshack attempted to break down the engraved marks using microanalysis. From the alleged identification of a number of tools he divided the marks into sets which were then correlated with Marshack's lunar scale. However there is no convincing evidence that this was a tally of any kind, and certainly there are no indications that the form of the composition related to the movements of the moon over a number of months.

Summary of Barma Grande.

This example is the least convincing example of lunar notation that Marshack presents and significantly it was removed from the 1991 edition of **The Roots of Civilisation** and referred to only in connection with motif marking. However the example is possibly decorative, as the lines concur with the principles of symmetry.

5.2.5 A Summary of Marshack's Work.

In a conclusion to this subsection, my criteria have discounted all Marshack's examples as lunar notation, however two, possibly three with the bone from Le Placard, of the examples presented here are identified as possible notational examples by my criteria. One of the principal difficulties of analysing Marshack's work was that the only information came from **The Roots of Civilisation**, and, although the photographs provided show areas in exceptional quality and detail, the line drawings provided by Marshack formed the only comprehensive guide. There are always problems of interpretation, but Marshack chose to stress his results from microanalysis by illustrating alleged differences in tools, line form and thickness, etc. which certainly coloured any interpretation of his drawings. In addition, Marshack was attempting to demonstrate his hypothesis of a system of notation throughout the Palaeolithic and so had a particular 'eye' for certain detail that may not be considered pertinent by another researcher. In addition Marshack presents artefacts to support his hypothesis so it is fair to ask, how representative are they of non-figurative engraved artefacts?

To provide additional data, this section uses my own drawings of items of engraved bone from the Upper Palaeolithic, taken from the collections housed at the Musée des Antiquités Nationales at St. Germain-en-Laye, Paris. The data comes from two sites, Isturitz and Mas d'Azil, both in the French Pyrénées. Although the data presented in the following section are representative of the collection in Paris, they are not entirely representative of the total range of material from the two sites. The excavators selected, retained and published only the most interesting and potentially meaningful bones that they recovered. It is supposed therefore that there are a number of engraved bones that are not included in these collections.

5.3 Examples from the site of Isturitz.

These bones come from the Collection Saint-Périer, which were excavated by R. and S. Saint-Périer earlier this century. In the publication of this collection, which totals three volumes, there are a number of sections which refer exclusively to 'notched' and 'engraved' artefacts. They appear to have been recovered in large numbers, and found in layers from the Aurignacian through to the Solutrean and middle Magdalenian, particularly numerous in the period that Leroi-Gourhan calls the Gravettian, c. 27 000 – 18 000 B.P. The Saint-Périers speculated on the enigmatic nature of these marks;

> 'Il dénotant une autre intention, intention décorative? Intention idéographique? où d'ordre magique?' (1936:64)

Further observation lead to the identification of certain characteristics, as the bones were often polished and worked, although not necessarily into a standardised or recognisable form. Figure 5.8 illustrates another of the popular interpretations of the time. One example they describe typifies some of the common features: a short notched fragment, 7 cms long, made from the rib of a small carnivore. There are three groups of marks along the longaxis, all evenly spaced and the same length with range of 2 – 4 mm. Of the three columns, two have 35 marks, one 36 marks. Interestingly the Saint-Périers note the similarity between this example and the finds from Gargas recovered by Carthailac, also in an Aurignacian level. Carthailac concluded that the primary function of the marks was decorative, and the thin form suggested use as hair pins or some other item of Aurignacian toilette (R. et S. Saint-Périer, 1936:63). However the Saint-Périers' own opinion is that the marks could represent a mark of property or personality, pure creativity, or aesthetics.

Figure 5.7 — Bone Points from Gorge D'Enfer and Isturitz, France.

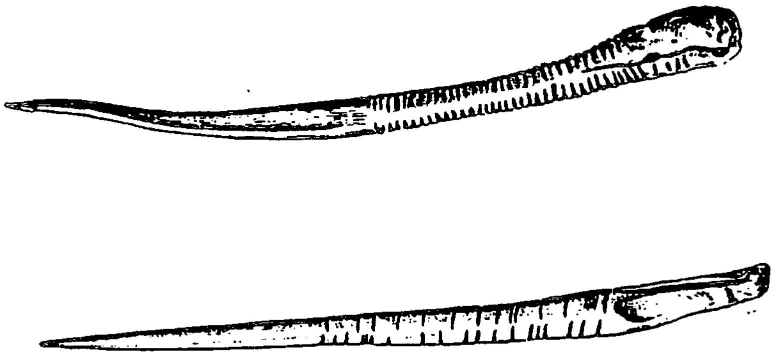


Figure 5.8 — An Australian, from the Arunta.

Saint-Périer, 1936:53, fig.24.

Figure 5.9 — Engraved Artefacts: Collection Saint-Périer.

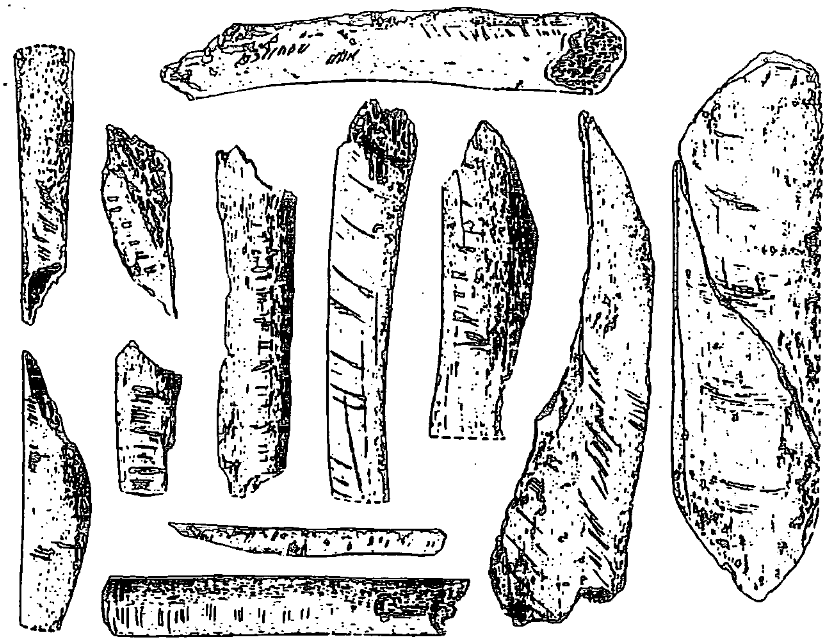
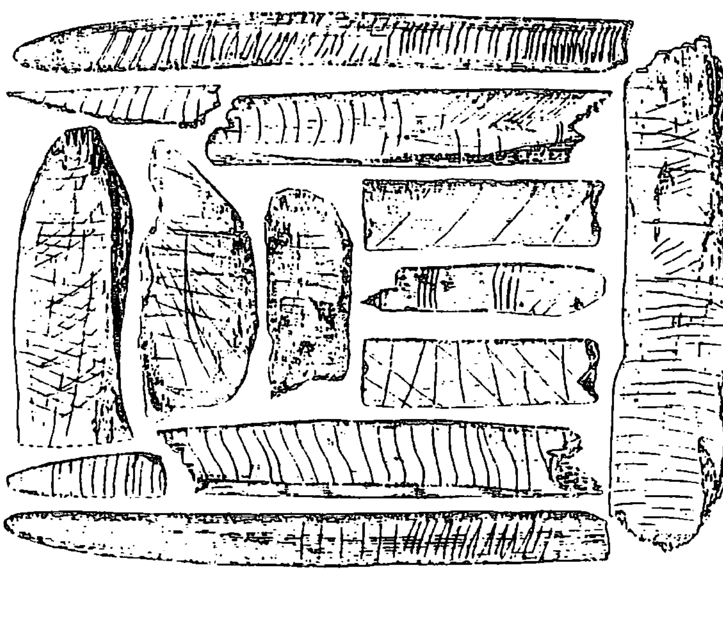


Fig. 70. — Aurignacien supérieur (Gravettien). Os gravés : touffes de poils (?). (Gr. nat.)



Saint-Périer: 1936

Figure 5.10 — Engraved Artefacts, Collection Saint-Périer.

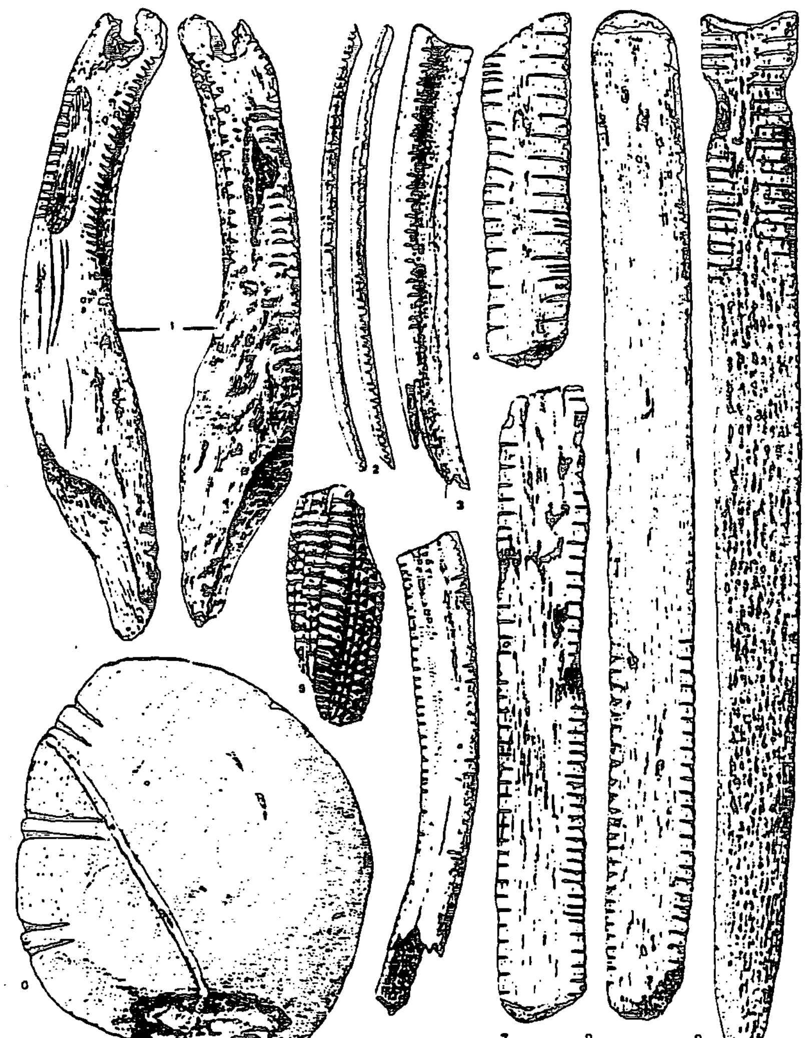


Fig. 75. — Objets encochés en os, en bois, en ivoire (5) et en pierre (6). (*Gr. nat.*)

Saint-Périer, 1936.

On a purely formal level the Saint-Périers divide these bones into two broad categories: those with parallel traits, perpendicular to the long axis, and marks that vary only slightly in their length and distance apart. Secondly those with 'crosses', 'arrows' and 'zigzags'. Further to this they look at methods of making the marks:

i. Those with many deep marks, but short and only at the edge of the bone.

ii. marks can be even deeper, wider spaced and occur all over the object.

Figures 5.9 and 5.10 show examples from the site of Isturitz which illustrate these principles. It is notable from their work just how numerous these bones were at the site, and how standardised are their forms. Three artefacts will be analysed from the site of Isturitz, according to my criteria. Other examples from my work at St Germain are presented for analysis in Chapter VII, and so the examples here represent a selection aned so the numbers are not consecutive. As they are all from the same site and collection, certain data is common to all these examples. Therefore Criteria 1 – 4 are applicable to all these artefacts, with additional detail supplied for individual artefacts as appropriate.

A. Establishing a Context for the Artefacts.

1. The site of Isturitz is located in the french Pyrénées at 107m above sealevel. It is made up of three river tunnels all containing human occupation and activity in prehistory. Bahn stresses the apparent isolation of this site, as it is the only known cave for miles (Bahn, 1984:85). However the river and lowland aspect of this site suggests a seasonal occupation in warmer periods, as it quickly becomes very damp and humid during the winter months.

2. There are deposits of human occupation from the Mousterian through to the Magdalenian and Azilian. Middle Palaeolithic material is confined to the southern chamber and along the cliffs outside the cave. The exceptionally thick Aurignacian levels are found in both the southern and northern chamber, where tool working debris and horse bones are abundant. There is direct continuity in the stratigraphy to the Gravettian levels which forms a dense layer containing evidence of prolific stone tool working which now represents 47% of the total assemblage compared to only 9% in the Mousterian (Bahn, 1984:88). Bovids replace horse as the dominant species, although reindeer and horse

are abundant. Finds of periwinkles and other marine shells indicate a broad and extensive resource base. There follows a clear transition to Magdalenian III, although there is some doubt about the date as it was assigned by Breuil as 'classic' Magdalenian which has since been challenged on stylistic grounds. During this later period there is a substantial layer with both fauna and art, and engraving on plaquettes are a common find in certain areas of the cave, as well as spiral-carved bâtons and spear heads.

Therefore the assemblage recovered from Isturitz makes this one of the major excavated sites in the Pyrénées. There is evidence of (seasonal) occupation throughout the Upper Palaeolithic in the sustained abundance of tools, faunal remains, and worked, bone, antler and engraved plaquettes.

3. Many of the bones are recovered in an excellent state of preservation, but there are representations adjacent to the drawings of the artefacts that indicate exactly where the bones are complete, and where they are broken.

4. All theses artefacts are known to have been recovered from the site of Isturitz, in direct association with evidence of human occupation. In addition they are classified by the Saint-Périers and accepted by curatorial staff at St. Germain-en-Laye.

Each of the examples are illustrated by both a detailed line drawing and by a second representation of the outline. The latter is included to provide additional information about the state of preservation of the bone and shown by colour-coded lines. A black line represents the presence of the original, undamaged bone, whereas blue indicates areas of the bone that have been worked. A green line highlights a break that occured either before the bone was deposited, or by post-depositional factors, and a red line indicates a 'new' break, which will have been made either on, or immediately prior to, recovery. s

B. Evidence for Iconicity.

5. There is no evidence for iconicity as, in common with Saint-Périers' identification of their properties, they are composed of simple lines, usually parallel to one another, and so do not indicate a natural model by their form,

6. Or by any characterising elements.

N.B. In the following sections the artefacts will be analysed in turn.

5.3.1 Example One, Isturitz.

C. Decoration.

7. The use of Symmetry:

i) There is translational symmetry as the elements at (a) and (b) are repeated, shown as Figure 5.11.

ii) There is no evidence of slide reflection.

iii) There is mirror reflection about the short axis of the bone, at (c).

iv) There is some evidence of rotational symmetry as the element at (a) is rotated through approximately 90 degrees to the position at (b), and then again through a slightly more obtuse angle to the position at (d).

8. The design is unbalanced, as it occurs only along one of the longer edges of the bone. There are two short marks on the other side, that could not be considered as properties of symmetry, as they are apparently isolated. This could of course represent an intentional juxtaposition, however this would only add to the unbalance of the overall image. However if the more numerous marks are isolated the regularity of their form and orientation creates a balanced composition.

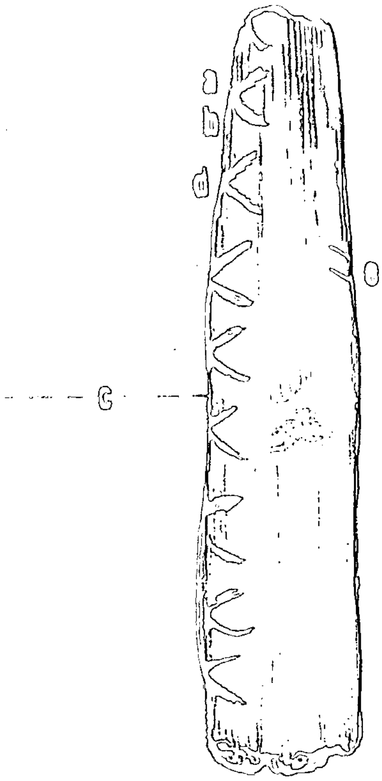
9. There is rhythm in the repetition of the marks, resulting from the consistency of the distance between them and the pattern of their orientation.

D.1. Notation.

10. There is a single repeated element.

11. The only variation in this single element is its orientation that varies alternately through 90 degrees. The two small marks at (e) may constitute pertinent variation, but their position removed from the other marks, and the fact that

Figure 5.11 — Example One: Isturitz, Saint-Périer Collection.



there are only two of them, means that they are not considered to be pertinent variation according to my criteria.

12. Each mark is clearly definable due to the regular spacing.

13. The 'path' of the marks follows one edge of the bone.

D.2. Subsidiary Criteria for Notation.

14. The sequence of marks along the edge of the bone is continuous, and other than the break in style between the marks (a) and (b) which serves to make them distinct, there is no evidence of 'groups'.

15. There is no evidence of positional notation, unless the change in orientation is evidence of a 'two count'.

16. There is no evidence of cipherisation, as the elements used are consistent throughout the sequence.

E. Lunar Notation.

17. There is no evidence to suggest that this sequence 'fits' with any lunar scale.

18. The pattern of the marks is repetitive, but not suggestive of a lunar one.

19. There are no grounds to distinguish variation in the marks that could consistently fit with a lunar chart.

Summary of Example One.

Evidently this example does not appear to be a convincing example of lunar notation. The use of translational symmetry is suggests notation, but there is also repetitive rotational symmetry which is perhaps more characteristic of decoration. However there is strong evidence that the marks are structured and are repeated rhythmically.

5.3.2 Example Three: Isturitz.

C. Decoration.

1. The use of Symmetry:

i) Translational symmetry occurs in the repetition of the lines across the bone.

ii) There is no evidence of slide reflection.

iii) There is no mirror reflection.

iv) There is no evidence of rotational symmetry.

2. There is some balance as the marks cover the surface of the face of the bone evenly.

3. The marks are repeated at the same distance over the bone.

D.1. Notation.

4. The element here is a straight line that is repeated over the surface of the bone.

5. There is one line at (d) that is shorter than the others, and does not follow the same pattern of spacing. However as it is not repeated anywhere else this is not deemed to be an example of pertinent variation, (see Figure 5.12).

6. As the lines are parallel to one another and repeated each mark is clearly definable.

7. There is no 'path' as such, as the lines cover the whole of the face of the bone and this surface is not complete.

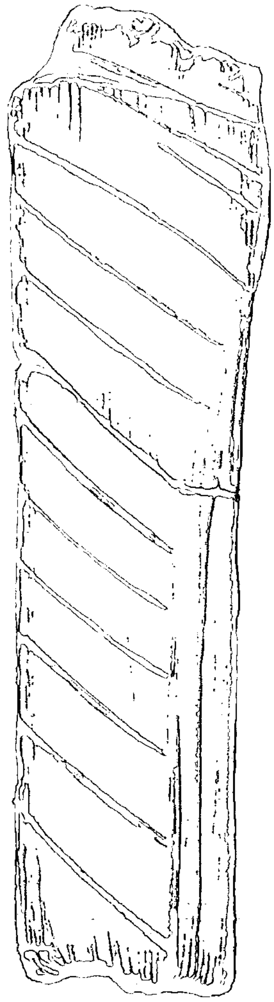
D.2. Subsidiary Characteristics of Notation.

8. There are no divisions.

9. There is no evidence of positional notation.

10. There is no evidence of cipherisation.

Figure 5.12 — Example Three: Isturitz, Saint-Périer Collection.



E. Lunar Notation.

11. There is no pattern in the nature of these marks that suggests that they relate to the patterns of the moon.

12. There is no variation, and therefore no reference to particular points could be claimed.

Summary of Example Three.

This example is characterised by the use of translational symmetry along a 'path', and is therefore a possible example of notation. There is no evidence to suggest that this example records the phases of the moon.

5.3.3 Example Five, Isturitz.

C. Decoration.

1. Symmetry i) There is translational symmetry of the lines identifies at (a) and (b).

ii) There is no evidence of slide reflection

iii) There is no real evidence of mirror symmetry.

iv) There is evidence of rotational symmetry, as the translation of lines over the bone, orientated in a slightly different direction, could also be interpreted as the rotation of a single element alternately through about 10 degrees then through 170 degrees, which creates a 'zigzag' pattern over the artefact. Certainly this is emphasised in the drawing provided by Saint-Périers', yet my own analysis of the bone provided a slightly more moderate interpretation, where the zigzag was not so pronounced.

2. There is balance in the design as it covers the flatter face of the bones, and widens as this widens. The length of the marks is consistent, and so is their orientation.

Figure 5.13 — Example Five: Isturitz, Saint-Périer Collection.

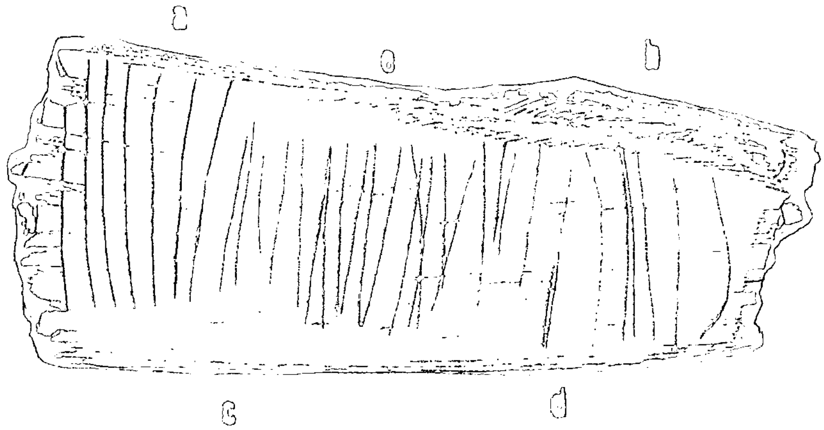
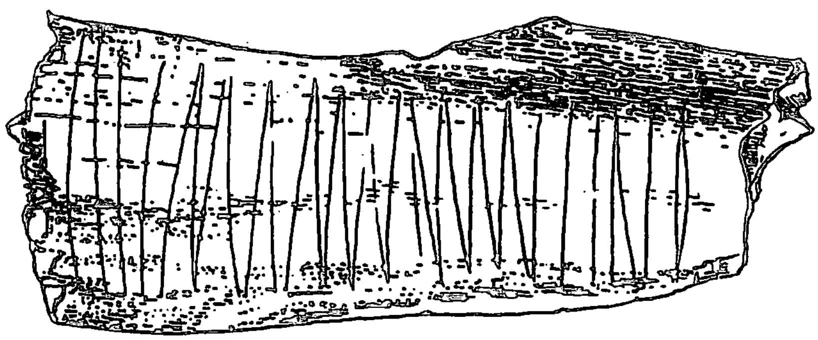


Figure 5.14 — Illustration by R. and S. Saint-Périer.

Saint-Périer, 1936:141, fig.76.



3. There is also evidence of rhythmic repetition of the lines, due to the regularity of their form, and the fact that they are all marked with the same emphasis.

D.1 Notation.

4. There is only one element, a simple straight line.

5. The changes in orientation of marks from parallel to the short axis at (c) and (d), and the zigzag at (e) is consistent and repetitive and therefore is considered to be pertinent variation. The length of the lines on the drawing is not consistent, but this is considered to be due to erosion under post depositional factors, and therefore not pertinent to meaning.

6. Each mark is definable, however the zigzag joins the ends of many of the lines to one another thus indicating the possible intention of a continuous line, rather than a number of discreet lines, as at (c).

7. The lines all conform to the natural boundaries of the artefact and broadly follow the longaxis of the bone while spanning the short axis. However the variation in orientation of the marks makes it difficult to talk of a single point.

D.2. Subsidiary Features of Notation.

8. The only 'divisions' are stylistic, related to the changes in orietation of the marks.

9. There is no evidence of a system of positional notation.

10. There is no evidence of cipherisation.

E. Lunar Notation.

11. There is nothing in the form of this sequence to suggest that it is intended to represent the movements of the moon, sun, or the stars.

Summary of Example Five.

This example, with its use of alternative rotational symmetry, or zigzags, forms one of the Saint-Périers' groups mentioned in the introduction to this section. Although there is some translational symmetry, and the length of the lines is relatively standardised, this example is more likely to be an example of decoration than notation.

5.3.4 Example Six, Isturitz.

C. Decoration.

1. The Use of Symmetry.

i) There is evidence of symmetry on both sides of this artefact, although it is more pronounced on what I have labelled 'side 2' as the marks are parallel to one another, straighter, and their lengths are more standardised.

ii) There is no real evidence of slide reflection.

iii) There is some evidence of mirror reflection about the long axis of the bone, although it is more standardised on 'side 2 ' for the reasons stated at (i).

iv) There is no real evidence of rotational symmetry.

2. There is a degree of balance on 'side 1' of this artefact, as the lines are roughly aligned to one another. However this is marred by the variation in orientation and length of the marks, which alters the overall harmony. As before, 'side 2' is more balanced, particularly as the distance between the marks increases to a ratio of 1:7 creating three 'groups' which balance the composition.

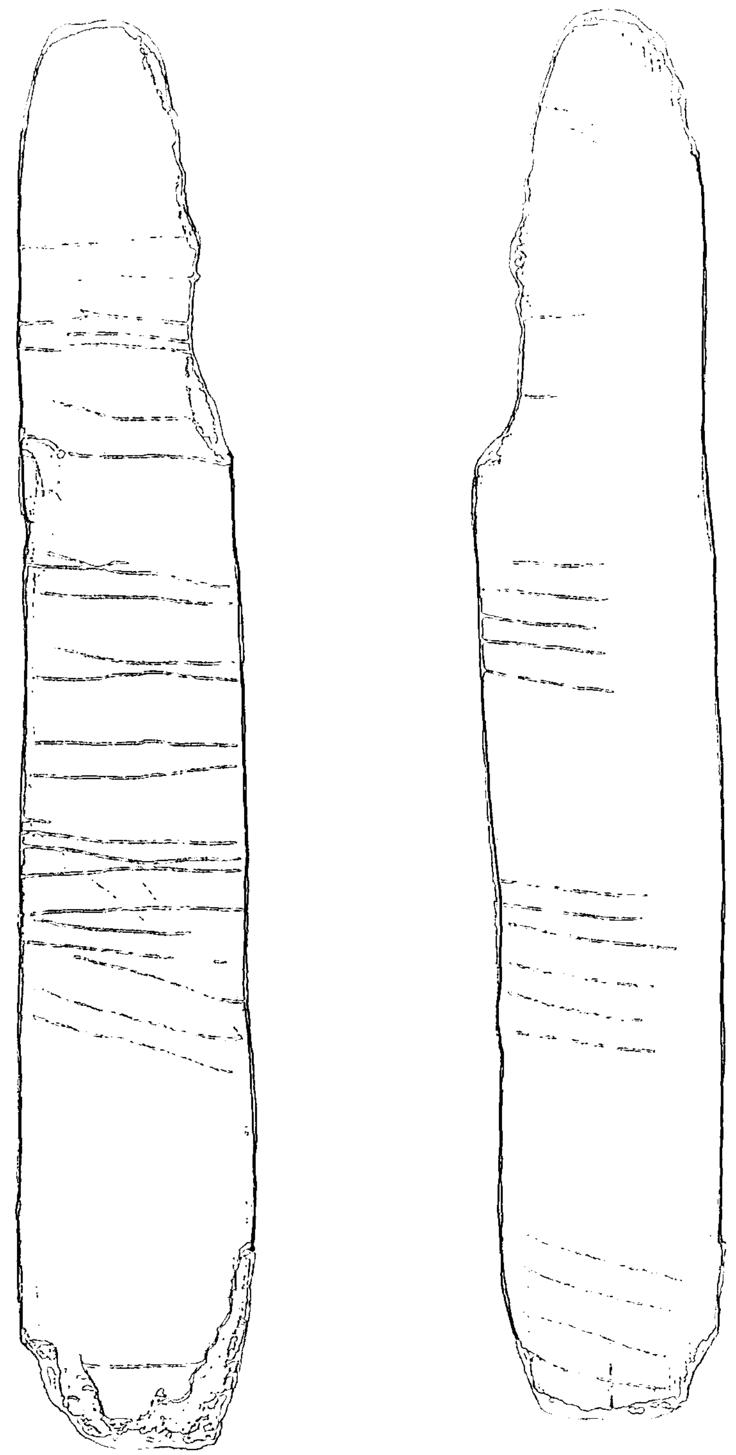
3. The rhythmic repetition of the lines on 'side 2', form the equal distances and length of lines and orientation. On 'side 1' this is not so pronounced, as there is variation.

D.1. Notation.

4. All the marks on both sides appear as a single line.

5. There is variation in line length on 'side 2' as the line at (a) is shorter, and the line at (b) longer. However, as this is not repeated and therefore not standardised, and the orientation and spacing does not vary, this is not distinguished as pertinent variation. There is more variation in 'side 1', with shorter lines at

Figure 5.15 — Example Six: Isturitz. Saint-Périer Collection.



(a), and neither the orientation nor spacing is consistent. Therefore, it must be seen as pertinent variation at (a), (b), (c) and (d).

6. Despite the variation on 'side 1' each mark is clearly definable over the bone. However the regularity of the marks on 'side 2' makes them easily identifiable.

7. The marks on 'side 1' roughly conform to the edge of the artefact at (e). However this conformity is not strict, as there is deviation at the area at (f). However on 'side 2' the marks are aligned down the long axis of the artefact, enhanced by the fact they are all parallel to the short axis.

D.2. Subsidiary Characteristics.

8. There are some divisions on 'side 1' as the marks could be isolated into groups of two as the spacing roughly follows a pattern of 1:1, 1:3, 1:1, but this is a rather contrived interpretation. Far more convincing is the division on 'side 2' where there are three well defined groups of five marks, six marks and then four, differentiated by spacing on a ratio of 1:7 and 1:5.

9. There is no evidence of positional notation: 'side 1' is too irregular, whereas 'side 2' does not appear to have any numerical pattern in the number of marks in each group.

10. There is no evidence of cipherisation

E. Lunar Notation.

11. There is no evidence on either of the sides of a system of 'lunar notation'.

Summary of Example Six.

Although not a convincing example of lunar notation, the repetition of single lines on both sides of the artefact is suggestive of the characteristic order of notation. The groupings of side two are convincing as the distances between the lines are sufficiently structured, but this is not really the case for side one. Also as the orientation and length of the lines on side one are not strictly regular, only side two is considered to represent a possible attempt to order and structure the lines in a potentially meaningful way.

5.4 Data from Mas d'Azil.

The following artefacts are also from the Musée des Antiquities National in Paris. They were recovered from the site of Mas d'Azil, Ariége, also in the foothills of the French Pyrénées. In common with Isturitz there are remains from the Solutrean, which is unusual in the Pyrénées. Mas d'Azil and Isturitz are also two of the few caves in which wall art is found in conjunction with very large concentrations of mobiliary artefacts. Bahn comments on the further similarities between the site of Mas d'Azil and Isturitz, as both are essentially river tunnels, with material from periods throughout the Upper Palaeolithic, and both sites are 'ultra-rich' in fine portable artefacts. Marthe and St. Just Péquart recovered thick deposits from the Middle Magdalenian on the left bank, and other galleries yielded more evidence of habitation in the Solutrean which was thought to indicate a new concentrate of an increased population. In his excavation on the right bank Piette found firstly habitation debris above the shelter, and five rich Magdalenian levels upon which are directly superimposed Azilian layers.

The format of this section is the same as for Isturitz, as the known context of the artefacts is essentially the same. These examples are also a sample of those that I examined from St Germain-en-Laye, the other examples are represented in the analysis in Chapter VII, hence the discontinuity of the numbers.

A. Establishing a Context for the Artefact.

1. The bones come the site of Mas d'Azil in the foothills of the French Pyrénées. The artefacts are dated to the middle Magdalenian.

2. This site, in common with Isturitz yielded up the full range of mobiliary artefacts, including *baguettes, rondelles, bâtons de commandment*, bones and plaquettes with 'geometric' and iconic depictions.

3. The state of preservation of the artefacts is indicated by the drawings accompanying the illustrations.

4. Given the nature of the site at Mas d'Azil, with its extraordinary range of worked bone and antler, accompanied by tools and habitation debris, there is

good reason to accept that the engraved marks on these artefacts are man-made.

5.4.1 Example Eight.

B. Iconicity.

5. There is no resemblance to a natural form by outline,

6. nor by characterising detail.

C. Decoration.

7. Symmetry.

i) There is some evidence of translational symmetry, as some of the lines on the bone are roughly parallel to the short axis of the bone and follow an even pattern of spacing. However a number of marks do not conform to this and the lines that do are not strictly parallel.

ii) There is one example of slide reflection at (a), although, as an isolated occurrence, is not necessarily a design element.

iii) There is some evidence of mirror reflection about both the long and short axis of the bone, although a number of marks do not conform to this, and the lines that do are not straight.

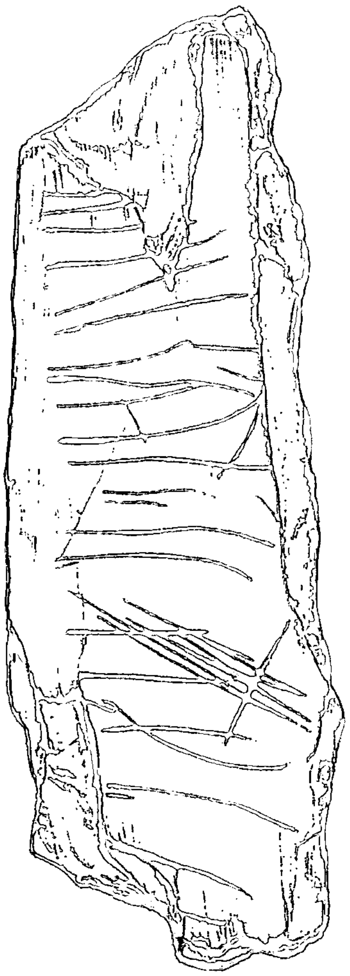
iv) There is no real evidence of rotational symmetry.

D.1. Notation.

8. There are only relatively straight lines on this example.

9. It is difficult to isolate pertinent and non pertinent notation for this example as none of the marks are truly standardised in their alignment, orientation or length. A number of marks that are parallel to the short axis are relatively standardised in these respects, although the deviation from these possible norms are not. As none of the variations are standardised they cannot be assumed to be pertinent to meaning.

Figure 5.16 — Example Eight: Mas d'Azil, Saint-Périer Collection.



10. Although there are a number of marks crossing one another the lines are discrete.

11. It is difficult to discuss the path of these marks, although the majority are parallel to the short axis of the bone.

D.2. Subsidiary Characteristics of Notation.

12. Other than the non-standardised variations in line length and orientation, there are no 'divisions' as such on this artefact.

13. There is no evidence of positional notation.

14. There is no evidence of cipherisation.

E. Lunar Notation.

1. There is nothing in the structure or total of these lines to suggest that these are examples of lunar notation.

Summary of Example Eight.

This example is not a convincing example of notation. Although there is some identifiable structure in the ways in which the lines are ordered with respect to one another there is no real evidence of the standardisation needed to order and structure the lines.

5.4.2 Example Fifteen.

B. Iconicity.

2. There is a configuration of lines on this bone that possibly indicates the outline of a cervid, possibly a doe, as there do not appear to be any antlers. This outline consists of the head in profile, and the beginning of the line of the back and the throat.

There is also possibly the outline of the fore quarters of another animal, perhaps a large herbivore, although only a portion of a foreleg, the throat and the line of the belly is indicated, as the area occurs along the broken edges of the bone, and has no additional characterising details to make this a convincing identification.

Figure 5.17 — Example Fifteen: Mas d'Azil, Saint-Périer Collection.

3. This possible 'cervid' is enhanced by the identification of some characterising details, as the 'mouth' appears to be open, with the outline of the lower jaw showing clearly, and also two lines where the 'eye' should be, and further lines that could represent an 'ear'.

C. Decoration.

4. Symmetry

i) There are a number of lines indicated at (a) that follow translational symmetry in 'groups' of two or three, the 'group' delineated by a change in the orientation of the marks. There are more at (b) where there is translation of a short line along the 'back' of the cervid, and following this, two lines juxtaposed to form a 'v' sign.

ii) There is no evidence of 'slide reflection'.

iii) Each of the 'chevrons' at (a) have mirror symmetry about the point where they join.

iv) These marks at (a) also show possible representations of rotational symmetry.

5. Other than the marks at (a) there is no real balance to the marks made on this artefact, although it is incomplete.

6. There is no real rhythm evident, other than at (a) and possibly (b).

D.1. Notation.

7. There is no single 'element' that can be isolated from the engraved lines.

8. There is the variation at (a) although the lines that make these 'chevrons' is not consistent in the number of lines. There is the possible iconic representation, and the incomplete outline of another animal; the group of lines at (b), and their juxtaposition to form 'v' shapes. There are also longer lines roughly parallel to one another at (c). What might constitute pertinent variation is hard to define, but it seems certain that variation is not consistent with that predicted by a lunar notation.

9. Each mark is not clearly definable, as there are a number of overlapping lines, whose superimposition obscures the 'reading' of the images.

10. There is no path, other than at (a) where the lines follow the edge of the bone and appear to have been made sequentially, and at (b).

D.2. Subsidiary Characteristics of Notation.

11. There are no spatial 'divisions' only stylistic ones.

12. There is evidence of positional notation.

13. There is no evidence of cipherisation, other than variation at (b) which is simple, consistent and repeated.

Summary of Example Fifteen.

This is not a convincing example of notation. Although there are possible 'sequences' on the bone, that is, areas where the form and position of one mark appears to have been made with exact regard to those preceding it and those coming after, these are not sufficiently standardised. The interpretation of a 'cervid' is convincing, although the schematised form and the use of minimal iconicity provides only a rudimentary idea of species. The over engraving of the image and the possible 'sequences' is entirely consistent with Palaeolithic art, notable for its lack of boundaries, (Conkey, 1978, 1982, 1985). It is possible that the use of lines and iconic imagery is intended to convey additional information in the manner suggested by Marshack, who links the juxtaposition of similar images to the recognition of 'seasonality' on the part of the maker. However neither the image of the animal or the marks are suggestive of this.

5.5 Preliminary Conclusions.

This chapter has examined two classes of data, the first provided by the work of Alexander Marshack, and the second by the collections Piette and Saint-Périer from the museum of St. Germain-en-Laye. The former group of artefacts was selected by Marshack from a whole range of material from museums all over Europe. He claims that they are all examples of lunar notation and, by microscopic analysis of how they were constructed he presented his interpretation of the structure of the marks. From a discussion earlier in this chapter, I concluded that microanalysis was of limited value to my study and so I chose to concentrate solely on the structure of the marks in the course of my analysis. The results of this disagree with those of Marshack, as I can find no convincing evidence that any of these artefacts represent lunar notations. In addition I believe that the example from Barma Grande is not convincingly notational, although there is some structure evident in the arrangement of the marks. The bones from Gonzi, Forneau de Diable and Ishango do conform with the criteria that I have forwarded to isolate possible examples of notation, although this does not necessarily indicate that they *were*.

Although only a very small sample was analysed, these examples from the Saint-Périer collection confirm their divisions, summarised at the beginning of the section, notably those bones with straight parallel lines, and those with zigzags, with Examples One and Three representing the former category and Example Eight representing the latter. Although Example Five shows regularity in the manner in which the lines are ordered, this is not thought to be characteristic of notation, more of decoration. The examples from Mas d'Azil were not convincing, as although Example Eight had elements of conformity, none of the characteristics required by my criteria were standardised. Example Six showed an interesting combination of representational and abstract imagery, although this is considered non-notational according to my criteria.

It is possible to hypothesise that the use of rotational symmetry provides the distinction between notational and decorational artefacts, as this is a shared symmetrical property of Barma Grande and Example Three from Isturitz. However some of the known notational examples from the ethnographic record, analysed in Chapter III, used rotational symmetry to order and structure the marks. Similarly rotational symmetry did not exclude Example One from Isturitz being considered as a probable example of notation by my criteria. Therefore the observable presence of rotational symmetry is not sufficient to distinguish between possible examples of decoration or notation. However as this thesis is dealing with *probability*, the undoubted recurrence of translational symmetry in the most convincing examples from all collections indicates that perhaps this is the most significant symmetrical property, and the presence rotational symmetry in the *absence* of translational symmetry admits the conclusion that such an example is likely to be non-notational.

The fundamental problem here is that single lines are non-directional, and therefore rotational symmetry and translational symmetry cannot conclusively discriminated. This is the reason why Washburn (1983) chose a ' ' as the design element in her illustrations of the principles of symmetry.

Translational' symmetry appears like this,

whereas *rotational* symmetry looks like this,

Where a single straight line is used, a sequence like this,

could be interpreted *either* as two modes of opposing translational symmetry, that is,

or as rotational symmetry.

Therefore until the absence of rotational symmetry can be demonstrated from *all* convincing examples of notation from the Upper Palaeolithic, a combination of translational and rotational symmetry remains a possible feature of notational examples, providing that this conforms with the other criteria that I have specified.

Chapter VI

Fieldwork and the Cave of Enlène.

6.1 Introduction.

The purpose of my thesis is to discover whether possible notational artefacts can be identified in the archaeological remains from the Upper Palaeolithic. The method that I devised in Chapter II as the most appropriate means of testing this concentrated on identifying a set of criteria which can distinguish between the *structural* principals of notation and decoration and also iconic representation. In Chapter III, I applied my criteria against comparatively recent examples of known notation and communication from cultures all over the world. The results from this first stage were encouraging, that is I concluded I could discriminate between likely and unlikely cases of notation. Following this analysis, I tested five of the examples that Marshack used in **The Roots of Civilisation** and a number from the collections at the museum at St. Germain-en-Laye, and again isolated a number of artefacts as possible examples of notation.

The discussion in this chapter focuses on the problems of contributing further to the debate surrounding notation. The results of my analysis in the previous chapter confirmed the *possibility* that some of the examples that Marshack claimed to be notational may have been, but this does not mean that they *were*. All that my results so far admit is that certain bones exist with non-figurative engravings that conform well to the structural principals of notation. However the examples that I examined from the French collections and the **Roots of Civilisation** have been extracted from their archaeological context which could have provided further information that could have been used to present a stronger case. Marshack's work on notation relied heavily on his 'microanalysis' to confirm that his examples were notational, and as was explained in previous chapters his theories were widely accepted, see Bahn (1988), Conkey, (1980), Mellars, (1989), Phillips, (1980), Trigger, (1968:351).

Yet there have been a number of critics of both his ideas and of his means of demonstrating them. From my own assessment of his work, I concluded that it was possible to isolate certain errors and inconsistencies in both his reasoning and methodology which were fundamental to his argument; notably in relation to his selection of examples, the 'evolutionary' trend to his presentation from complex to simple, and his application of the lunar cycle to the engraved artefacts. However the basic *idea* , that of the need for a system of recording a given quantity, whether of abstract time or recognisable number, in a society of emerging social and cultural complexity remains plausible, and so the focal point of my thesis remains to devise the most effective means of testing and investigating the existence of such a system during the Upper Palaeolithic *and* to supply as much contextual information as possible to enhance our understanding of the artefacts.

One of the principal criticisms of Marshack's work is that he draws on sites from all over Europe and from the entire timescale of the Upper Palaeolithic to provide the examples for his theory. This strategy conveys the impression of a continuous picture of the phenomenon of notation in time and space, and thus the sheer weight of 'evidence' apparently demonstrates the validity of the original hypothesis. However the presence of one isolated example of 'notation' on a given site is not sufficient to demonstrate that a *system* of communication was active. It is possible that such an example could be a mnemonic tally which, although significant, is not necessarily representative of an entire communications network throughout a group or society. Thus, I concluded that an examination of *all* the appropriate material from *one* site in detail with regard to the other excavated associated evidence would provide a surer base from which to derive any conclusions.

The initial stages of the research that I have summarised directed me towards an examination of more Palaeolithic material in order to test the hypotheses and the methods that I had devised. The data in this chapter comes from a single site, Enlène, and come from the 'sub-class' of engraved artefacts that I identified in Chapter I, namely non-utilitarian portable artefacts with a number of engraved lines, that have not been incorporated into the traditional classifications of decoration or representative artefacts. They form a particularly interesting data set for the following reasons:

- They are discovered on a high proportion of the major excavated sites both throughout Europe and throughout the timespan of the Upper Palaeolithic.
- They form a particularly interesting group as, although they are potentially 'debris', a residual by-product of meat-eating, they have sometimes been clearly utilised for another purpose or purposes.
- The configuration of engraved lines can range from a few faint traces to a series of deeply engraved and evenly spaced lines on examples from the same area on a site.
- As they are mobiliary objects, they could be utilised as a running tally or a record that can be potentially transported from place to place, and therefore serve a function over time.

6.1.1 The Aims of My Fieldwork.

From the discussion above on the theoretical perspective and methodology that I had devised, and the decision to continue in broadly the same field as past researchers, two fundamental aims emerge:

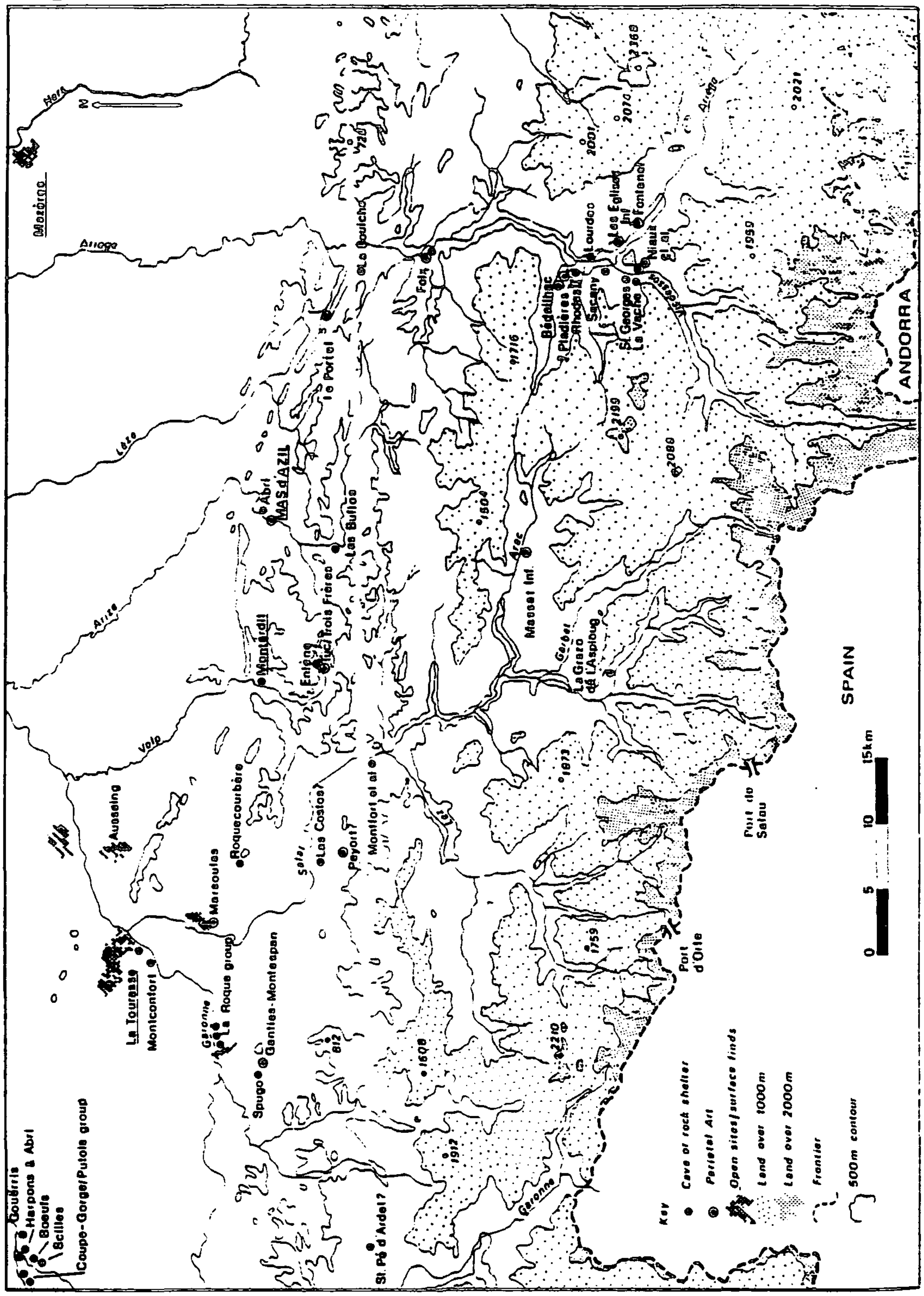
- To discover whether the criteria that I devised and tested to classify the engravings and thus isolate examples of possible notation, can be successfully applied to a larger sample of Upper Palaeolithic material.
- By analysing the various forms in which the engraved lines manifest themselves, to identify various patterns, and hypothesise as to their possible relevance and function in the Upper Palaeolithic.

To fulfill the first of my stated aims, my fieldwork concentrated on collecting original data in the form of engraved bones from the European Upper Palaeolithic from one specific area in order to observe in detail any patterns of change in both time and space.

6.2 The Pyrénées and the Upper Palaeolithic.

In this chapter I will describe my fieldwork which was conducted at the site of Enlène, and the museum at Pujol, Montesquieu-Avantès, in the Ariège region of the

Figure 6.1 — The Cave Sites Surrounding Enlène, Ariège, France.



Midi-Pyréneés in Southwestern France. In the **Roots of Civilisation**, Marshack claims that a system of notation existed during the Upper Palaeolithic, represented by examples from sites all over Europe, (1972:108). Should the following discussion demonstrate that the site of Enlène fell entirely within Upper Paleolithic culture then there is a reasonable probability that notational artefacts are represented amongst the engraved bones from this site. This discussion of the wider context of Enlène briefly considers the wider social system that existed in the Pyrénées during the Middle Magdalenian and the region of Ariège before concentrating on Les Trois Frères and Le Tuc d'Audoubert which form part of the same system of caves as Enlène. Following this is a description of the topography and basic geology of the caves and an account the excavations carried out there over the last century up to 1990. The specific nature of the work that I undertook is described in detail, and following this are subsequent analyses concluding in a presentation of the results and conclusions.

6.2.1 The Southwestern Area and Ariège.

Mellars (1985) singles out the archaeological assemblages from the habitation sites in the southwestern area of Europe as being particularly 'complex'. During the Magdalenian there is an exceptionally high density and concentrations of sites (Sackett, 1968). This represents an increase both in the Perigord, from a total of 40 – 60 sites for the Aurignacian, Perigordian and Solutrean to 80 – 100, and from 16 – 17 sites to around 70 during the Magdalenian in the Pyrénées. Many of the sites yield rich deep levels which provides evidence for the continual (seasonal) occupation of the same sites year after year by quite large groups of people. The quantity and quality of the artefacts, which include evidence of bone and antler working, suggests periods of intense activity with possible craft specialisation judging by the probable level of skill and investment of time in some of the carved objects (Bahn, 1988).

This view has been challenged. Gamble (1991) points out that this region has always been well researched and excavated in France, and the 'concentration' of sites could be matched by other areas had they too had the same intensive level of research. He goes on to criticise the common assumption made by archaeologists that the 'complexity' of a site can be deduced by assessing the density of finds in a given area. Gamble compares this approach to the use of Childe's discredited 'Ten Point Plan' (Childe, 1951) to identify Urban areas, and suggests that all that such quantitative analysis demonstrates is that the population inhabited an abundant environment with unrestricted access to resources, which is *not* a measure of cultural complexity.

Instead of concentrating on 'regions' based on specific geographical areas and then mapping objects on to the landscape, it is more useful to look at systems of interaction by the human population, which may be evident in the archaeological record (Gamble, 1991, Conkey 1985). Recent work in other areas have shown comparable ranges of finds, and Soffer's work in Eastern Europe challenges the view that the Southwestern area was the sole cultural 'centre' of the Palaeolithic (Soffer 1985).

Conkey's work on the engraved plaquettes from site of Altamira in Northeastern Spain lead her to conclude that it was an place of seasonal aggregation, the evidence coming from the size of the site and from the various styles evident in the material culture (Conkey, 1980b). In this study, Chapter V included an examination of material from two sites in the Pyrénées, Isturitz and Mas d'Azil, which were forwarded by Bahn as possible 'Supersites' (Bahn, 1982). The range of material culture and the density of the occupation, coupled with the evidence for movement and a wide resource base lead Bahn to conclude that they provided a focus for all the sites of the area. Bahn proposes a similar model for Mas d'Azil and Ariège, citing the range of mobiliary artefacts and the evidence for large scale bone, antler and flint working. He proposes a seasonal occupation of the site,

> 'it seems sensible to see the Mas d'Azil as primarily an archetypal spring/autumn regional focus for economic, social and ritual activities.' Bahn, 1984:260.

In the limestone foothills of the french Pyrénées there are innumerable caves cut into the rock by the continuous erosion of the rivers which has occurred from ancient geological time to the present day. These caves run from east to west, and are matched on the southern side by caves in Spain that extend to the Atlantic coast, following the line of the limestone rock. However, only a small percentage are known to have been occupied by prehistoric populations, the evidence coming usually in the form of habitation debris, but sometimes and most spectacularly by the decoration of the cave walls by painting and/or engraving. In prehistoric studies the broadly speaking Pyrénéean caves are grouped together in much the same way as those of the Lot and the Dordogne

The area of Ariège as described by Denis Vialou (1986a), is more than a government Department with boundaries created for the convenience of administration: instead he stresses the physical features that enclose the region and so presents a geographical area that has on this basis existed for thousands, even tens of thousands of years. Perhaps the most dramatic feature are the Pyrénées which run in a virtually unbroken chain from the Atlantic to the Mediterranean, rising steeply on their northern sides so that even now few road run their length or cross to the southern side and Spain. To the south there is the Garonne river which flows from the west, and to the east there is the Ariège river whose northerly course towards the Garonne, surrounded at its source by high mountains which form an effective barrier. The Salat lies to the west, and its north westerly course means that it too eventually joins the Garonne. The possible importance of rivers for long distance communication is highlighted by Bahn (1982) in an analysis of the finds of sea shells on inland habitation sites. From the Aurignacian to the Magdalenian, the sites on the west have a higher proportion of shells from the Atlantic, whereas those in the east come from the Mediterranean. However the sites in eastern Ariège, which is more proximate to the Mediterranean, have higher concentrations of Atlantic shells, possibly due to the fact that the rivers in this region all flow to the western seaboard.

The Ariège region possesses some of the most highly decorated caves in France, with a concentration in the valleys that is typical both of the choice of settlement by Palaeolithic populations and of limestone cave formations (Vialou, 1986a). The caves of Niaux and Bedheilac have spectacular entrances rising many metres and command a view of the surrounding areas, and no lesser in scale is the entrance to Le Mas d'Azil with a 'live' river running along a lower level. The decorated caves of Les Eglises a Ussat and Fontanet lie on the left bank of the river Ariège in a steep sided valley at virtually the southeastern limit of Ariège. Significantly the main route to Barcelona follows the Ariège and passes through the town of Foix where Le Cheval is located, and on to Tarascon as this is a natural route to the plains but also across the Pyrénées to Spain.

The fact that there are no inhabited caves further east than this suggests that the river constrained the movement of the human populations, and similarly the populations, and similarly to the south the Garonne plain would have provided an 'ecological' barrier in its lowland environment. Yet rivers are not necessarily impassable, as the evidence suggests that populations in prehistory crossed and re-crossed the Garonne and the Salat. There are numerous sites on their banks, particularly around their confluence at Salies-du-Salat and in the limestone hills of the Petite Pyrénées around Montrejeau which form a mid-place in terms of altitude between the Pyrénées and the plain. Furthermore the sites continue to the west where the cave of Montespan forms a natural and cultural axis between Ariège and the next Departement of Haute Garonne. In the latter lie Gourdan, then Gargas, Tibriran-Jaunac, Lorthet and further still Labastide and Espéche.

6.2.2 Les Cavèrnes du Volp.

Bahn's model of the sites which come within the range of the 'supersite' of Mas d'Azil includes the site of Enlène and the adjacent sites of Les Trois Frères and Le Tuc d'Audoubert which lie 12 km distant from Mas D'Azil as the crow flies (Bahn, 1982). These caves lie about 65 km to the SSW of Toulouse, and were caused by the action of the river Volp which cuts through a zone between the Upper and Lower Cretaceous rocks and runs from the limestone foothills of the Pyrénées to meet the Garonne some 40km distant. Close to its known source, near to the hamlet called Enlène, there is a hill that rises to about 470m through which the river runs. In this hill on the south bank of the river there two fossil river beds directly above one another which remain connected in places by steep shafts and gullies which collectively form the 'Volp Caverns'.

It is only the central level that has concerned prehistorians as here traces have been found of human occupation which date from the Perigordian to the Magdalenian (Bégouën & Breuil, 1958). Although geologically speaking the level forms a unified system, the nature of its rediscovery during the last two centuries meant that it was divided into three; namely into the caves of Enlène, Les Trois Frères, and Le Tuc d'Audoubert (Bégouën, 1921). The tri-fold division relates to the quite distinct entrances on the north side of the hill through which they were discovered, which in the case of Tuc d'Audoubert is at some distance away. In addition, the constant twists and turns, descents and ascents and deviations in the caves themselves make it virtually impossible for an investigator to orient themselves, and so it was not until careful maps were made that the pattern of their direct relation to one another could be established. Blocking by debris and the collapsing of areas are constant features of cave systems in a limestone area, and it is only by careful sampling of the sediments that a representation can be made of how the Volp caves would have looked during the period of occupation and/or utilisation in prehistory. As Enlène and Les Trois Frères remain connected by a tortuous lower shaft of some 60 metres it is almost certain that had these two been penetrated to their fullest extent, they both would have been known to that population. Le Tuc d'Audoubert is at present separated from the others – all known links with Les Trois Frères are sealed by rockfalls and the natural accumulations of debris in prehistoric times suggests that this was also the case at that period.

One reason why they continue to be regarded as distinct from one another is due to the evidence of human activity in prehistory. Each cave retains idiosyncratic traces of use and occupation: the cave of Enlène, other than a few enigmatic spots of ochre, has no parietal art and although both Les Trois Frères and Tuc d'Audoubert have many engravings on the cave walls, the most outstanding remaining features, namely the sculpted clay bison and the painted sorcerer respectively, suggests that the focus of the artistic traditions in each cave was very different (Bégouën & Clottes, 1981). This has lead to the hypothesis that Enlène was the focus for living, whereas the other two caves were of special, perhaps ritual significance, although it is virtually impossible to establish whether or not the parietal art is associated or even contemporaneous with the habitation assemblages (Bégouën & Clottes, 1981, Bégouën, Briois, Clottes & Servelle, 1985).

The cave of Enlène proved to be an ideal choice as the focus for my research. The material from the Upper Palaeolithic was mostly recovered from the modern excavation conducted over thirteen years (1977 – 1990) under the direction of Dr. Jean Clottes and M. Robert Bégouën. As all finds were recorded with meticulous detail this provided information as to their context and an idea of their date. Although Enlène has been excavated sporadically since the middle of the last century the present directors chose to create several designated 'sites' within the length of the entire cave. As a result, researchers are able to compare finds from the entrance to the innermost chambers and thus assess for the first time the patterns of occupation and utilisation of the various areas of the cave over time. This provides a dynamic context within which to interpret the nature of the finds, and predict their possible relationship to one another within a theoretical cultural framework.

The discovery of material at all the sites so far excavated within Enlène implies that there is a continuous scatter of debris over the entire cave which means that to some extent, the spatial 'concentrations' that are being analysed are artificial, which is why they are referred to in inverted commas. However there is a clearly identifiable and dateable change in the assemblage at the cave entrance site: the underlying material is Perigordian, and the later overlying layer Middle Magdalenian, with a definite and marked separation in the stratigraphy between. The upper level is believed to be directly contemporaneous to the other Middle Magdalenian 'sites' within the cave. Therefore the cave of Enlène provides the ideal situation in which to test the second of my stated aims which was to establish the exact nature of any changes in the engraved assemblages over time, as well as any functional differentiation between the cave areas.

The significance of all the finds is heightened by the cave's direct association with the more famous caves of Les Trois Frères and Le Tuc d'Audoubert (see Figure 6.2) although virtually unexcavated themselves, have a wealth of parietal engravings and art as well as the magnificent sculpted clay bison in the latter. Enlène itself does not possess any parietal art, but there is a substantial layer of habitation material extending from the entrance to the back of the cave where it 'meets' with Les Trois Frères, a distance of about 200 m. The following section describes the sister caves of Le Tuc d'Audoubert and Le Trois Frères, and finally Enlène itself using the loose bound unpublished site reports located at the private museum at Pujol, Montesquieu-Avantes as the primary source, combined with information gained from working on the excavations at Le Trois Frères and Enlène with M. Clottes and M. Bégouën.

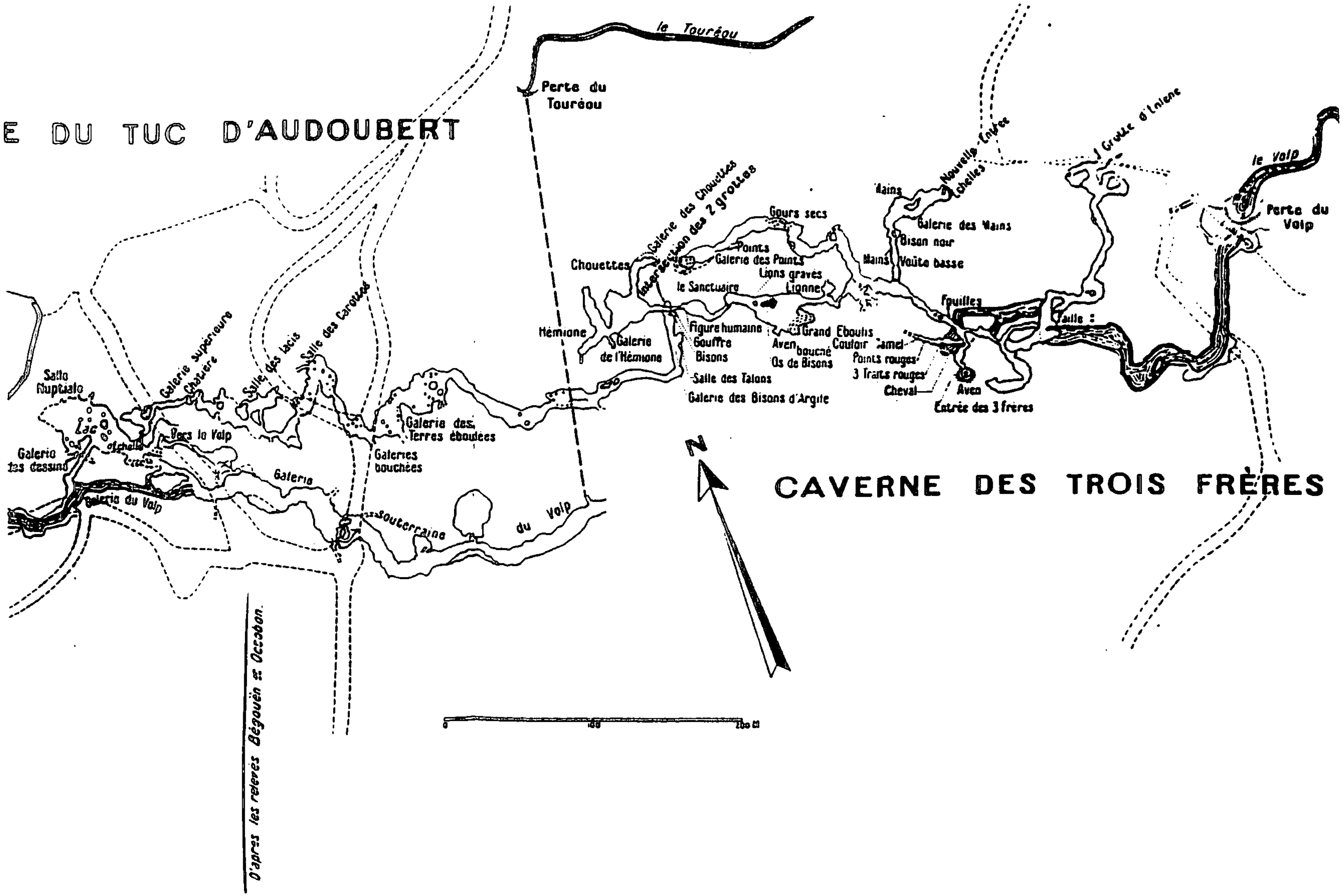


Figure 6.2 — A Map of the Volp Cavernes.

6.3 The Volp Caverns : A Description.

The following information is devised both from documentary evidence and from my own visits to the caves. I was fortunate enough to visit Le Tuc d'Audoubert on two occasions, Les Trois Frères at least five times, and Enlène on a day to day basis during the course of the excavation.

6.3.1 Le Tuc d'Audoubert.

It is from this cave that the river Volp emerges after running for roughly 2km underground. In order to enter the cave it is necessary to traverse directly upstream, which is now managed using a small boat. The level of water varies according to rainfall levels over the seasons, running as a small stream in summer and autumn whereas in winter and spring the river rises so high that it is impossible to enter. This has lead to the hypothesis that the occupation of the cave was only possible during the late summer / early autumn, and this is supported to a great extent by the archaeological evidence (Bégouën & Breuil, 1958, Bégouën, Briois, Clottes & Servelle, 1982). There are basically three stages to this cave (See Figure 6.2): the lower on which the river still flows, a level some metres above, and a further fossil level which represents the remains of the oldest surviving river passage.

The Middle Layer.

Once inside the cave mouth, and about 80 metres upstream, ladders have been built to aid the rather steep ascent to the levels to reach the initial fossil river bed that the Magdalenians discovered. As the river runs so close, the walls and floor remain damp which makes it perhaps a surprising choice of settlement, except that the much wetter cave of Montespan and the dripping and misty entrance of Labastide to name but two were also chosen by comparable populations, and so the situation is not unique. The cave system comprises a number of chambers, connected by passageways with occasional drops to the Volp below. The first chamber is called the Bridal Chamber, *La Salle Nuptiale* as the calcite here is dazzlingly white, covering the floor, and ascending and descending in stalactites and stalagmites from floor to ceiling in huge and graceful columns (Bégouën, 1921).

The paintings and engravings of horses, felines and the head of a reindeer are all confined to relatively inaccessible and narrow passages, where the roof level is often very low and curved overhead. There is also a large engraving of a bison with 'fleches', that is, signs that are thought to resemble arrows, covering the body. There are also some other engraved signs including claviforms, the latter are unusual as the majority of claviforms are painted, as in Les Trois Frères and Niaux (Bégouën, Briois, Clottes & Servelle, 1982). Further into the cave are some traces of red line paintings that have now deteriorated - Breuil (1958) remembers seeing a beautiful doe turning to the left which is now lost. There are two interesting inscriptions in the main gallery - written in french to record that two men went into the caves in the seventeenth or eighteenth century. There seems no reason to doubt their validity, as all the other remains are far more ancient, and it is hardly remarkable that they didn't see any of the engravings in the passages, although of course it was possible that they did, but had no idea of their antiquity (Bégouën, Briois, Clottes & Servelle, 1982).

The evidence for the Palaeolithic occupation derives from the engraved cave walls and the habitation assemblage, which has been dated by style to the middle Magdalenian, probably Magdalenian IV, and possibly V (Bégouën & Breuil 1958). The Bégouën family first excavated in 1926 and discovered evidence of occupation on this middle level at a distance of about 200m from the entrance. The actual deposits form two fairly clear layers, never more than 8 - 10cms deep, including a scatter of burnt material from two hearths, (Bégouën, 1926). The layers are separated by a layer of sand which must have come from the river below rising in flood between the two phases of occupation. This inevitably raises the question of how much material was lost then and by subsequent activity, although Louis Bégouën remained confident that not too much damage had occurred The evidence tends to support his optimism, as although the quantity of material cannot compare to the richness of the sister site of Enlène or to the neighbouring site of Le Mas d'Azil, it does indicate the full range of activities that are recovered on settlement sites, and appears to have been occupied for some time, (Bégouën, Clottes, Servelle 1982). The faunal evidence is not abundant but shows the remains of a mixed economy, with the teeth and broken and calcified bones of bison, reindeer, *Bos* and horses, (with the latter predominant) and the rare find of the canines and penis bone of a bear.

Amongst the worked bones there are *sagaies, baguette demi-ronds* and two worked and perforated *bâtons*. Those with iconic engravings show representations of animals and anthropomorphs, and there are two pieces of antler engraved with a bison and a possible fish. There are also twelve pierced teeth – 1 horse, 5 reindeer, 1 bovine, 4 fox, and one indeterminate example. A characteristic find in the Volp Caverns are engraved 'plaquettes' of sandstone, which like the iconic representations of the bones show the head of a horse, a fish, anthropomorphs and bison.

The Upper Level.

Other than a few dots of ochre on the walls, there are no paintings in Le Tuc d'Audoubert, and in the Upper Gallery there is no evidence of habitation, (Bégouën, Clottes, Servelle 1982). The chambers here are graceful in their proportions and there are many engraved images on the walls. It is on this level that Max Bégouën discovered behind a sheet of more recent calcite the further chambers that run on to the debris which long ago blocked the communicating tunnels with Les Trois Frères. At the entrance to this network are two 'fantastic animals' that lie one above another, described by Breuil as half-feline and half-bull and the *'Gardiens du Sanctuaire'* (1958:90) This chamber is connected by an extremely narrow passage, 53 cm wide and only 35 cm high for a distance of 1.80 meters, but it emerges into a large chamber with stalagmites, with traces of cave bears – clearly indicating the existence of other entrances in prehistory!

Further from this, nearly 600m from the beginning of the level are the famous clay bison (Bégouën, 1984). One of the remarkable things about the entire cave was that the clay on the floors was as moist and supple as it must have been in the prehistory. At about 150 metres the first imprints of human footprints are found, and they continue to the furthest extremity of the cave. In the 'Petit Rotonde' there are heel prints of children which look clear and natural, not baked and dried and cracked as they would have been had they been exposed in the outside air which indicate that the humidity level is not only high now, but has remained suitably constant for thousands of years. Before the bison are reached there is a clay bank covered with a toddler's footprints, and right at the edge there is the perfect outline of the toes; splayed out and apparently gripping tightly. All over the cave there are worked pieces of clay - the fingers that gouged the clay still leaving trails, and the rolled 'sausages' were kneaded and worked to make it malleable. It was thought that this area could have supplied the material for the bison, as it certainly seemed to be favoured as a source of clay.

The bison themselves are approached along quite a broad and wide passage, and lit by our torches in anticipation, they certainly seemed to dominate the whole chamber. Made of a light yellow clay, they leaned against a jagged rock, one positioned at a slightly more exaggerated angle to the horizontal than the other, which has lead to speculation that they are about to mate, (Breuil, 1958). From observing the finer details it has been speculated that not only were they intended to represent a 'male' and a 'female', but that they may have been made by different sculptors. Although it is impossible to ever replicate a sculpture, it seemed that different features were rendered differently on each – on one the tail had a tasselled end on which the individual hairs were marked, on the other it was simply a larger lump of worked clay – for one the shoulder was carefully moulded, with the hint of the second shoulder behind, whilst on the other, it was shown in a stricter profile. There is also a smaller bison, only 12 cm long, the original of which is now in the museum at St. Germain-en-Laye, Paris, who purchased it from the Commune of Montesquieu- Avantès earlier this century (Bégouën *et al*, 1977). Directly surrounding these sculptures are raised lumps of clay that indicate that possibly other sculptures may have existed that were either unfinished, or have now deteriorated. The proximity of footprints and heelprints to the images suggests that perhaps some ceremony was being performed around them: a similar idea has been forwarded for the bear of Montespan (Bégouën *et al*, 1982). As the roof level is so low around the bison, it is entirely consistent that these footprints too were made by children.

Around the back of the rock there was a large outline of a bison, deeply engraved in the clay – possibly a failed initial attempt, or a rough artist's sketch? The latter suggestion had been dismissed by some, as it is relatively crude in outline when compared with the bison, but any form of drawing to a sculptor is art in a very different medium, and there is no reason why the creators should have been good draughtsmen. If there were two or more sculptors, it is possible they used such a model to pool their ideas, and ensure that the two were as alike as they are. There is also the reproduction of the tiny bison that was sold to the Musée des Antiquitiés in Paris, ceremoniously placed in position some years ago (Bǵouën, Clottes, Delporte, 1977).

It is undoubtedly the image of bison that dominates in Le Tuc d'Audoubert, (Bégouën *et al*, 1982), as in the Upper Gallery there are two engraved bison in addition to the four of clay, compared to the other engravings of one doe and two fantastic animals. In the Middle Gallery there are three engraved bison, one engraved head of a bison and one of another bovid, and a further two engraved bison with claviforms in a small chamber away from the main salle. The other representations are of three horses (two in the *Salle des Gravures* and another in a small chamber with claviforms), a feline, a reindeer and a indeterminate animal. There are lines that are believed to represent the backs of bison, one 'vulva' and fifteen claviforms in the main chamber, and over eighty in a small chamber. This emphasis on the bison is in direct contrast to the images represented on the mobiliary artefacts as horse is the dominant image, and there are no reindeer or felines and no claviforms as for the cave walls, instead there are fish and anthropomorphs. Yet it is claimed that the two art forms are linked, as it is claimed that two of the parietal images, that of a doe and a bison, have direct stylistic counterparts on the engraved mobiliary artefacts, (Bégouën, Clottes, Servelle, 1982), and therefore the same inhabitants were responsible for both. This has lead to the theory that the Upper Gallery of Le Tuc d'Audoubert was reserved as a sanctuary or special place, and so the day to day living was confined to the lower level.

6.3.2 Les Trois Frères.

This cave was discovered after Le Tuc d'Audoubert, by the three Bégouën brothers in 1914. Breuil recounts that over the winter a local had seen a hole in a neighbouring field, exposed by the snow, of exactly the type that usually denotes a cave system beneath. The brothers and friends descended to find the high galleried cave, and furthermore the 'corridor' that joins it to Enlène (Bégouën, 1921). As mentioned previously, where Enlène is famous for the mobiliary artefacts, and Le Tuc d'Audoubert for the clay sculptures, in Les Trois Frères one can find many representational paintings and engravings. Unlike Enlène, this cave has a great many chambers, and to reach the end chamber it is necessary to ascend and descend narrow iron ladders to move form one level to the next. Sometimes the way is narrow, and as in Le Tuc the height of some passages are less than half a metre from the floor. Yet at other times the roof is so lofty that even the beam from modern torches can hardly locate it. There are many stalagmites and stalactites along the way, with layers of calcite over the floors that resembles sand blown into barchan dunes and ripples in a desert. Some areas are dry but this is seasonal, and there are other chambers that are covered in sheets of water even in summer.

It is known that Les Trois Frères had a number of entrances in prehistory, although the exact locations are impossible to establish (Bégouën & Clottes, 1987). It is generally considered unwise to search too strenuously, as the dislodging of rockfalls and calcite formations is not only destructive, but it could also either introduce fresh air currents should the entrance be found, or at least subtly alter the established pattern of air circulation that could lead to the deterioration of existing art works that have been preserved (Bégouën, 1980). From the present entrance there is a 'crossroads', with passages leading not only to the couloir Francois Camel and to Enlène, also to the main body of the cave. Deeper into this there is the *Salle de Théâtre* – so called because the horizontal alignment of the calcite formations resembles tiers of balustrades (Bégouën & Breuil, 1958). There are only a few representations and dots of ochre here, and it is not until the *Chapelle de la Lionne* is reached that there are engravings in any number – a group of large felines – apparently lionesses and a cub – occupying a very small chamber, with the remains of a lamp and a cache of flints 'shelved' in one of the niches in the rock (Bégouën & Clottes, 1986/87).

The way is littered with bones; the almost complete skeleton of a bison, the skulls of two felines and a lot of fox bones as well as the skulls of cave bears. This evidence along with quantity of intrusive clay indicates that there was probably a roof collapse in this chamber of the cave at some point, and these animals simply fell in. The presence of the cave bears, as for those in Le Tuc, provides evidence that there were certainly other entrances previous to the Magdalenian visits/ occupation. More Lions occur at the entrance to the Sanctuary, where the famous 'Sorcerer' is located. There are far too many representations to discuss in detail:

mammoths, anthropomorphs, a large ibex, bears, bison, a rhinoceros and a reindeer stag to name just the most complete, all over- engraved with other animals and indecipherable lines (Bégouën & Clottes, 1987).

There is an extraordinary rendition of a bison around a convex section of rock – although elongated, the line remains true along all the contours and presents a surprisingly accurate iconic image. The central image is the painted figure called by Breuil the 'Sorcerer' which appears to be suspended high on the rock 'creeping' behind an overhang. Scaffolding was not necessary as it was for other works in other caves, as there is a way 'under' the rock up behind the overhang. Here to the right is the panel of the 'Petit Renne', with the associated images of bison, an ibex and many animals of indeterminate species.

In 1989, an excavation was carried out in a far chamber of Les Trois Frères, covering a wide area from wall to wall. Here there was only a very thin layer of clay across the Magdalenian level, and the intention was to remove this, and leave all the finds of flints, bones and teeth revealed just as they would have been when it was abandoned in prehistory. As far as I am aware, this is the only recent excavation in this cave.

6.3.3 Enlène.

Enlène is a fairly deep cave with a high pitched roof and broad passageways, although there are smaller galleries and chambers away from the main route. Apart from a low narrow entrance, slippery mud, a few confusing twists, and a couple of treacherous drops down to the Volp 60m below (now covered), it is possible to walk upright throughout its 600m length. Perhaps because of its noble proportions Enlène was 'discovered' relatively early by prehistorians and casual walkers (1805), and the excavations which date from the middle of the last century and are amongst the earliest to have been attempted. The Abbés Poech, Cabibel and Cau-Durban, Félix Regnault, Dr. Garrigou and Dr. Filhol were perhaps the most famous, and they excavated the entrance to the cave, finding the Neolithic levels and evidence of Magdalenian occupation. This distinguished procession was limited after the acquisition of the Volp sites in 1912 by the Bègouën family, and was confined to the immediate family members and the Abbé Breuil and Emile Cartailhac.

The present excavations were lead at the instigation of M. Robert Bégouën by Dr. Jean Clottes, the Directors of Prehistory for the Midi- Pyrénées, and commenced after some preliminary reconnaissance early in 1976. The site was recognised to be unique in terms of its potential as a relatively unexcavated cave with deep Magdalenian levels, as it was hoped that modern techniques of recovery in archaeology would provide new insights into the way of life of the prehistoric occupants. One of the expressed initial aims of the dig was to try and establish the link between Les Trois Frères and perhaps Le Tuc d'Audoubert, that is, the relation between the decorated and the inhabited caves that the work of Bégouën and Breuil had already begun to establish [Bégouën & Clottes, 1977].

Yet there were other considerations regarding the conservation of the site: as is usual for the Pyrénéean sites some the Magdalenian levels are at the surface and are not protected by top soil, and are therefore vulnerable to damage by visitors to the cave, and are particularly evident to the many clandestine excavators who have broken into Enlène over the years. In addition other areas are covered by the debris of the former excavations and some by a calcite floor, and one of the first acts was to establish where the layers remained in place and undisturbed. Over the period of the excavation much of Enlène was dug, and yet because of its size, still more remains untouched: in the *Salle du Fond*, or 'ESF', for example the sectors covering 3m x 1.20m directly adjacent to the walls were left, partly as they were calcified, but partly to provide the section for the adjacent area. [Bégouën & Clottes, 1989:6].

The thirteen year excavation of material from the cave floor indicated that it was used extensively at certain points in prehistory, and during such times there was intensive use of specific areas, many of which have now been excavated. One area known as the 'diverticule gauche', or 'EDG', which leads off the main chamber close to the second entrance has finds that have been ascribed to Perigordian V, overlain by the later Magdalenian I [Bégouën & Clottes, 1984, 1985]. Evidence of Middle Magdalenian occupation is found virtually everywhere and the evidence is relatively homogenous, but the principal concentrations are in the *Salle du Fond* which lies some 170 – 200m from the entrance, close to the link with Les Trois Frères. It is in the *Salle du Fond* that traces of painting have been found in two distinct areas of the chamber. All are made with ochre in points or patches up to

15 cms across, which means that the Enlène should be classed as a minor decorated cave as well as including habitation debris [Bégouën & Clottes, 1990].

The occupation seems to have been in two distinct time periods within the stylistic period of Magdalenian IV, and these two levels occur more or less throughout the cave's stratigraphy, and are most pronounced in the *Salle du Fond* (ESF).

- Layer 1 (level a) : Magdalenian V
- Layer 2 (level b) : Stalagmitic Floor
- Layer 3 (level c to e) : Magdalenian IV
- Layer 4 : Thick Stalagmitic Floor
- Layers 5 and 6 : Clay mixed with animal remains, with no trace of human occupation.

There is considerable evidence to suggest that Enlène was used as a habitation site. Poech (Regnault 1869) and Bégouën (1912) record the presence of abundant flints in the caves, with both cores and flakes and so the evidence suggests that the knapping was done *in situ,* with the raw material coming from the Camarade/ Mas d'Azil region, (Bégouën 1921). Evidence of antler working in the form of cut and prepared pieces (Bégouën, 1912) is found throughout the cave, but principally in the *Salle du Fond* where most of the decorated artefacts are found. In the Magdalenian level under a calcified layer were found some perforated plum and cherry stones (Bégouën 1912) and even some grains of wheat (1936) although Breuil at the time asserted that they had been brought in by rodents. Yet Bahn details the recovery by Piette of similar finds, and concludes that they are possibly attributable to the Palaeolithic, (Bahn, 1984:257).

6.4 Enlène: Sites within Sites.

This section concentrates in describing the excavated areas in more detail. A brief description of the excavation techniques is included to demonstrate the efforts to recover the maximum amount of material from the site. As the material for my fieldwork was drawn from every part of Enlène, there follows a brief description of certain 'sites' within the cave, and reference is made to some of the most notable finds from each area. Three areas are described in detail and were included as the most representative sites within the cave. EDG is an area close to the original entrance to the cave, whereas ESM is towards the back of the cave where it is joined to Les Trois Frères. The third site of ESF is at the furthest end of the cave where the heaviest concentration of habitation debris was recovered. These areas are illustrated on a plan of the cave in Figure 6.3.

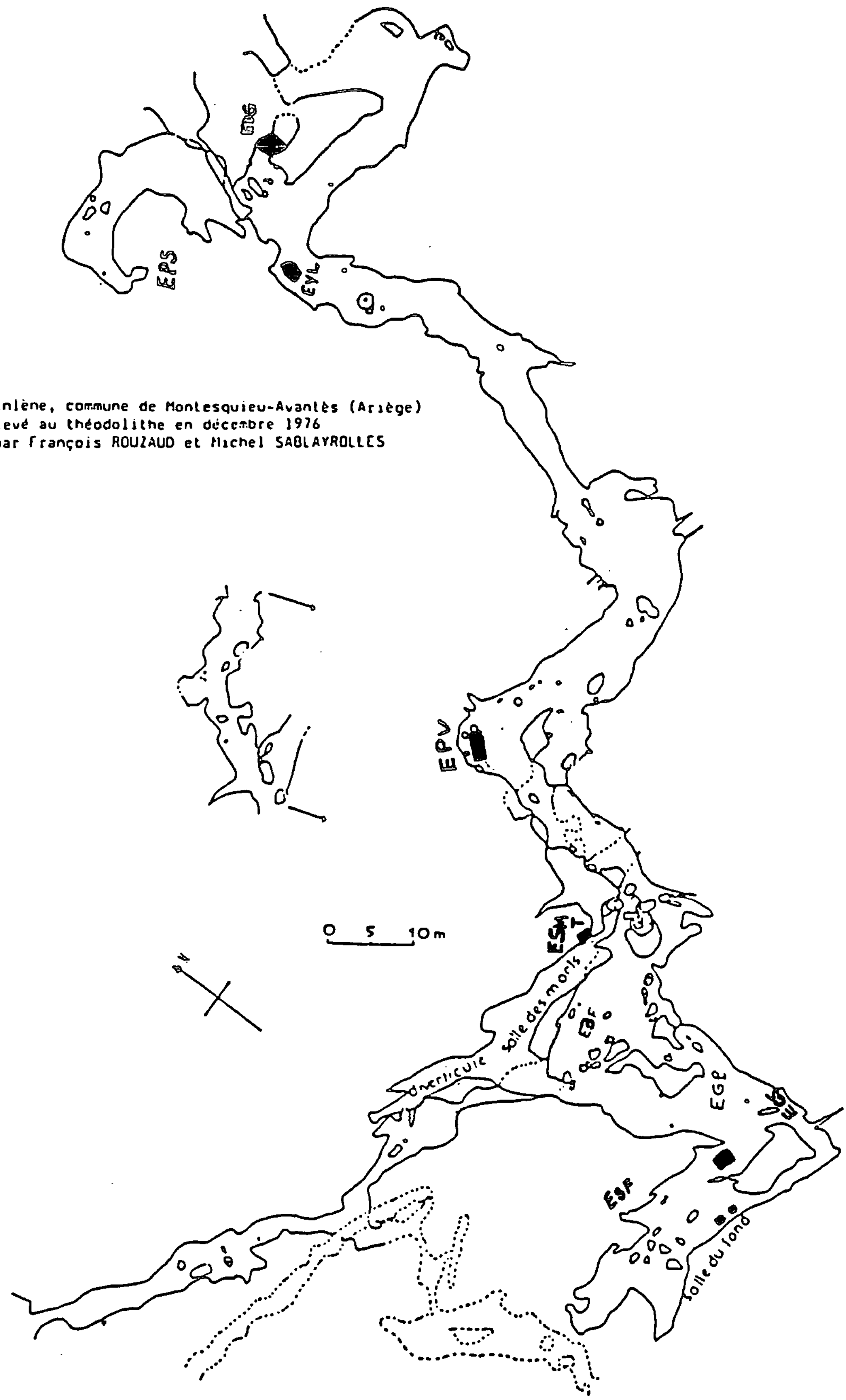
6.4.1 Dishing the Dirt: Recovery Techniques.

All areas of Enlène were excavated meticulously, which has helped to maximise the recovery of finds. This will prove to be crucial in the future when more detailed comparative studies will require exact methods and recording techniques in order to open up new sources of information. The area surrounding the sites were bounded by scaffolding, and by using a system of ladders and ledges the excavator and 'assistants' were suspended at anything from a few inches to a rare and uncomfortable couple of feet over the exposed layer. The advantages of this method were firstly that a large area could be completely exposed, without the need for walkways between. Also because the uncovered clay remained moist, all the important hollows and imprints could be eroded by some one kneeling on them and, equally, fresh ones could be made! In ESF there were a number of imprints, possibly footprints, and almost certainly traces of some form of human activity. As the cave narrowed at this point, all the floor level was excavated, and thus a representative picture of an individual layer can be reconstructed. A thorough sieving of all the material was made once back at Pujol, using jets of water and progressively reducing the mesh used from 10mm to 5mm to 1.25mm. As a result most of the bone, flint and micro fauna was recovered.

6.4.2 ESM : Enlène, *Salle des Morts.*

This area was named after the quantity of Middle Bronze Age burials that were recovered by both this and previous excavations. These remains were particularly vulnerable to looters, who easily identified the surface features. Over 3 000 items of human remains have been recovered, including 925 teeth from at least 45 – 50 individuals, with a relatively high proportions belonging to juveniles [Bégouën & Clottes, 1981:3].

Figure 6.3 — A Map of the Cave of Enlène.



The Magdalenian levels were located in 1977 under a thick layer of stalagmites that were carefully removed aided by the use of a dilute acid. In a fissure between two rocks at the entrance, there were lots of *esquilles* and the pierced incisor of a horse, a bear canine and a complete arrowhead, [Bégouën & Clottes, 1982:4].The finds included a needle and a *perle á béliére en jayet*, identical to some found at ESF, and therefore providing evidence of the contemporaneity of the two sites. Also close to the entry to ESM, on the left hand wall, there is a piece of antler deeply planted in the soil, like those found in ESF. Yet in other respects this site differs in its nature as the number of plaquettes recovered is less, and there are two arrow heads of the Lussac-Angles type that have not been recovered from ESF - unless some that were recovered by Louis Bégouën came from there, but as he excavated primarily in ESM it is likely that they did not [Bégouën & Clottes, 1981:3]. In addition it is possible that this area was occupied prior to ESF, which is plausible as it is closer to the entrance to Les Trois Frères. Dates have been made of 13 950 BP. + 250 whereas for ESM it is 12 950 BP. +/− 140.

Two hearths were recovered in depressions made in the clay only 20cms away from one another [Bégouën & Clottes, 1977,78], (Bégouën, Clottes, Giraud & Rouzaud, 1989). The carbon was analysed by Mme. Delibrias and dated to 13 940 +/− 250 BP., that is 11 990 BC. which dates the level to the middle Magdalenian, thought to be IV. However further work on the material from the top of the level gave the inconsistent dates of 10 080 BP. +/− 230 and 2 200 BP. +/− 120 (Bégouën, Clottes, Giraud & Rouzaud, 1989). More hearths were discovered in 1982, of the basin type peculiar to this area. The report describes them as follows; 2.50m into the chamber, 1.20m from the left wall, there is a steep-sided, practically circular basin (57 - 55 x 15 cms) filled with burnt material, but no evidence of wood; only 40cms away on sloping ground there is a smaller hearth (32 x 26 cms) with blackened material at the base, and immediately adjacent there is another (40 X 42 X 7 cms) with a blackened bottom and the wall at the side is similarly charred [Bégouën & Clottes, 1982:4].

There is another large hole (1.40 x 1.00 x 0.25 m) in the middle of the area, close to the passage to Les Trois Frères, with two other holes cutting through. The larger of the two, (38 x 36 cms) with a variable depth, had constructed walls with traces of carbon, and the other has similar traces (32 x 20 cms). Less than a metre away

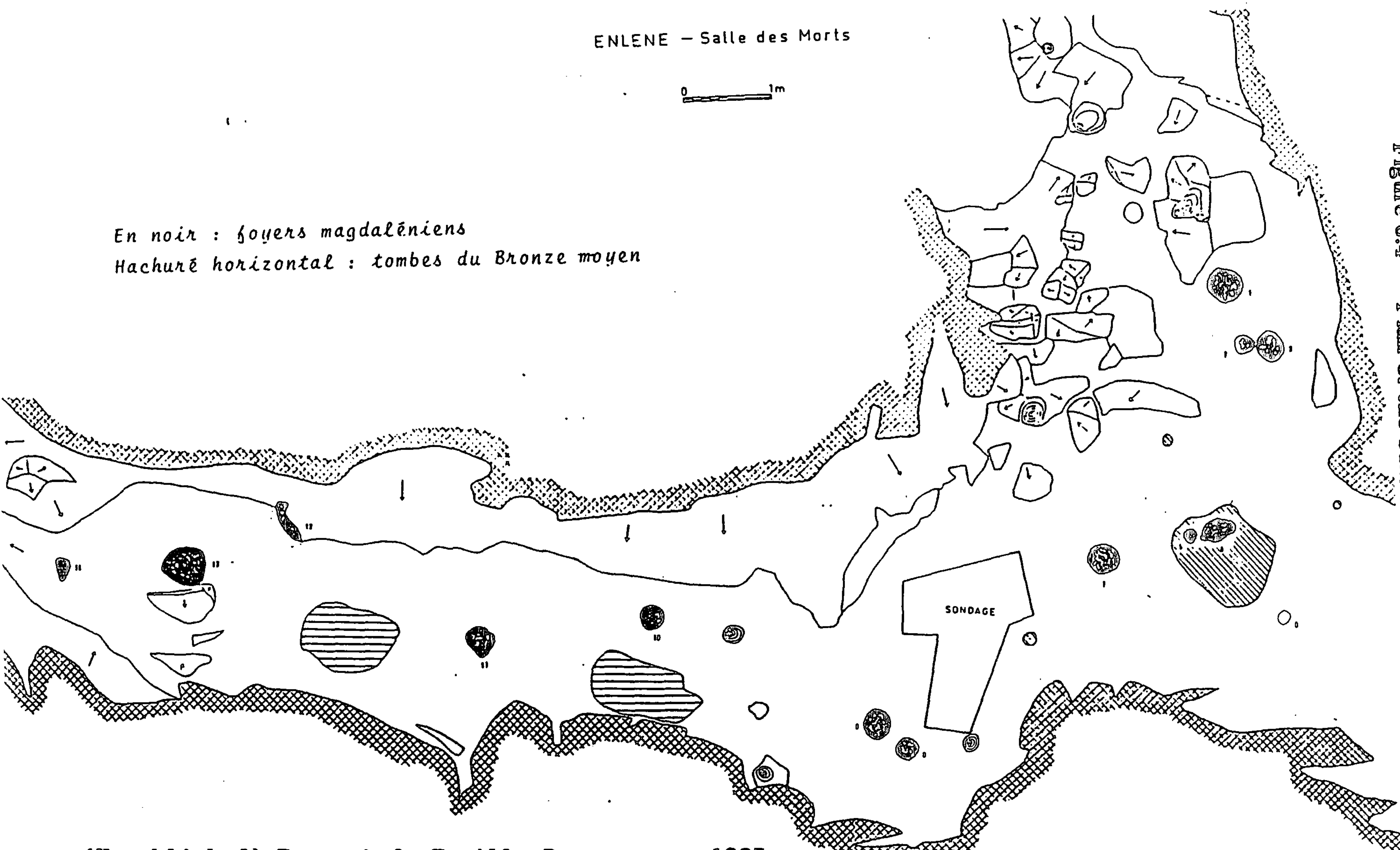


Figure 6.4 — Plan of the *Salle des Mortes.*

(Unpublished) Rapport de Fouille Programmee, 1985.
R. Begouen & J. Clottes.

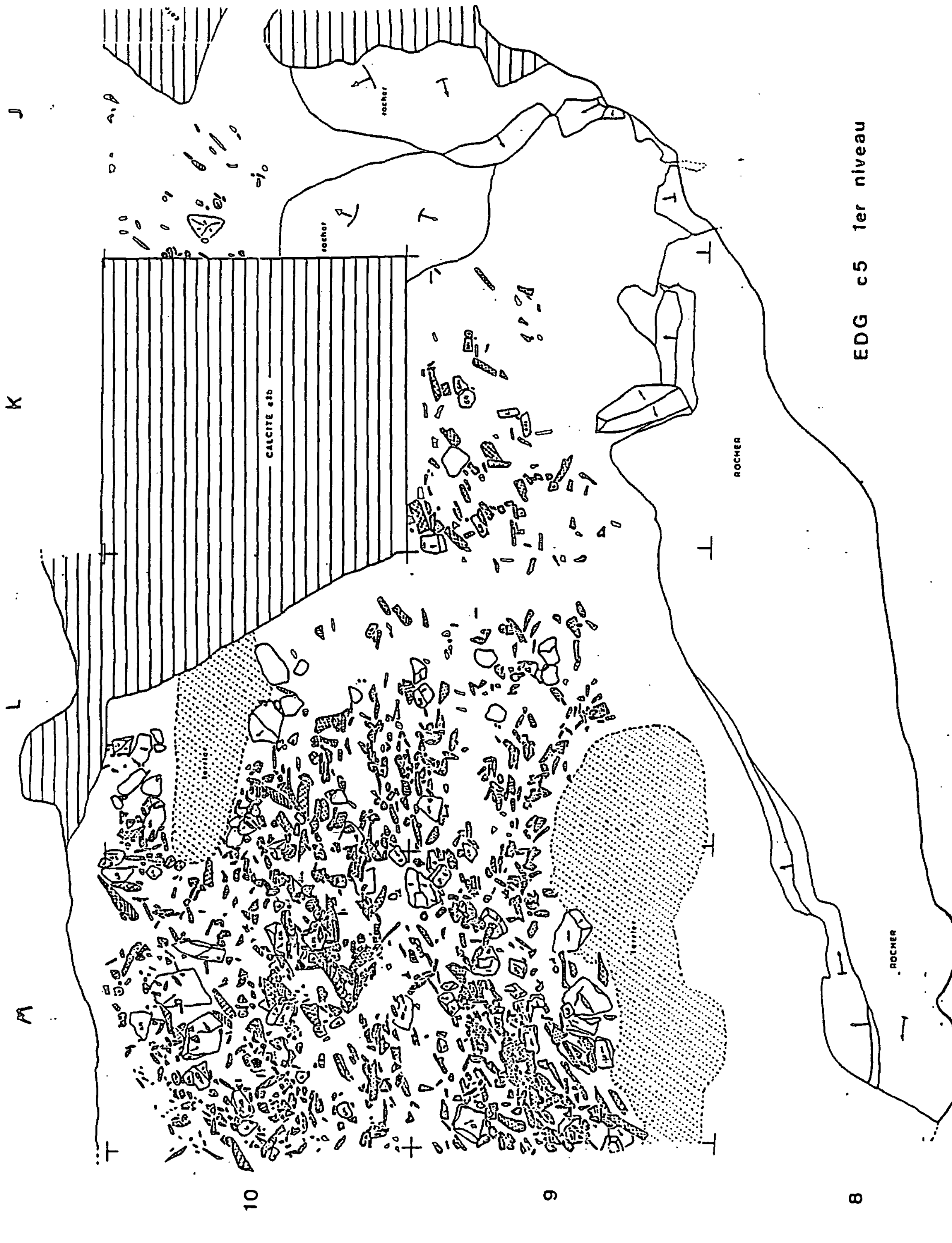
there is another basin (47 x 42 x 15) with steep walls and plenty of ashes, but no real traces consistent with it being used as a fire. 1.20 m from this there is an oval hole (24 x 13 x 30 cms), but the line of the base follow the line of a probable burrow, as there is another (16 x 11 x 15 cms) only 80 cms away. To the right, against a wall, there is another basin with a layer of carbon over the base, (30 x 20 cms). Finally there is another basin made in the clay 65cms in diameter leaning against a rock (100 x 50 x 25 cms) which has left a blackened zone. (Bégouën, Clottes, Giraud & Rouzaud, 1989). There are other holes in the area, including two 'ditches' both along a wall. The soil is chaotic, and in the left corner there are two holes (150 x 70 cms) and (20 x 30 cms) that appear to have been for bronze age burials, as although there are Magdalenian remains at the bottom, there are human bones and pottery above. The second ditch is larger, (140 x 90 x 30 – 50 cms), with no trace of it being a hearth. Yet only 70 cms away on the stalagmitic floor there are marks of a contemporary fire. The final feature of this nature is an almost circular hole 26 cms from the left wall, (15 x 13 x 23 cms) which is thought possibly to be the remains of a post hole [Bégouën & Clottes, 1982].

In 1977, the levels were taken down in the area to establish the stratigraphy of the sector, and by the time the cave floor was reached ten levels were recognised. These have subsequently been shown to be the characteristic pattern for the cave; level 3 is the Magdalenian, with those below (4 – 10) comprising levels of stone and clay. With the exception of level 5, which contains faunal remains predominantly those of cave bear, they are apparently sterile [Bégouën & Clottes, 1977].

6.4.3 EDG, Enlène, Diverticule Gauche.

This site is located in a smaller chamber close to the later second entrance. The site has been dug to a considerable depth over the years as the material had been piled up by subsequent occupations nearly to the roof, and from there it seems to have gradually slipped under its own weight into the length of the chamber, which means that there has been *lateral* disturbance to the levels [Bégouën & Clottes, 1983, 1984]. The oldest levels above the bedrock were obviously sterile, but above that there were the remains of cave bears who seem to have utilised all the Volp caverns over the Aurignacian. Levels 10 – 6 are not thought to be actual habitation levels, but do have intrusive finds from the later occupation [Bégouën & Clottes,

Figure 6.5 — Plan of Enlène, Diverticule Gauche.



(Unpublished) Rapport de Fouille Programmee, 1985.
R. Begouen & J. Clottes.

Figure 6.6 — Bones from Enlène *Diverticule Gauche*.

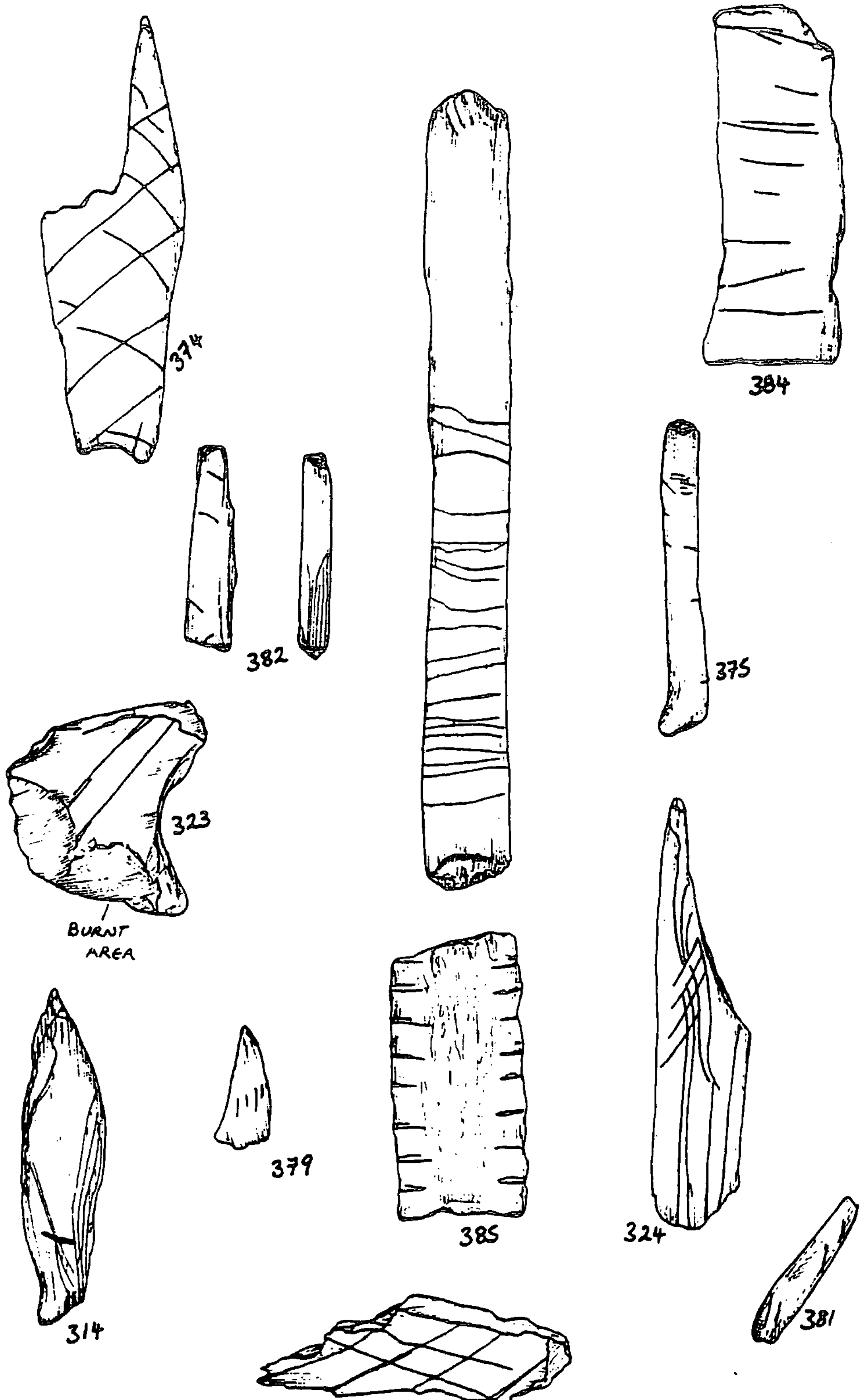


Figure 6.7 — Bones from Enlène *Diverticule Gauche.*

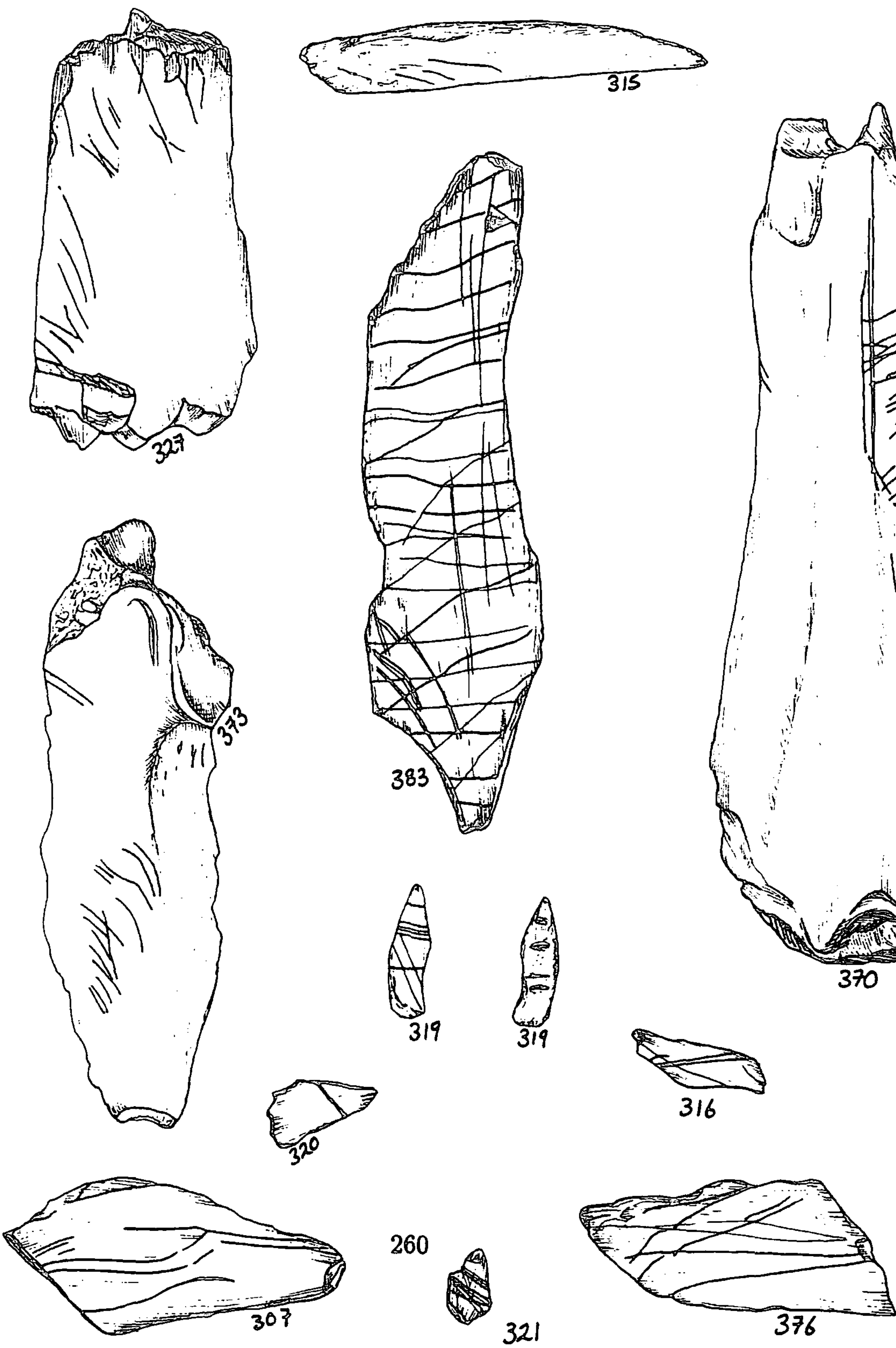
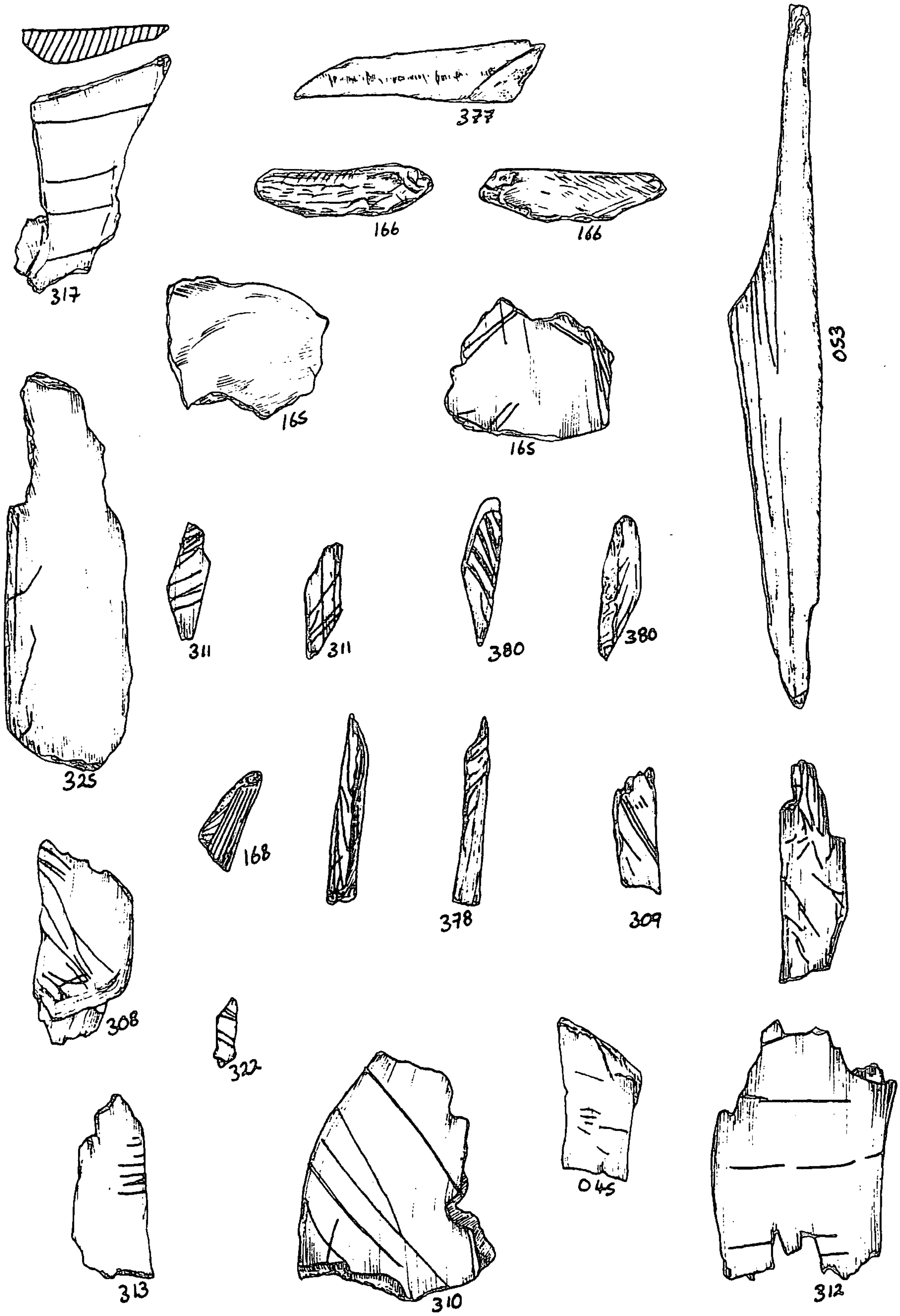


Figure 6.8 — Bones from Enlène *Diverticule Gauche.*



1984, 1985]. The human evidence started some Gravettian but principally with the Perigordian V, dated both by the stratigraphy and the flint typology of Gravettian points and later Noaille burins [Bégouën & Clottes, 1984, 1985:8]. Dates were taken from some larger bone fragments using Radio Carbon Dating, which gave a date of 24 600 BP +/− 350, that is, *c.* 22 650 BC [Bégouën & Clottes, 1985:9].

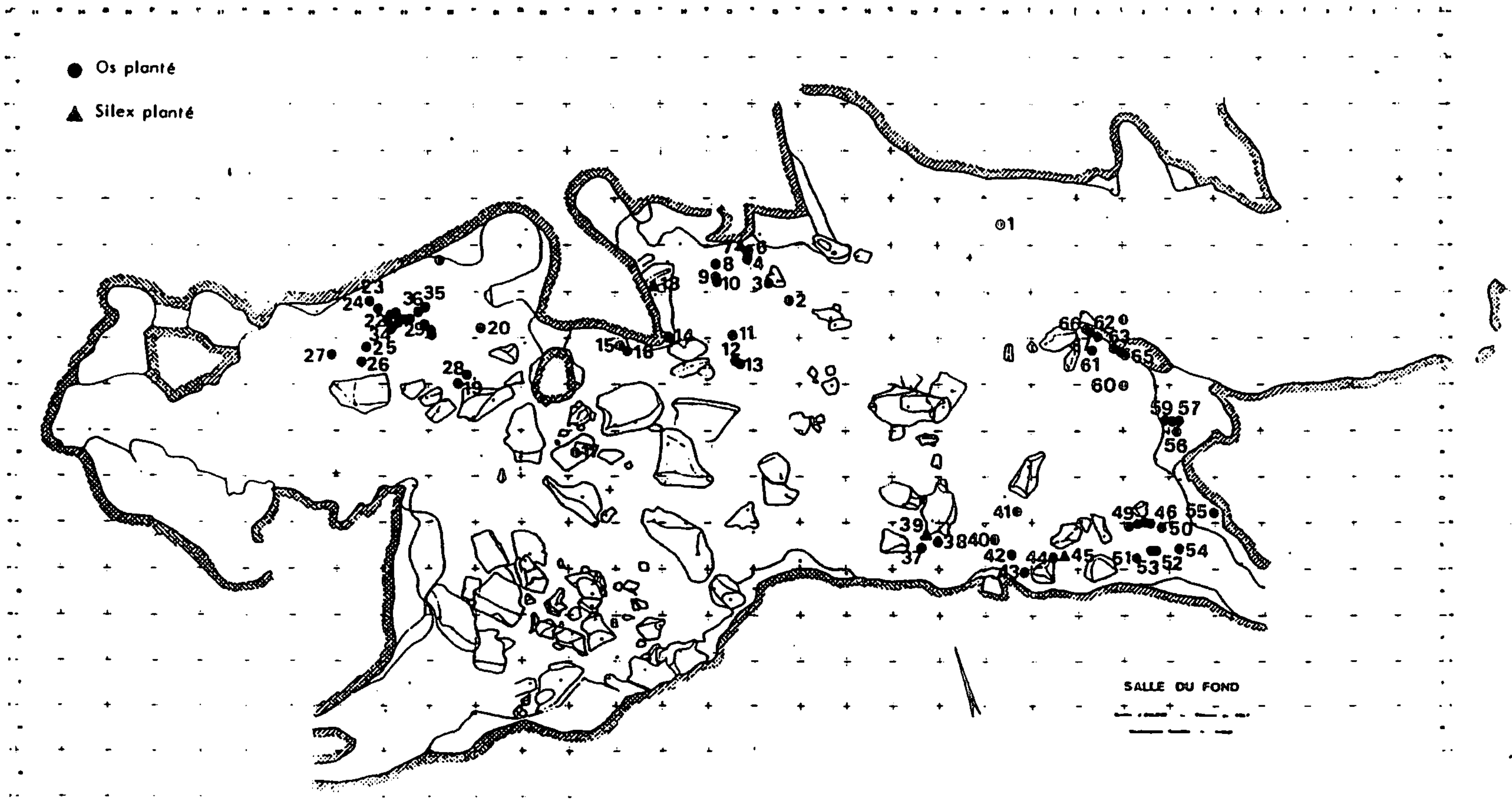
One of the most noticeable features of the finds from this area were the number of flints that littered the area. Most of them were whitish and thus possibly came from the same source. Apparently the source of this flint has not yet been discovered. The other finds included some sandstone plaquettes and numerous fragments of unworked bone. There are some engraved and worked examples of bone although these are not as numerous as for ESF. A number of the bones recovered from both layer 4 and layer 5 are illustrated on the following pages. This layer is overlain by level 4, which includes what was first thought to be a mixture of Perigordian and Magdalenian material. However the number of raclettes and the nature of the bone artefacts lead the excavators to conclude that this was early Magdalenian I, or Badegoulien [Bégouën & Clottes, 1984, 1985]. Other finds from level 4 are numerous bones, with some pierced teeth, bone tools, needles.

Overlying this is layer 3 which includes mainly middle Magdalenian finds of bone and flint. However there are a number of later finds which means that the layer is contaminated by the Bronze Age layers above in layer 2. These include remains of snails and charcoal fragments, separated from layer 1 by a thin layer of calcite. Layer 1 belongs somewhere in prehistory, although there are no real finds to date it, and this too has contaminated the Bronze Age finds below [Bégouën & Clottes, 1985:7]. Therefore only the level of Perigordian V is completely untouched, although the probability is that layer 4 is not a mixture of Perigordian finds, but early Magdalenian. Some debris from earlier excavations was known to have been 'dumped' close to the entrance of EDG. Obviously the stratigraphy was lost, but in 1989 the remains were sieved and finds were recorded as EYL [Bégouën & Clottes, 1989].

6.4.4 ESF: Enlène, *Salle du Fond.*

The evidence for Bronze Age occupation extends to the *Salle du Fond* as there is a small fire in N.8. (40 x 25 x 30cm) and shards of pottery. Also a piece of

Fig. 3. — Enlène, Montesquieu-Avantès (Ariège) - Salle du Fond.
Répartition des objets planté dans les fissures de la paroi, essentiellement des os.



Dessins S. Lacombe, Fig. 5.15.
(Unpublished) Rapport de Fouille Programmee, 1990.
R. Begouen & J. Clottes.

Figure 6.9 — Plan of the *Salle du Fond.*

bronze plate that can be dated to La Tène. In M.8 there is a small fire in a slight depression on the surface, (50 x 20 x 25 cms) with two stones above and two fragments of pottery which date it to the Bronze Age period (Bégouën, Clottes, Giraud & Rouzaud, 1989). The digging went down in 'spits' from layer c to h, and it is important to remember that these 'layers' are conceptual rather than actual. One feature of this sector are the burrows that cut through the area, recognisable by the comparative looseness of the earth, and the various directions they take, always parallel to the level in question [Bégouën & Clottes, 1977, 1981, 1984].

One problem with the excavation is that the previous digging is right in the center of ESF [Bégouën & Clottes, 1977]. However the area is fairly recognisable, and the present work has isolated the regions and sifted the debris that filled them. The other significant disruptive element has been the burrowing of rodents, who have created entire networks in the debris for thousands of years – their work evident by a change and looseness in the soil and material, and their morphology by the thousands of tiny bones that appear in the fine meshes of the sieves [Bégouën & Clottes, 1981:4]. Why they too chose to live so far back into the cave is also a mystery unless they entered by another entrance that is now not evident. Their presence is sufficient to disrupt the stratigraphy for example in N.9 it is so bad that two fragments of Neolithic pottery were discovered in layer 3 [Bégouën & Clottes, 1985:7].

There are a number of questions that need to be answered for this section of the cave: why was the occupation so deep into the cave, and did it extend to the other areas? Why did they occupy the same place year after year, choosing to live in the debris of their predecessors, or was their motive to be close to the passage that links Enlène to Les Trois Frères?

The work commenced in this area in 1977, and started with trial sampling over 6 metre area to establish the regions suitable for excavation. Even this preliminary work revealed the pattern of stratigraphy that is common to this sector, namely two levels of Magdalenian occupation separated in most places by a calcite floor [Bégouën & Clottes, 1985]. The upper and later occupation is quite thin – at times 15 cms but generally only 1 - 5cms, and in some squares on the grid sector is absent. The amount of material with no sterile sedimentation between indicates a long and virtually continuous occupation of the area [Bégouën & Clottes, 19].

In 1980, the earliest occupation in the area was discovered in O9e under an area of concretion sealed by the most recent levels. Layer e itself lies on a bed of pre-Magdalenian yellowish clay from layer 5 *argile á ours*, and it is under this that the inferior level lies, 2 – 3 cms deep and characterised by extremely well conserved bones [Bégouën & Clottes, 1980, 1982]. Found also in O.N.M.8 – 9 with the same scatter of clay, and when not covered in ochre, or mixed with clay, there first Magdalenian levels are generally dark brown and firm, with plenty of burnt bones, and littered with flint. The clay is occasionally mixed up to form a greyish-yellow mélange as in Q.R.9 and R.8, and in places the layer disappears and e and e inf. are indistinguishable. This is not a natural formation in the sediment, as still more of this clay is found even higher up in the disturbed areas of N.8 and 9. The dates of this layer is 13 400 BP. +/– 120, 11 450 BC. as opposed to 10 950 BP. +/– 140 for the other layer [Bégouën & Clottes, 1983:4].

There are far more stones in layer 1 than in layer 3, some pieces of calcite 5 – 15 cms. In N.9 at the bottom of layer 1 on the calcite floor there is a hearth 40cms in diameter [Bégouën & Clottes, 1980:4]. In L.M.N.13-14 layer 1 is patchy and thin and there is no evidence of layer 2. The previous excavations had made a large hole in this area but the area around is in place [Bégouën & Clottes, 1980]. The layer is thin in P.8 – 9, and is absent in places, although there is a band of deposit to O.8, with plenty of stones and some rare artefacts, namely *plaquettes* and *esquilles.* There are also two large blocks in the vicinity of P.9, with traces of disturbance and fragments of stalagmites in the area. In Q.R.9 –8, here the layer slopes down to the entrance to ESF over a 150 cms area perpendicular to the wall [Bégouën & Clottes, 1978]. In Q.R.10-13 layer 1 is for the most part sterile and extremely thin, perhaps as a direct result of its position on the main axis of the entrance. In N.O.8-9 at the base of the layer of calcite that forms layer 2 there is a cavity in the clay that looks as if it is the void less by the decay of a piece of wood [Bégouën & Clottes, 1980].

Layer three marks the beginning of the material attributed to the Middle Magdalenian. In Q.8 there is an animal burrow 50cms long where the remains are extremely

Figure 6.10 — Bones from Enlène *Salle du Fond.*

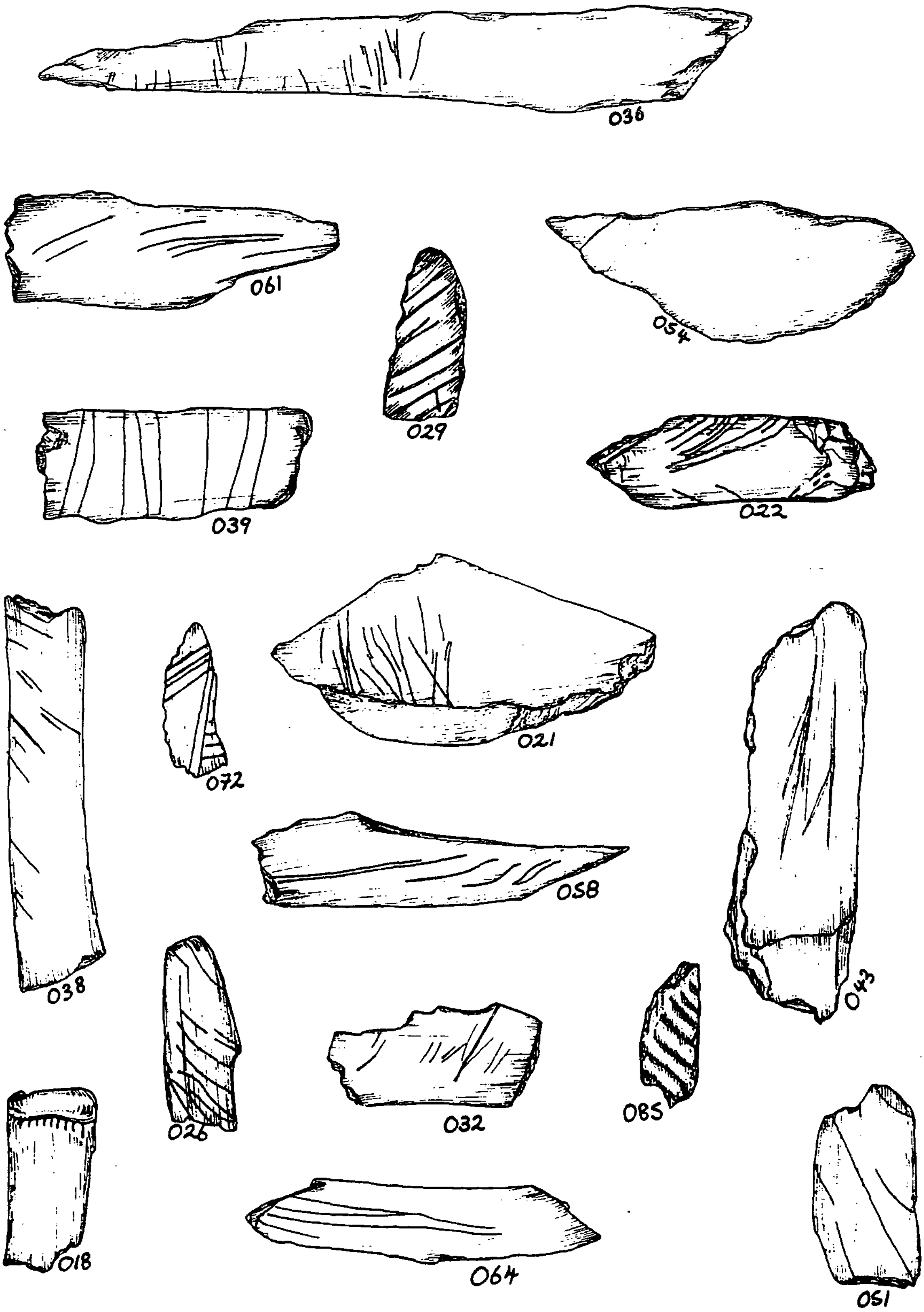


Figure 6.11 — Bones from Enlène *Salle du Fond.*

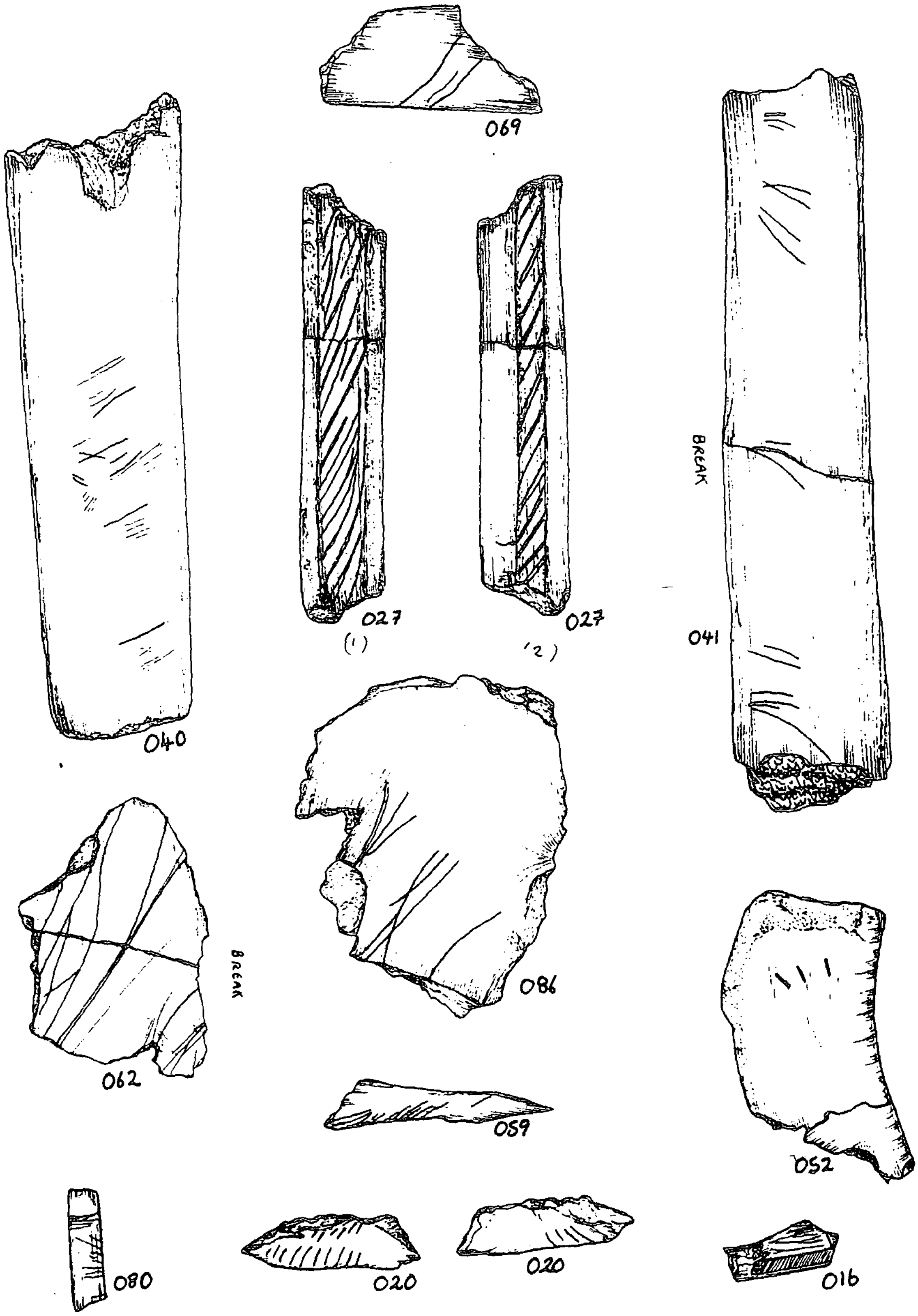


Figure 6.12 — Bones from Enlène *Salle du Fond*.

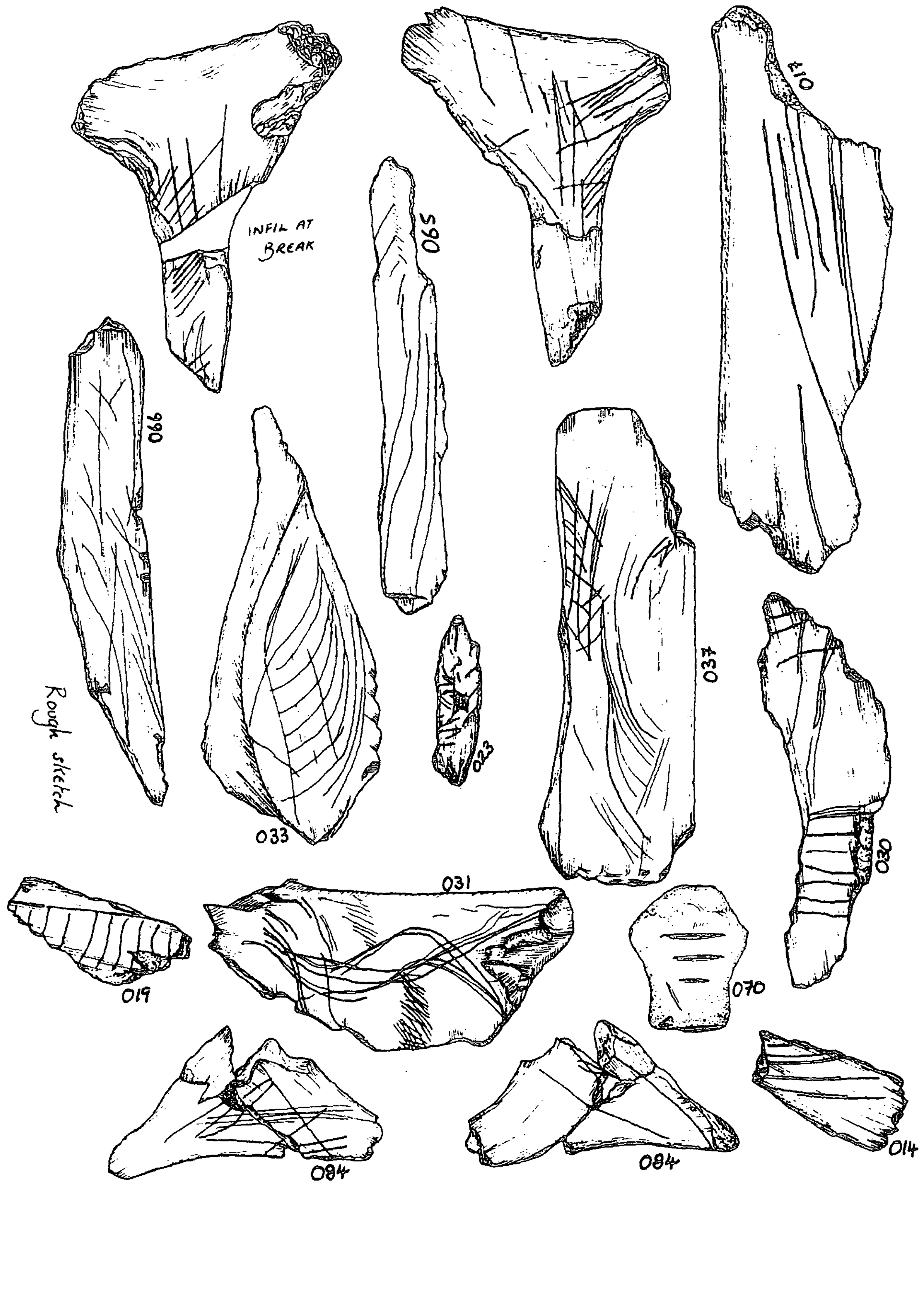
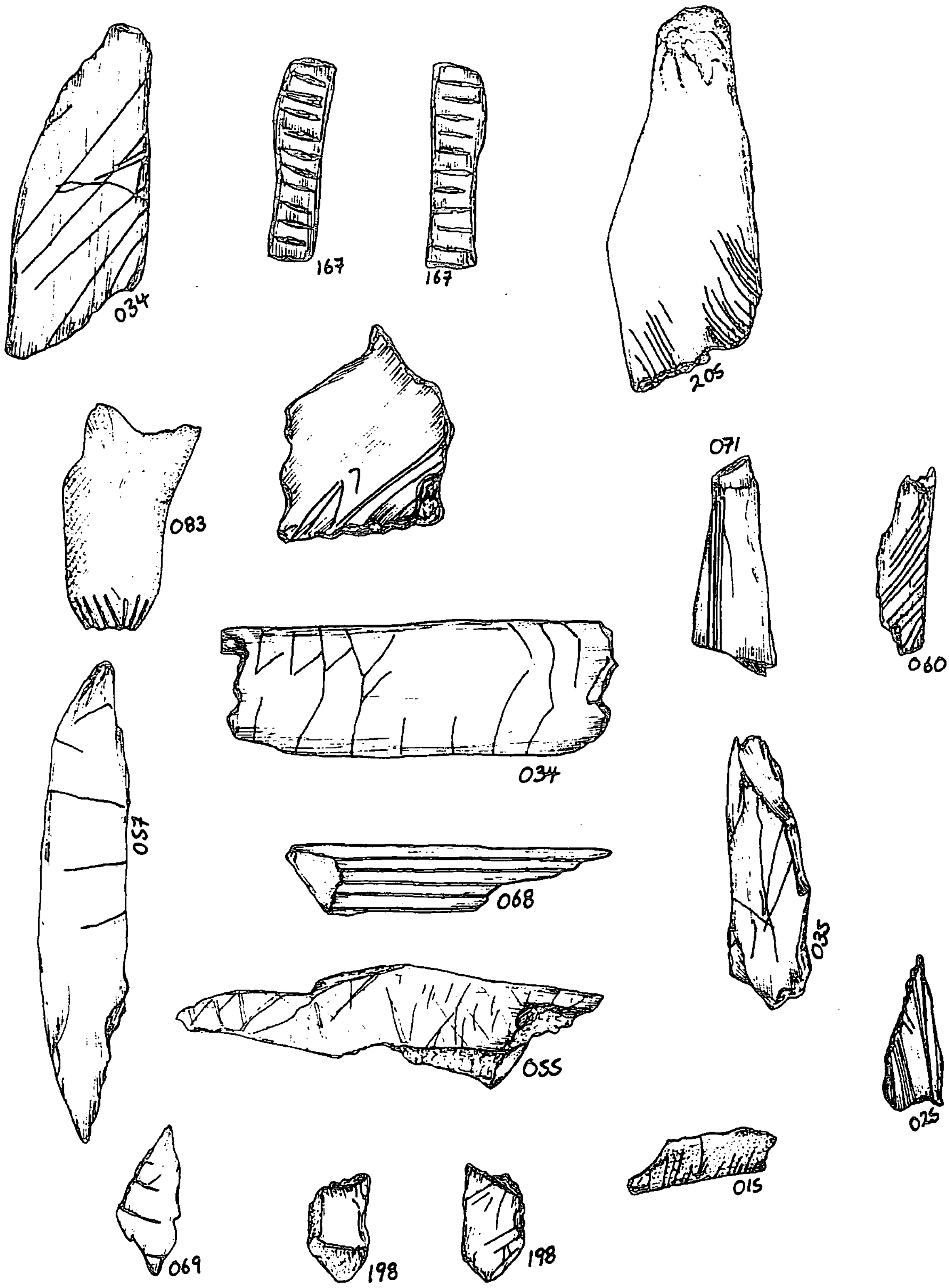


Figure 6.13 — Bones from Enlène *Salle du Fond.*



disturbed, in P.9 between the two blocks at the entrance the layer is crushed by two overlying rocks, and into P.10 the area continues with lots of stones around. Similarly in level d in Q.R at the axis of entry into ESF the rich sediment is crushed, and further disturbed by the burrowing rodents which have occasionally collapsed and the remaining plaquettes and bones lie at oblique angles [Bégouën & Clottes, 1983]. A selection of bones from the layers of ESF are illustrated on the following figures.

Due to the meticulous methods the work in this area was inevitably slow. In the immediate area within ESF there was a large pit filled with flints and bones. Half of the pit had been excavated in previous years, and other slightly different pits had ben found in the adjoining chamber that constituted the rest of ESF [Bégouën & Clottes, 1981:6, 1988]. These pits were the most interesting feature of the area. All had been carefully dug to a couple of feet or so, and then filled with what is presumed to be occupational debris, namely lots of bone, flint, and some stones and plaquettes. The layers are often very distinct, and it appears that the pits were either carefully filled with clay after each deposit, or some time may have elapsed between each infill [Bégouën & Clottes, 1981:5]. At one place where I worked, it appeared that a second and even a third pit had been dug into the initial pit, thus suggesting some degree of continuity in their location.

One small area in S.14 is calcified to form a breccia along the left hand wall which is so hard that it had to be removed in blocks, the rest left to provide the section. However in R.S.8-9 only 1m was left in place as the line of the wall comes forward in this area. There was a quantity of burnt material in all the pits, thus suggesting the repetitive construction of hearths (Bégouën, Clottes, Giraud, & Rouzaud, 1989). These would have been essential not only for light, that could have been supplied by torches, but for heat. Although the cave occasionally seemed warm compared with the cooler summer days outside, as it was free from all draughts and winds, it was necessary to move to keep adequately warm, and often after a couple of hours slow digging and recording I was really very cold. Although there were patches of clay stained by the traces of ochre, surprisingly no lumps of ochre had been found. Also in a couple of the pits, a large number of flints were discovered.

EPV, Enlène, près du Volp.

The excavations in this area commenced in the final phases of the excavation in 1989 and 1990. The site was selected for its location on a wide bend almost exactly half way between ESF and EDG at the entrance and 20m away from the fissure leading to the active layer of the River Volp. The remains of old excavations in the area had left a hole 1.90m x 1.30m x 0.50m in the thin layer of calcite that covers this area of the cave, and the area had some animal burials and so it was necessary to isolate an undisturbed area to establish the stratigraphy of the area. [Bégouën & Clottes, 1989:1]. Layer 1 is comprised of a thin clay layer with some Bronze Age pottery fragments, but also later intrusive finds and at the base is a small thin layer of calcite.

Layer 2 yielded a few Magdalenian finds, with the real concentrations occurring in the thicker layer 3, where there were finds from the Middle and Early Magdalenian., The exposed layers were full of bone, plaquettes and flints, with concentrations of burnt material that indicated a hearth [Bégouën & Clottes, 1989]. In fact there were several such hearths, all in different layers, which suggests that the spot was a 'fireplace', rather than the chance location of one specific fire. The principal objects to be burnt were bones, which proved beyond reasonable doubt that they were utilised as fuel. The fourth layer was full of stones and with a few intrusive finds.

The fact that this site did yield the full range of finds that are characteristic of Enlène, with some beautifully worked pieces of bone and engraved plaquettes, suggests that the full length of the cave had been utilised at various times in prehistory. The bones are similar in form to those found in the other areas of the cave, and are illustrated on the following pages. However once this area was exhausted, it was taken down to the bedrock and the ancient river bed, and the geologist was called in to confirm the stratigraphy and the underlying geology. This analysis was to be carried on at all the other excavated areas. The other work in this area consisted again of removing any debris from the old excavations for sorting. This small excavation confirmed the possibility that the entire length of the cave of Enlène is full of layers of habitation debris. The stratigraphy is roughly the same as elsewhere in the cave, specifically same long Middle Magdalenian

Figure 6.14 — Plan of Enlène, près du Volp.

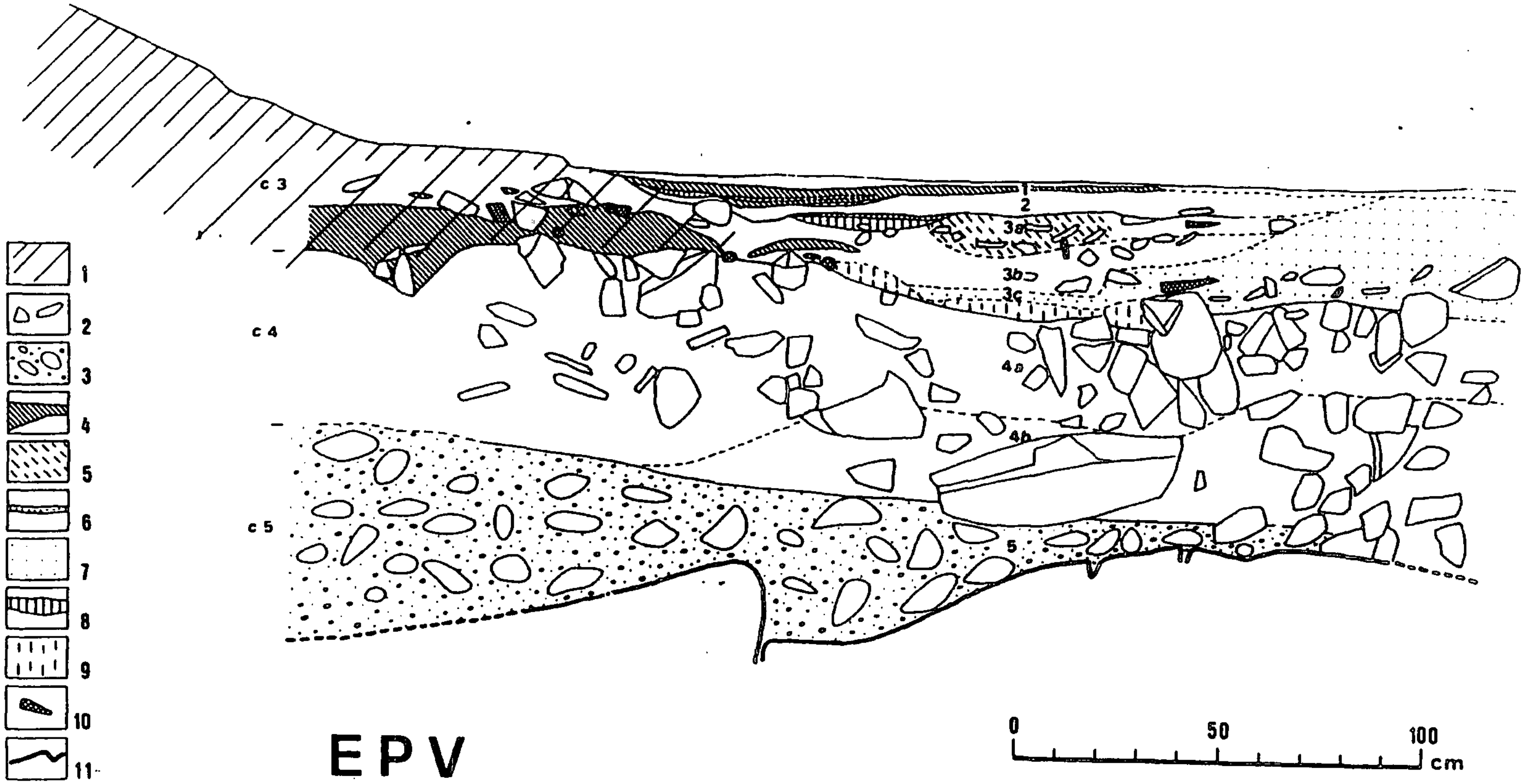


Fig. 1. — Enlène, Montesquieu-Avantès (Ariège) - EPV. Coupe N → M (6-7-8); les niveaux magdaléniens reposent sur le haut de la couche 4a; les couches 4 et 5 sont stériles. 1, Concrétionnement; 2, cailloutis dans argile jaune; 3 graviers et galets alluviaux; 4, lit de couleur noire; 5, lit charbonneux; 6, lit cendreux de couleur blanche; 7, lit très cendreux, de teinte grise; 8, lit rubéfié (rouge); 9, niveau de teinte rose; 10, ossement; 11, substratum calcaire.

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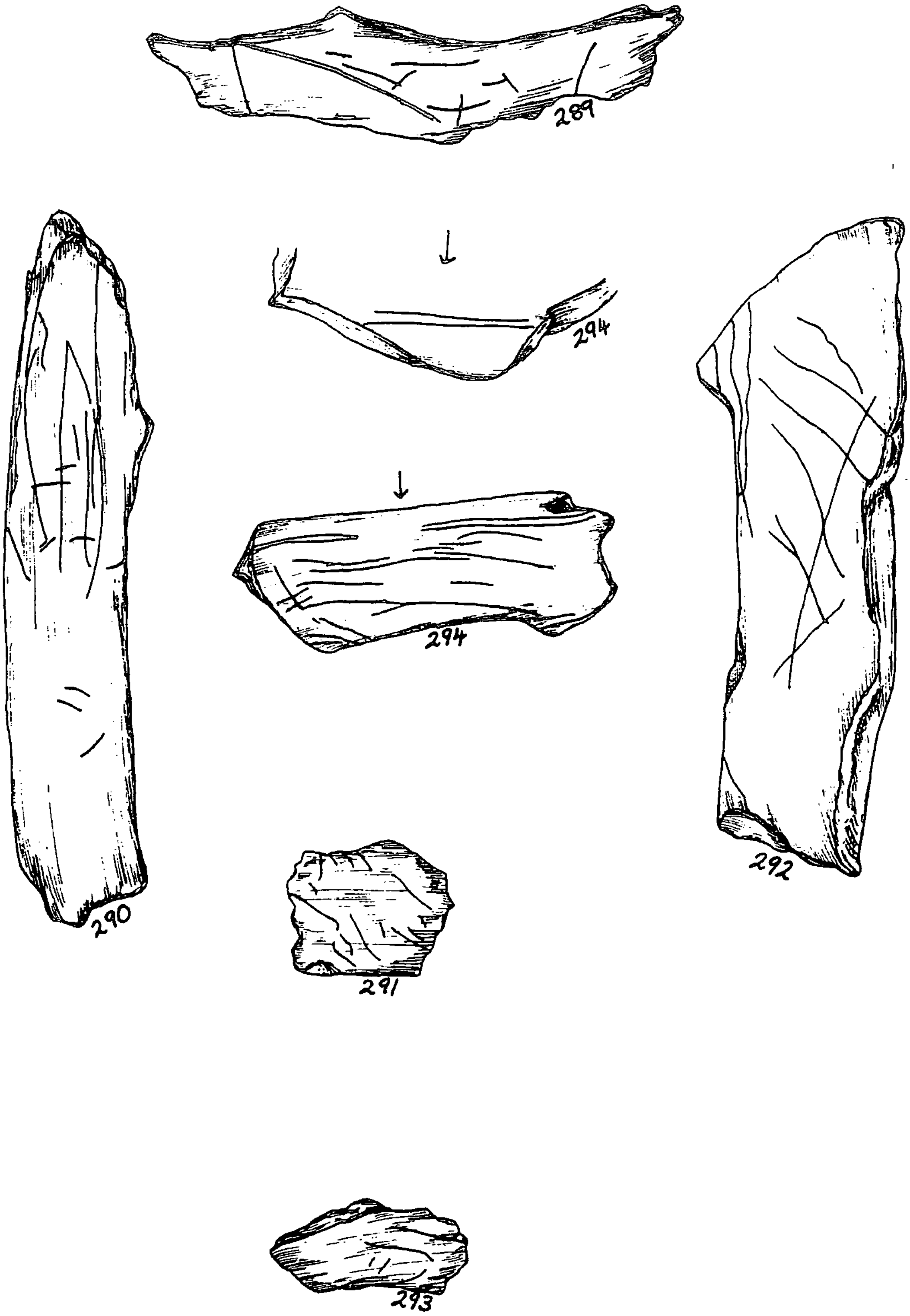
Figure 6.15 — Bones from Enlène *Près de Volp*.



occupation as ESM and ESF with the same calcite layer and then clay layer as ESF. The latest layers of Bronze Age occupation correspond with those of ESF and of course ESM [Bégouën & Clottes, 1989].

6.5 Putting the Data in Context.

'Despite the fact that most engraving or treatments of bone-antler implements and pieces of raw material are not visible even at relative proximity, their very portability and the fact that some are and some are not engraved enhances their rôles as potential informers on stylistic groups.' Conkey, 1978:80.

6.5.1 Introduction.

Having looked at the wider context of Enlène, as part of the 'Southwestern area', as part of the Magdalenian culture of Ariège, and as part of the Cavernes du Volp, the following discussion concentrates on what information can be extracted from the excavated material from the cave. The stated aim of this section is to isolate a data set from a single area and to examine it in detail. This is to counter the common prejudice that this data is uninformative and meaningless, yet until researchers concentrate on trying to understand its distribution and common characteristics, they won't be able to establish *why* they can afford to ignore it. This neglect of this data is perhaps why Marshack's work was so readily accepted by some, as the theories were attractive and it appeared to solve the problem without anyone having to go to the trouble of properly formulating the question.

The question is, what can we observe about these bones? What data can be assimilated to enhance our understanding of the non-figurative engraved artefacts and how does trying to understand the context of these artefacts actually help? The reply isn't perhaps as reassuring as one would like, but if common properties, shared principals, evidence of selection and refinement can be identified either within or amongst this class of data, our understanding and knowledge of the bones has already increased. Over the years of excavation a great quantity of material was recovered, mostly bone, although there was also a significant number of plaquettes and flints. During the excavation the bones were sorted into groups, which can be summarised very generally as:

- Bone that is unmarked, and thus presumably the residue of meat-eating in the cave.
- Bone that is marked, but in such a manner as to indicate cut-marks, which are the result of butchery practices.
- Bone that has been worked in some way, either to form a tool, or a decorated item, such as a *rondelle.*
- Bone that has not been worked, but is marked in such a way as to imply deliberate human action, yet unassociated with butchery practices.

6.5.2 Any Iconicity?

It is the material from the last category that was of primary interest to my research although any 'iconic representations' which might have fallen into either this category or that of point three were for the most part excluded from my study except the five bones indicated on the Table 6.1. As the bones had been sorted before my arrival, and my access to other material was restricted, there were few bones on which 'iconic representation' could be found, (see Chapter II and the glossary for my definition). There were a couple of examples however, that appeared to have been engraved with the express purpose of recording the image of a known natural form, and was therefore classified as 'representational'. Knowing from my research into other engraved artefacts and the engraved cave walls, particularly in the region of Ariège, that there are a few standardised 'stylistic' points in this extensive and varied repertoire, I was tempted to conclude that some configurations of lines on a fragment might be indicators that this is the broken piece of a representational image.

The bones from Enlène have been classified as either *gravé* or *strié* depending on the nature of the engraved marks. Of all the material recovered, this most numerous category, which numbers upward of 1 000 examples, is perhaps the most difficult to classify; firstly because of the sheer number of examples and secondly because of the nature of the marks which can range in appearance from thin faint streaks, *strié* to thick engraved lines *gravé*, and any combination of both. Furthermore, these can either smother the bone or be confined to one area, and perhaps the most

Table 6.1 — The Recognition of Iconicity.

Name of Site	Identifiably Iconic	Pierced	Not Iconic
E?			11
E	1		16
ECS			6
EDGc4	1		46
EGP			19
ELB			21
EPS			42
EPV			11
ESF	3	1	174
ESM			5
EYL			3
E3F			8
EDGc5–8			93

frustrating aspect of all is the fact that they are all broken and thus potentially 'incomplete'

This section deals with my fieldwork data, and begins with an account of the properties that I recorded from the engraved bones. At each stage the results are given, and a profile of the results is presented at the end of the section. The intention of my fieldwork methods was to record as accurately certain properties of each individual bone and then return with these results to England to perform the analyses. This additional contextual information is crucial to enhance our understanding of 'notation', should it be demonstrated to exist. The methods that I have devised and used and the results presented, use the 'criteria for establishing a context' described in the previous chapters.

6.5.3 Classification According to my Criteria.

When examining an artefact to discover its function, rôle, or use, it is hard enough to make an objective assessment when using all the available relevant material directly associated within the archaeological context, without examining an object in isolation, *ex situ* so to speak, merely to draw on similarly extracted objects and contemporary theory for support and comparison. The practice is widespread, perhaps because it is easier to create hypotheses unhindered by precise considerations of time and space, or perhaps more realistically it is the result of the historical fact. The material from past excavations is unlikely to have a 'context' in the fullest sense of the word as collections have been dispersed over the years and the exact stratigraphy of many sites was unrecorded. Investigators are faced with the decision of either ignoring a vast and challenging body of data from virtually all the major prehistoric sites, or compromise, by proceeding with as much care and research as possible, yet with the probability that their work will yield nothing.

1. The site location and approximate date of the artefacts.

2. Some knowledge of associated finds and context.

3. Whether or not the artefact is complete, and comment on the general state of preservation.

4. Grounds for assuming that any marks are man-made, with recognition of any that are not.

However expedient this practice was, there is no real justification for continuing in this way as modern techniques of recovery mean that these data are available – how it should be used is another matter. The criteria above are offered as a guide to researchers who recognise the value of including certain contextual details in the presentation of any artefact to be analysed. These criteria encourage researchers to describe the artefacts used in various studies and articles in the most informative manner possible. Any reluctance to do this raises interesting questions, namely is it because the data has been adequately described elsewhere, or because there are limitations in the data itself, such as lack of provenance or dates, no knowledge of associated finds, and the material is eroded, damaged and broken? Perhaps the latter is more likely to be the case, as so many Paleolithic artefacts are broken, worn and with doubtful provenance.

If so, then there is a distinct possibility of a conspiracy of silence in order to conclusively demonstrate a favoured hypothesis on the part of the researcher. Yet these artefacts are over 12 000 years old, and have formed part of a cave floor or have been exposed to the elements, so surely to describe a worn and incomplete data set does not immediately compromise the validity of the study in question. If every researcher admitted the limitations of the data studied the result would be a new and solid basis for fresh ideas and more accurate interpretations. Such a process will not necessarily *change* any conclusions at all, but it does provide a more accurate reflection of the archaeological record. This section leads the advance of a general armistice, and admits any potential inaccuracies, basically starting from first principals and coming clean.

6.5.4 Starting from First Principles.

Criteria 1: The site location and approximate date of the artefacts.

Site location is an appropriate point to start, which assigns each artefact to a certain site. In the case of Enlène this refers to all those artefacts which have an 'E' in front of their number, *except* those that have a question mark after the 'E'. Those so termed come from the excavations of Louis Bégouën earlier this century and their provenance is in doubt as Louis Bégouën excavated widely in the area they might be from Le Tuc d'Audoubert and Les Trois Frères, or even from another excavation in Ariège.

E? – Thought to be from Enlène

E – From somewhere in Enlène

ECS – Enlène, Couloir adjacent to EPS

EDG – Enlène, *Diverticule Gauche*

EGP – Enlène, *Galerie du Propulseur*

ELB – Enlène, Louis Bégouën

EPS – Enlène, *Porche Supérieur*

EPV – Enlène, *près de Volp*

ESF – Enlène, *Salle du Fond*

ESM – Enlène, *Salle des Morts*

EYL – Enlène, near to the entrance of EDG.

E3F – Enlène, near passage adjoining Les Trois Frères.

A selection of the bones from two of these sites (EPS and ELB) are illustrated on the following pages. All are drawn to scale, and for a further description of the drawings see the end of this chapter.

Where in the Cave?

The associated finds and context can include the whole habitation assemblage, but but with areas of the cave being delimited, it is more profitable to look to the immediate zone and layer. In the case of some excavations it is possible to recover objects *in situ* presumably in the place where they were left, as the sealing layers above were deposited fairly rapidly. Perhaps by their nature some caves have remained undisturbed for millennia, as they present a relatively inhospitable

Figure 6.16 — Bones from Enlène *Porche Supérieur*.

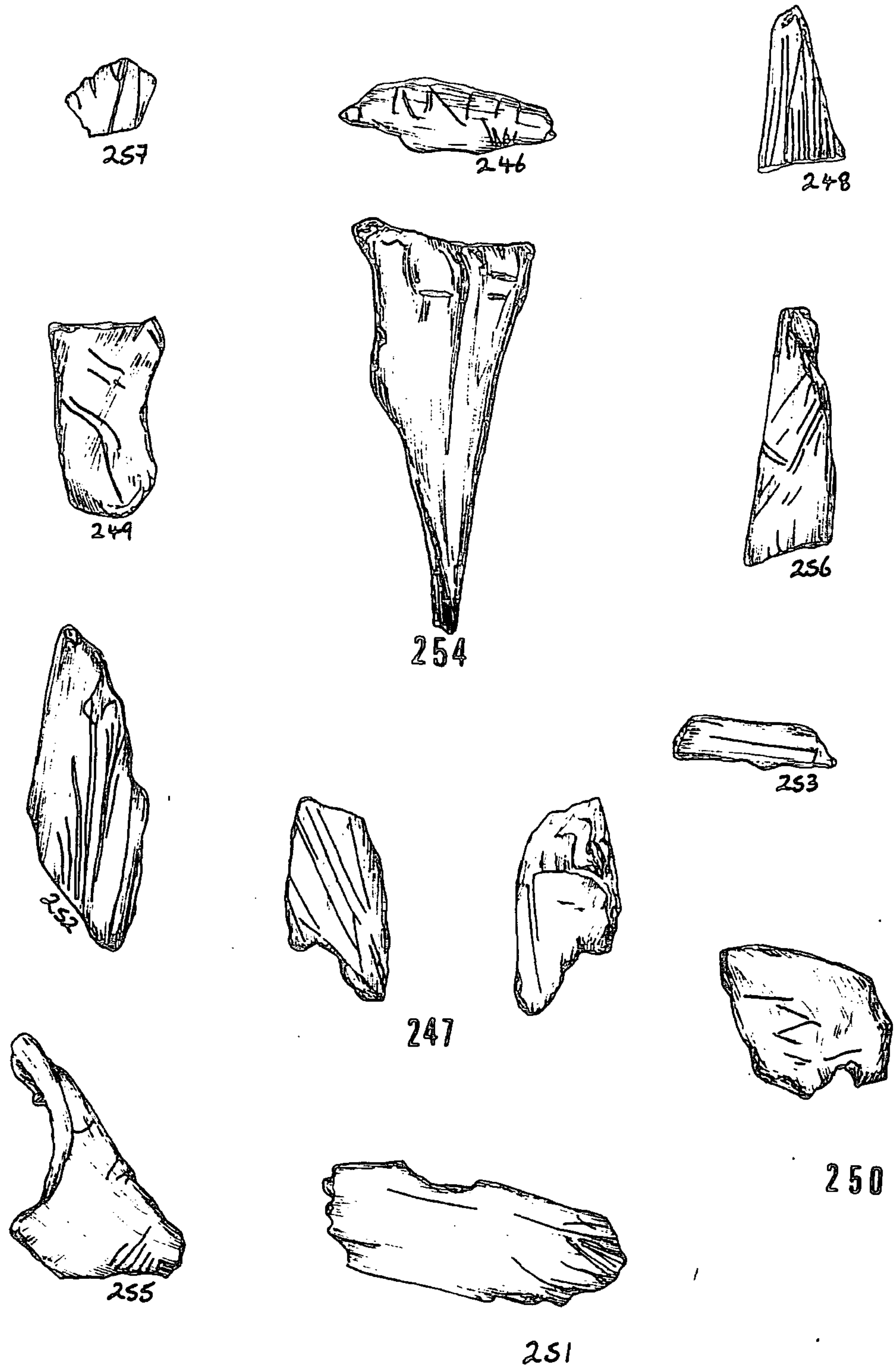
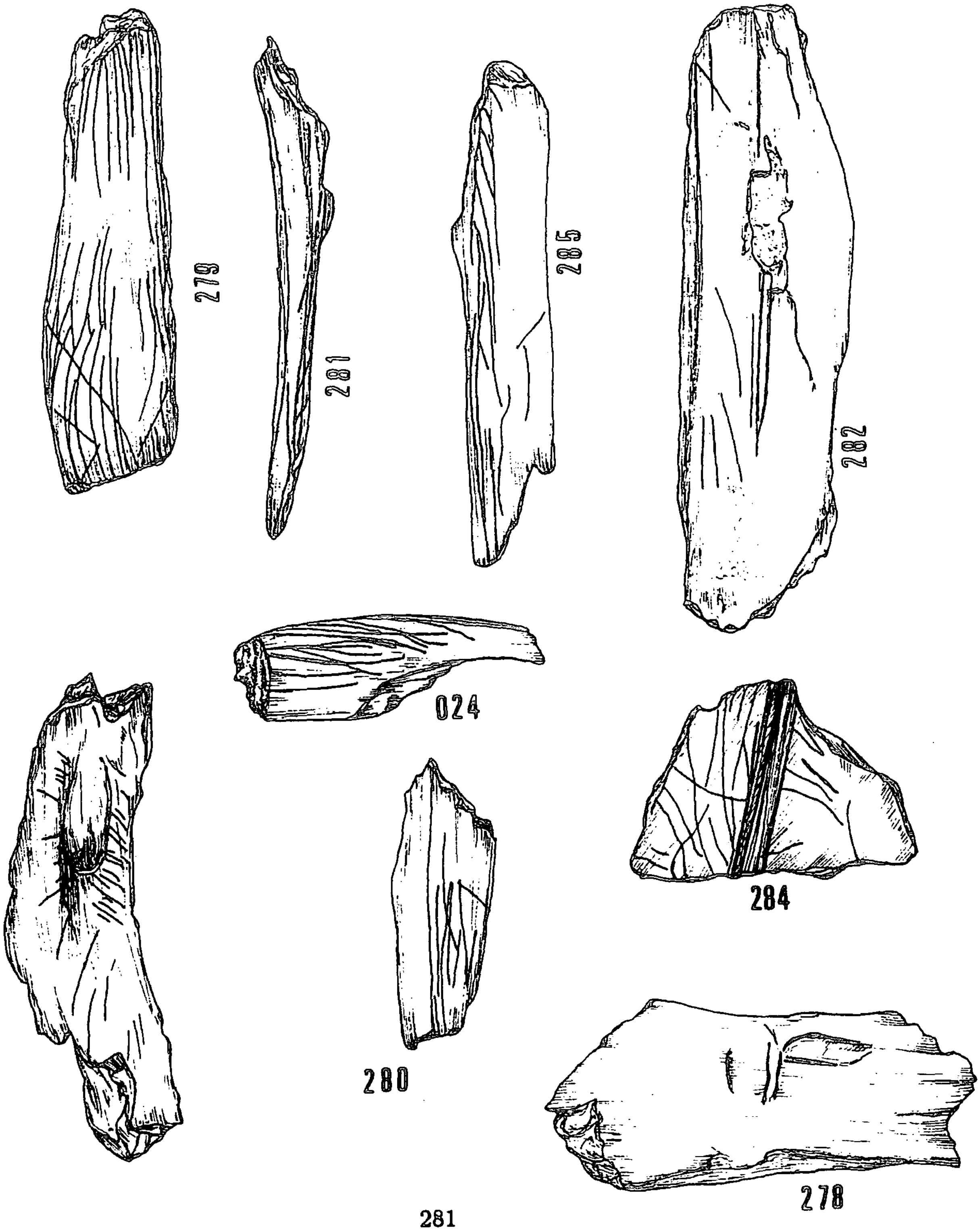


Figure 6.17 — Bones from Enlène Louis Bégouën.



environment for most life forms, including humans. Others have suffered from exposure to the elements, and in the case of Niaux, Ariège from tourism, as graffiti indicates that it was visited in the seventeenth century, and guided tours were conducted into the main galleries from the eighteenth century.

Although some material including footprints have survived, other objects were 'collected' by antiquarians, or simply trampled, eroded or rapidly deteriorated. Enlène was fortunate as although some material has inevitably been lost, much remains undisturbed. However except in cases of mud slides and roof collapse the sedimentation process in a fossil cave (i.e. not active) is very gradual and fine, leaving the remains vulnerable to disturbance by subsequent intrusions. In the case of the long occupation of Enlène the layers that remain are thick and rich, and therefore excellent vertical stratigraphy. As the bones are part of the living floor, the horizontal stratigraphy must be regarded with caution as here, unlike a cave such as Fontanet, it cannot be claimed that things are exactly as they were left.

The first stage in dealing with artefacts recovered from a site is to assign an identifying code to each item with information as to the site and possibly the location within the site and a number. During the course of the excavation any engraved artefacts are treated as 'finds' and therefore assigned a number. Also the information as to where some bones are recorded is encoded in the form of a grid reference that indicates that the engraved marks were recognised at the point of recovery and is identified in the site records. A typical example of this would be

N175 417

that is, square coordinates N,17, layer 5, and noted find number in that area 417. The following four numbers are the date of that recovery, which can be from 1977-90.

However other bones have just the site location, which means they were recovered after the initial stages of recovery, back in the sieving and sorting. This unfortunately was the case for the majority of bones in my sample and so a projected study of the differences between middle and late Magdalenian material which is indicated in the unique number proved to be infeasible.

Setting a Date.

The only dates that can be stated with certainty for Enlène are from the modern excavations as the stratigraphy from the earliest excavations is virtually unknown. Only the material from the modern excavations has been dated, not only by type, style and association, but also by modern dating techniques, namely Radiocarbon dating. Therefore it can be stated with confidence that dates have been obtained for EDG, EPV, EPS and ESF, whereas for ELB, EYL, ECS, E3F, E, E? and parts of ESM the date can be assessed only on style and probable association. It is thought likely that these latter classes of objects are from the Magdalenian, as although Bronze Age incursions were made into a number of areas in the cave, the majority of other dated finds are from the Early or the Middle Magdalenian.

The dates taken from burnt bone in ESF date the occupation to 12 900 +/− 140 BP, 10 950 BC. for level 3, and 9 630 +/− 170 BP, 7 680 BC. for level 1. Other dates from N.8 and 9 in ESF are 13 400 +/− 120 BP, 11 450 BC for the Middle Magdalenian level and 10 950 +/− 140 BP for the latest Magdalenian levels in level a. There have been other dates for level 1 of 890 +/− 80 BP, 1 040 A.D. which are far too recent just as the dates for the calcite floor at layer 2 to around 40 000 in 1981 by Dr. Hennig at the University of Cologne, are too early. The dates of the Perigordian V levels in EDG are put at 24 600 +/− 350 BP.

The dates for the majority of bones put them in the Magdalenian but those from **EDG c5** are earlier therefore at each stage of the analysis differentiate between the Perigordian and Magdalenian material. The Perigordian sample is composed of 93 examples, all recovered in the recent excavations from layers 5 – 8 in the area known as 'EDG'. The remaining 368 examples form the Magdalenian sample, taken from all over the cave, namely ESF, EDGc4, ECS, EPV, ECB, ECS, EGP, EPS, ESM and EYL.

Sampling the Artefacts.

The number of engraved bones from each designated excavated area of the cave proved to be too high for the limitations of time and practicality for study during my fieldwork. Thus it was necessary to sample randomly most of the site locations with the minimum of 10% examined. A summary of the results is shown on Table

6.2. It is considered that a minimal percentage of 10% will provide a sufficiently representative sample of the material to be found within each group.

The decision to perform a 100% sample of the material from EDG is based on two reasons. Firstly, the nature of the site , as it is situated as the entrance to the cave, and therefore it is my intention to compare the material from here and the more numerous material at ESF which is located at the back. Secondly, it is in EDG that the cave's Perigordian levels are found, and in order to truly isolate any variation between this period and the Magdalenian it was considered that all 93 examples should be analysed. In addition, as it is necessary to compare the Perigordian material (EDG, layer 5) with the Magdalenian (EDG, layer 4) found stratigraphically directly above to isolate any viable differences between the material in the two levels.

Table 6.2 — Percentages of Bones Examined.

Name of Site	Total Number of Bones	% of Total Examined	Number of Bones in Sample
E?	Unknown	–	11
E	Unknown	–	17
ECS	6	100	6
EDGc4	47	100	47
EDGc5–8	93	100	93
EGP	59	32.20	19
ELB	204	10.20	21
EPS	42	100	42
EPV	53	20.75	11
ESF	1200	14.83	178
ESM	Unknown	–	5
EYL	3	100	3
E3F	74	10.81	8

6.5.5 Produced in Association With...

Criteria 2: Some knowledge of associated finds and context.

Magdalenian occupation of the *Salle du Fond* is scattered in layers of varying depth over the area of the chamber. Contained within it are very fragmented bones, fragments of plaquettes and the remains of flint working, that is, both flakes, cores and tools. Level b or level 2, is the thin calcite floor that more or less covers the area, reaching over 3cms deep. Level 3 is of brown compacted clay between 5 – 40 cms deep and is filled with bones, some shattered, and numerous plaquettes as well as needles, 'smoothers', arrowheads, *baguettes demi-ronds* and fragments of decorated bone. There are of course the characteristic tools of the period, notably long blades, burins, *grattoirs, percoirs, divers* and cores [Bégouën & Clottes, 1980, 1981, 1984]. There is a significant depression in O.8, averaging 1m in diameter and 30 – 35cms deep which could continue into O.8 – 7, P.7 and P.8, which is responsible for the thickness of the layer and the complexity of the stratigraphy. The bottom is filled with bones and burnt material from a number of fires and large esquilles which could have been deposited by later populations who widened the hole. There is a significant area (30 – 40 cms) covered in red which the Magdalenians must have scattered [Bégouën & Clottes, 1981:5]. There is also clay in the pit from layer 5, as in e inf. In L.M.N. 13 – 14, level e in the horizontal stratigraphy there is an oval hollow (21 x 16 x 8 cms) with an irregular base, in which *esquilles* (some burnt, some not) and flints were found. There is a significant patch of carbonised material in Q.11 in layer c, but it can't be followed for more than 30 – 40 cms. There is also evidence of ochre throughout the two levels of Magdalenian occupation.

An unusual feature was recovered in 1978 in sectors P.Q.15,16 and 17 in the *Salle du Fond*, where a layer of sandstone plaquettes was discovered over a 5 – 2m area, all regularly spaced and non-overlapping and horizontal, apparently forming a 'pavement', preserved by the thickness of layer 2 above. In Q.R. 8-13 and P. 8 – 9 there are also plaquettes, and in parts of Q.16 the plaquettes became disrupted, probably as the result of animal burrows [Bégouën & Clottes, 1978]. This apparent use of sandstone perhaps explains its introduction into the cave in such large amounts. Certainly, if it was used to construct a floor it would alleviate the problem of trampled and wet mud that must have been present during the period of occupation. In N.O.8 and 9 there were also plaquettes discovered, though these overlap one another, and are at all angles to one another. Unlike those in P.Q.15-17 they are unprotected by the calcite of level 2 and being away from the wall they have been subject to disturbance first by the humans passing over but also by the burrowing rodents. In Q.R.10 – 8, in layer 1, there were also plaquettes in an unusual concentration, possibly following the same principal as those in P.Q.15 – 17 [Bégouën & Clottes, 1982:6]. There is an accumulation of engraved plaquettes in Q.10 (5) and R.10 (9) and those in neighbouring areas are nearly as rich Q.9 (4) and R.9 (5) at the entrance to the chamber [Bégouën & Clottes, 1982].

In P.17 there is more evidence of the intentional use of stone as there are 3 large rocks standing upright, apparently wedged in this position by some smaller rocks. There is was a small constructed wall partially excavated from the stalagmitic concretions, which effectively closed the *Galerie de l'Aven* in Enlène/Les Trois Frères close to the Couloir de Francois Camel. A similar structure was found in Le Tuc d'Audoubert [Bégouën & Clottes, 1980:5].

Another feature of Enlène is the number of objects recovered either pushed into cracks in the wall, or into the floor. In R.16 there are three long blades of flint placed in the crack in the wall only 60cms above the Magdalenian level. The most enigmatic class of finds were the bones discovered sticking vertically into both the floor and the walls of the cave [Bégouën & Clottes, 1984:6, 1989:12]. Since all were left *in situ*, and marked with a white flag, it was possible to gain an idea of the way that they clustered in some areas. Jean-Pierre Giraud thought at one stage that those in the ground could mark the spot where the bones used for digging had broken off. However some of the points were unbroken, and besides they were not all located around any evidence for digging. In addition, it would seem that these bones and those in the walls might be part of the same phenomenon, and such an interpretation would not serve for both. Equally the suggestion that the bones wedged into the cavities in the walls were used for suspending certain objects is apparently disproved by the fact that some of the bones slope downwards, and others are located directly over overhangs, or deep crevices, so to make the hanging of most objects apparently impossible.

Table 6.3 — The General Condition of the Bone: Magdalenian.

Name of Site	Burnt	Calcified	Well Preserved	Some Deterioration	Pronounced Deterioration
E?	.5	.3	3	.5	.3
E		.3	2.7		
ECS	.3	.3	.6		.5
EDGc4	.5	.3	6.3		5.7
EGP	.3	.5	4.1	.3	
ELB		1.6	1.9	.8	1.4
EPS		2.2	4.1	.3	4.9
EPV		.3	1.9	.6	.3
ESF	1.6	1.1	44.3	1.1	.3
ESM			1.4		
EYL			.8		
E3F	.3		1.6	.3	
Total %	3.5	6.9	72.6	3.8	13.2

6.5.6 Bones and Antler, and 27 000 years.

Criteria 3: Whether or not the artefact is complete and a general state of preservation.

As I have already admitted, *all* the bones in my sample are incomplete. However there are other factors relating to their form that are worth recording.

The Condition of the Bone.

The condition of the bone when found was also recorded as either burnt, calcified, or simply as in a state of good preservation, some deterioration or deteriorated. Evidently the first two categories are examples of bones with some deterioration, but it was singular enough to form a separate class in my analysis. The terms referring to the state of preservation of an artefact are relative, as all bone/antler has deteriorated to some extent over 13 000 years, and the final category is expected to extend only to severely corroded examples. It can be seen from Table 6.4 that over 70% of my examples are in a good state of preservation. The calcified examples at 3.5 % come from all areas of the cave other than ESM. Equally ESM and EYL (debris from other areas) do not evidence any deterioration, but they are also exceptionally small samples of 5 and 3 bones respectively and so the result is unlikely to be significant. The Perigordian results from EDG are very similar, perhaps reflecting the overall moderating influence of preservation within a cave.

Table 6.4 — The Perigordian Material: Preservation of the Bones.

Site	Burnt	Calcified	Good Preservation	Some Deterioration	Deterioration
EDG	3.2	5.4	75.3	2.1	14

Burnt Material.

Of the 35 fires found dated to the Magdalenian, (Bégouën, Clottes, Giraud, & Rouzaud, 1989), there are concentrations in both the *Salle du Fond* (22 known fires) and the *Salles des Morts* (12). This systematic distribution is partly obscured by the possible and probable destruction of the others during the early excavations, yet the clusterings appear to be valid, and fit well with the amount of habitation material which is also particularly dense at these sites. Both layers 1 and 3 are full of burnt material, particularly burnt bone, which suggests the presence of hearths in the cave. In the *Salle des Morts* there is only burnt bone, and no evidence of wood at all. There is a small flat hearth in P.8 – 9, (21 x 15 cms) filled with carbonised bones. In O.N.8 – 9 there are some hearth remains 4 – 20 cms deep and 30 – 40 cms in diameter, although the evidence of the exact edges and much of the carbonised material is no longer evident. In N.8 there is a hearth (35 x 30 x 10 – 15 cms) with carbonised material at the bottom and modified walls, and two more hollows in N.9 and N.10 but there is no evidence to suggest that they were used for fires.

There is additional evidence on some of the bones that ochre was used in the cave, although in my sample it was in the form of traces and stains rather than complete coverage in whole areas of the bone. In ESF level 3, N.O.8 and 9 the area is disturbed either from the animal burrows or from another excavation. There is also a hole 10 to 20cms in diameter, which could be a bear's 'nest' (which are common in many caves) or perhaps a hole made purposefully? The function is no longer evident, but around the edges there appear to be ochre traces deliberately smeared. [Bégouën & Clottes, 1981]. In fact the whole of ESF appears to be stained with ochre,and there are traces on the cave walls but as yet no actual pieces have been recovered [Bégouën & Clottes, 1990].

Table 6.5 — Ochre Traces: Magdalenian and Perigordian.

Magdalenian					Perigordian
E	ELB	EPV	ESF	E3F	EDG
2	2	1	4	1	1

The Material of the Bone.

The 'material' of the example refers to the basic composition of the artefact, which is quite easy to determine, particularly as antler is more porous than bone and the surface appears slightly pitted. For this sample 97.2% (448) were of bone, and only 2.8% (13) were made of antler. This compares with 93.5% (87) for bone and 6.5% (6) for antler from the Perigordian, and 98.1% (361) and 1.9% (7) for bone and antler from the Magdalenian. All of the antler from the Magdalenian came solely from ESF. It is possible that this bias represents a preference for bone, but it is equally plausible to interpret the inverse ratio as indicating a preferential use of antler for the creation of other objects, such as *sagaies* and *baguettes demi-ronds*. Further analysis of this data indicates that there is no preference for using antler for *gravé* as might be expected from the Perigordian, although the sample is really too small to make any such assumption.

Table 6.6 — The Material of the Artefact.

Name of Site	Antler	Bone
E?	–	11
E	–	17
ECS	–	6
EDGc4	–	47
EGP	–	19
ELB	–	21
EPS	–	42
EPV	–	11
ESF	7	171
ESM	–	5
EYL	–	3
E3F	–	8
EDGc5–8	6	93

There was an attempt to identify the 'species' from which the 'material' came, although this proved impractical; firstly the bones were all fragments and usually lacking any distinguishing features, and secondly there was no 'expert' on hand to give a confident diagnosis, and I personally have no knowledge in this area. Therefore this column remained virtually blank on my data sheets and will not be used in my analysis, although the results I did achieve are shown in Table 6.7. This was also the case with the 'bone name' which referred to the part of the body the bone came from. Consequently this column too must be removed from my data list.

6.5.7 Which Side Are They On?

Criteria 4: Grounds for assuming that any marks are man-made, with recognition of any that are not.

As the examples were already sorted into 'categories' when I arrived at Enlène, I only really had to work with *gravé, 'strié* and *'travaillé* which as man-made marks are distinct from those bones with just scratches and scuffs. To a great extent, I believe that the form of the marks were not characteristic of the types of scratches that may have occurred in that post-depositional context, where they remained undisturbed for thousands of years. There are few abrasive flints in the stratigraphy that might have come into contact with the bones, and to a great extent bones were next to bones which would have left little impact, always assuming the layer was much disturbed. There were marks on the bones that did appear to be scuffs and scratches – short, wavering and faint, often many such marks creating an entire patina of faint, worn unevenness over the bone. Perhaps some of the deeply incised scratches were identified by myself as engraved marks, and that is a factor that must be dealt with. However the risk of a chance scratch being of the same length as all its neighbours, and the scratches being evenly spaced is quite minor, and I am confident that the scratch/mark question will only arise in a category of engraved marks where irregularity is the norm, and is unlikely to affect seriously a question of 'decoration' and/or 'notation'.

Having satisfied myself that I am identifying man-made and therefore potentially 'meaningful' marks, I then thought it useful to distinguish between examples that

Table 6.7 — The Original Species of the Bones.

Name of Site	Horse	Reindeer	Bird	Indeterminate
E?	–	1	–	10
E	1	–	–	16
ECS	–	–	–	6
EDGc4	–	–	–	47
EGP	1	–	–	18
ELB	–	–	–	21
EPS	–	–	–	42
EPV	–	–	–	11
ESF	1	2	–	175
ESM	–	–	–	5
EYL	–	–	–	3
E3F	–	–	–	8
EDGc5–8	–	–	–	92

Table 6.8 — The Number of Sides Engraved.

Name of Site	A	B	C	D	E
E?	7	3		1	
E	8	6	3		
ECS	3	1	1	1	
EDGc4	38	2	5	1	1
EGP	9	3	6	1	
ELB	18	1	2		
EPS	33	4	4		
EPV	11				
ESF	112	26	25	13	2
ESM		5			
EYL	2	1			
E3F	4	2	1	1	
EDGc5-9	64	7	18	2	2

- A = Engraved on one side and the other side *missing.*
- B = Engraved on *both* sides.
- C= Engraved on one side, and *blank* on the other.
- D= Engraved on one side, the other partially visible and *blank*
- E= Engraved on one side, and the other only partially preserved and apparently also engraved.

were engraved on both sides, and those on which one side appears to have been left deliberately blank. This relates to the question of deliberation and selection on the part of the engraver, as leaving one 'side' of a bone blank, whilst covering another with marks, could indicate a differential purpose or concept. Again, this factor is not significant in itself, but if it is consistently related to another characteristic, such as the use of ochre or 'decoration', then it potentially becomes a significant characteristic. As the bones were incomplete, and many had one 'side' missing, a distinction was made between those that could be conclusively identified as having *no* engraving on one side, and those with only one side, where no conclusive statement could be made.

The table indicates that much of my data was obtained from bones that were only engraved on one side with the other side missing. As there also appears to be as strong a preference for engraving on *both* sides as for engraving on only one side, with the other *blank*, one can only conclude that roughly equal number of bones were engraved on both sides and on one side only, although the data under D suggests an increased preference for engraving on only one side of the bone.

In establishing a 'type' for any artefact the presence and absence of certain formal qualities are assessed. In common with the majority of sites, the finds from Enlène were subjected to a rough classification on recovery. This information is vital to the subsequent researchers who wish to identify and analyse certain classes within the entire site assemblage and this offers a starting point for both classificatory, comparative and spatial analyses. The 'second stage' of detailed work attempts a more detailed classification, dividing into smaller groups focusing on certain characteristics. Once a number of researchers have examined a relatively small or homogeneous class of artefacts, further 'types' can be identified. However here there are a large number which are rarely ascribed, even in later analyses with more than three characteristics: their material, the nature of their marks (engraved, cut-marks or natural), and their possible function.

Certain terms were assigned to the engraved bones by the excavators of Enlène. The terms *strié* and *gravé* were ascribed to the bones as a provisional post-excavation classification, the intention being to refine the method when the entire range of excavated engraved bones had been recovered. *Strié* refers to bones that only have faint traces which are only visible when the bone is turned to the light, and seem to be the result of light pressure with a tool. *Gravé* refers to examples with deeply, apparently 'engraved' lines, that are the result of greater pressure with a stone tool, and are sometimes composite marks. Certain abbreviations refer to a named class of Palaeolithic objects, such as *bâtons de Commandment* or *rondelle* which simply indicates that the form of these artefacts conforms to a known type. *travaillé* simply means 'worked' and covers most bones with worked edges, and particularly those with two worked edges and surfaces.

This is a *preliminary* classification, useful as a control to see whether the results of the analyses assign the bones to the corresponding categories or not. In terms of actual statistical results for the classifications outlined above, it can be seen from Table 6.9, that bones with faint(er) traces are more numerous than those with lines that are thought to be engraved. From the whole sample for Enlène, *os gravé* represent 27.1%, (125) whereas *os strié* forms 68.8%, (317). The other categories of *sagaie, bâton, decoré, rondelle* and *travaillé* can be all included as *os gravé* in one respect, as the marks are engraved rather than 'traces', and would therefore 'round up' the total for *gravé* to 32.2%. However these other examples manifestly possess other formal attributes which allow them to be assigned to other categories, so it is important to recognise their similarities as well as the differences.

For the Perigordian, the relative percentages are 82.8% (78) for *os strié* and 14% (13) for *os gravé*, which are higher and lower compared to the average for the site. In the Magdalenian the percentage of 65.2% (240) is more comparable with the total of *strié* in the Perigordian, and the *gravé* is actually higher at 30.4% (112), even without the inclusion of the other classes, which would make it 34.8%. Thus from these initial results it would appear that the Magdalenian layers from Enlène possess twice the number of *engraved* examples than the earlier Perigordian levels.

Table 6.9 — Classification of the Bones.

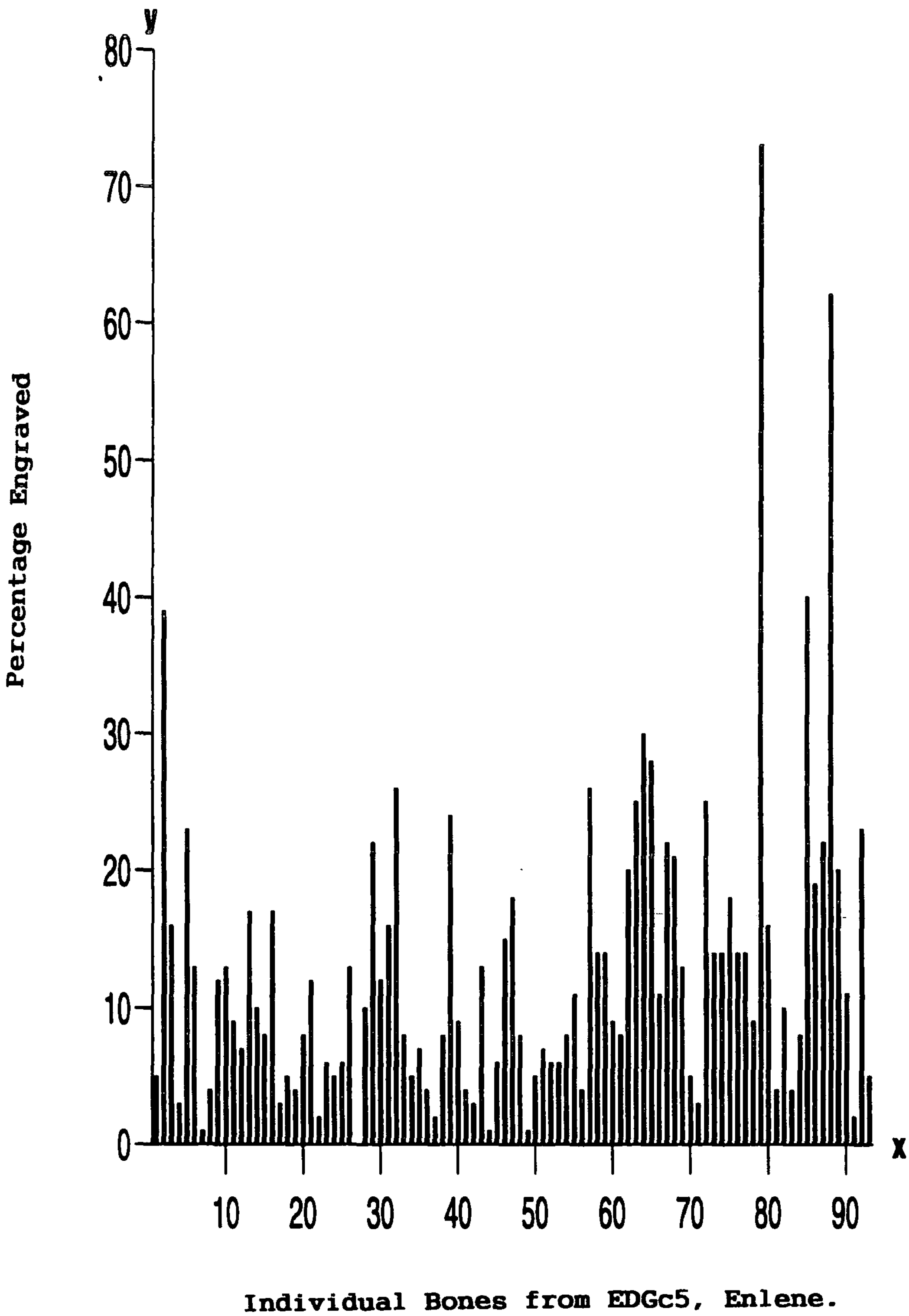
Site	Bâton	Os Decoré	Os Gravé	Rondelle	Os Strié	Os Travailé	Cut Marks	Natural	Post Deposition
E?		8			1		1	1	
E		13			4				
ECS					6				
EDGc4		32			15				2
EGP		1	2		156				
ELB		3			16		2		
EPS		5			36		1		
EPV					11				
ESF	1	41		3	130	1	1	1	
ESM		4		1					
EYL					3				
E3F		2			6				
EDGc5–9		13				78		2	

Table 6.10 — Known Functions of the Artefacts.

Name of Site	Known Function	No Known Function	Worked	Not Worked
E?		11	1	10
E		17	2	15
ECS		6		6
EDGc4		47	5	42
EGP		19	1	18
ELB		21		21
EPS		42	4	38
EPV		11		11
ESF	5	173	25	153
ESM	1	4	3	5
EYL	1	2	1	2
E3F		8		8
EDGc5–8	2	91	15	78

Some of the bones were known, or thought, to have another function other than as 'engraved' artefacts. Referring back to the classification of the artefacts, those known to be *bâtons, sagaies, rondelles*, or *baguette demi-ronds* would be considered to be 'functional' in nature. This distinction is made, as sometimes markings, often also considered 'decorative', may contribute as a functioning part of the object. For example, closely marked parallel lines on the flat side of a *baguette demi-rond* appear to have been made to minimise any movement and friction which occurred when they were bound to a spear haft. Or a certain configuration of lines may be a personal and idiosyncratic mark of ownership that might be crucial to the security of the individual and his possession of that tool.

Figure 6.18 — The Percentage Engraved: Perigordian.



The detection of a 'worked' example was relatively simple for a number of reasons. Firstly most of the edges of a typical artefact from Enlène were broken, and therefore uneven and jagged in appearance, thus any smooth edges, either natural or possibly worked, were identifiable. Secondly, natural edges were also relatively straightforward to select, and so there remained a residual category of bones with smoothed and straightened sides, that were usually found to be worked into this form by modification with a stone tool. Other natural agencies common to some post-depositional contexts can also produce a smoothing of the sides, such a running water, or friction caused by an earth movement, although this is more likely to affect the flat surface of the bone rather than the edge.

6.5.8 The Physical Properties of the Bone.

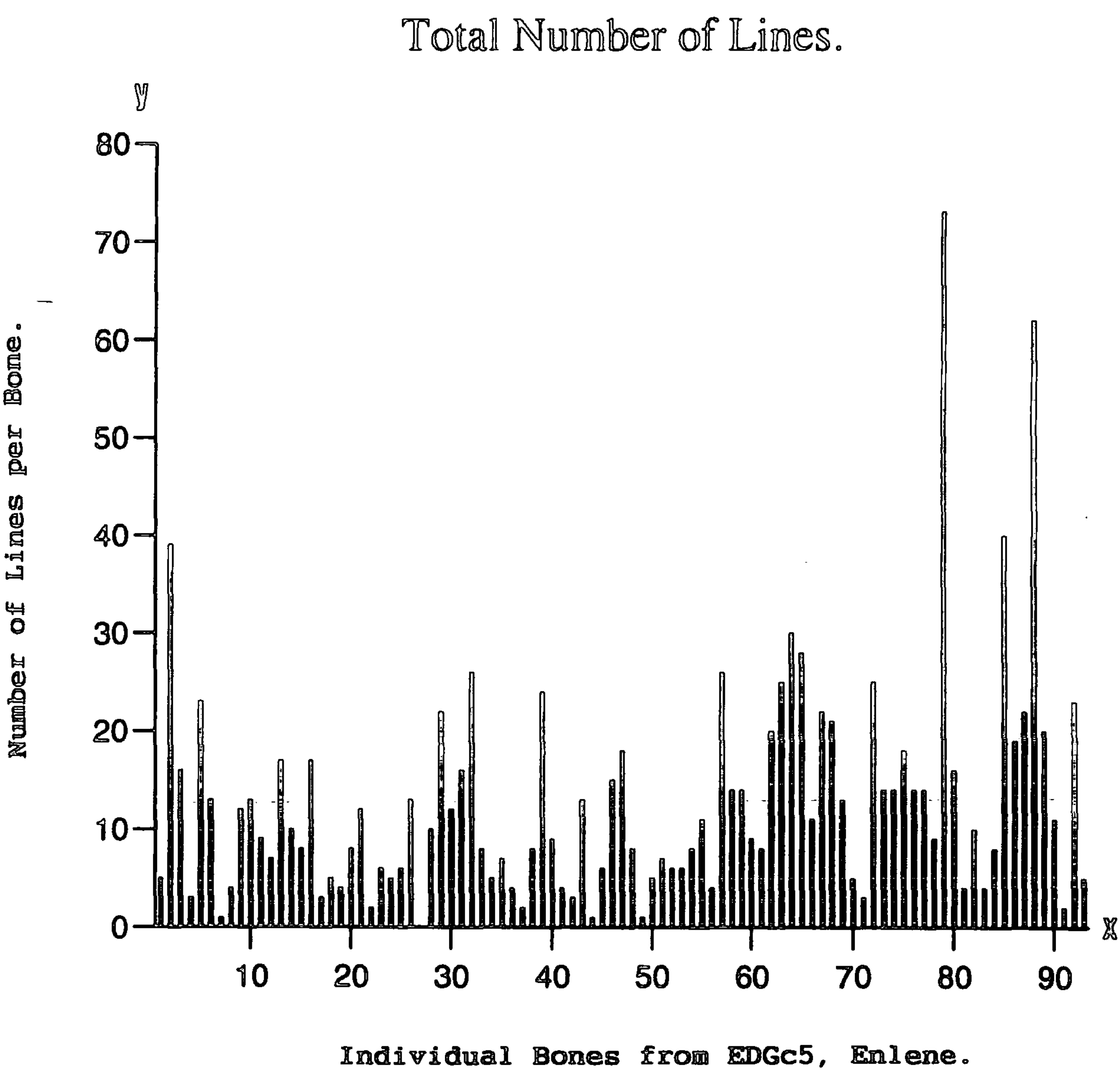
How is the bone Marked?

As a rough guide, intended both to supplement the drawings made of each bone, and to act as a rough indication in their absence, an approximate measure of the **percentage** of the bone area that was 'covered' by engravings was taken. This does not refer solely to the actual area of the bone that was physically influenced by the engraved line, but serves more as an indication of the area of the bone 'enclosed' by lines. That is, should a bone have one line at one end, another roughly halfway along its axial length and then finally one two thirds of the way along, this would be classed as 65%. For a bone that is covered with lines but all 50 of them are at the tip, then a percentage of 20% would be considered appropriate. As Figure 6.20 shows, there is no evidence to suggest that a system of 'design fields' was in operation as there appears to be no fixed or standardised use of the area on the bone.

6.5.9 How Many Marks?

The number of lines on the engraved bones varied from example to example. As, Figure 6.21 indicates, the range within a site such as EDGc5 is considerable, and to talk of averages in this instance is misleading.

Figure 6.19 — Total number of Marks: Perigordian.



6.6 Visual Recordings.

6.6.1 Visual Recording.

Photography

This is often considered to be one of the most accurate means to record a given image, as all that appears through the lens is exactly reproduced on paper. However the bones under consideration were small, thus needing a macro-lens, and the engravings were rarely well defined, requiring careful lighting to throw them into relief. Furthermore, the surface of the bone was convex which aggravated the former circumstances, and in consequence photography did not prove to be the most satisfactory means of recording all the detail, although it was used for some of the examples where appropriate

1. **Drawing by Hand.**

Each bone was drawn to the scale of 1:1. See Figure 6.22. The problem of absolute accuracy is a perennial one for all archaeologists, and as Bahn states,

> ' Every tracing or copy of a Palaeolithic figure is inevitably subjective to some degree; it is also a distortion of reality since – except in the case of accurate casts – three dimensions are being reduced to two. Every tracing is a personal piece of work, and it is impossible to remove subjectivity completely. A copy is only as good as the copier, and all copiers make mistakes, the number and extent of which depend on the method they use and on their experience and personality', Bahn, 1988:48.

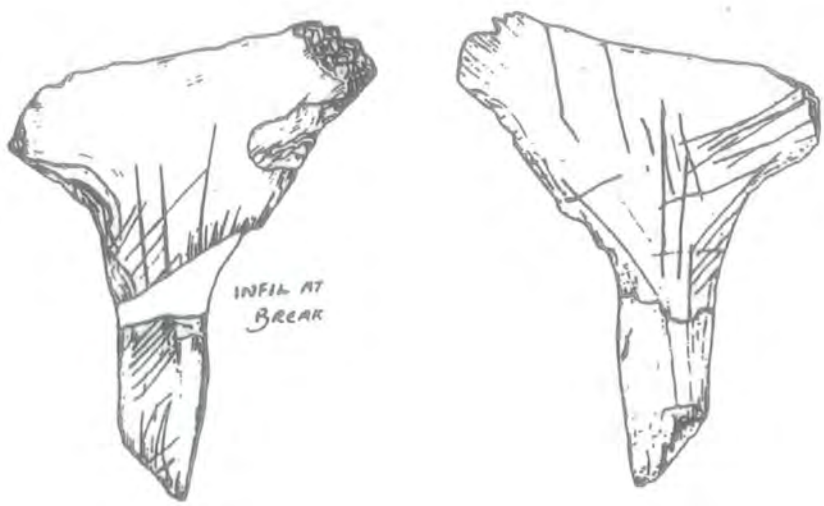
Despite the problems involved, this method was preferred to photography, as although the drawings made are not 100% accurate in all circumstances, they do at least present an reasonable image of the marks on the bone and their relative position.

2. **Supplementary Drawings.**

To supplement this information, additional drawings were made to record associated properties of each bone. Whether the break was old or recent, or an edge worked or natural, was indicated in each instance by colour coding;

Figure 6.20 — Recording the bone by Drawing.

a) A typical line drawing of a bone indicating the engraved lines. The scale is 1:1.



b) The 'intentionality drawing', which indicates the state of preservation of the bone by colour coding, and the relative definition of the engraved marks as they appear at present.

red : new break green : old break blue : worked edge black : natural edge.

A 'new break' is considered to have occurred post deposition as a result of disturbance or excavation, whereas an 'old break' is here considered as having occurred in prehistory, either previous to use/deposition, or immediately after deposition. The purpose of the drawings was to provide a valuable record of the location of the lines with regard to the bone. If the engraved lines that occur on the broken bone are confined to the centre and/or on a worked edge then although the record is incomplete, the lines are complete, whereas had they overlapped a new break, then they are known to be unrepresentative of their original state. The case of lines that overlap an old break is more problematic, as it is possible that the bone was broken when the engraving was made.

The relative thickness and definition of each bone was also recorded, in an attempt to isolate faint traces from the more heavy and possibly more 'deliberate' marks. It is plausible to assume that the maker of the marks may have intended some lines to be more 'visible' or 'significant' by engraving them more deeply, see Figure 6.10. However as the exact intention of the artist remains unknown, the primary purpose of the drawings is to provide more information as to the exact appearance of these artefacts.

6.7 Summary.

The aim of this section was to closely investigate the distribution and physical characteristics of the non-figurative engraved bones. Although there are many bones in museum collections over Europe that could have been used, it was considered necessary to restrict the scope to the assemblage from a single area, namely the site of Enlène, Ariège. The advantages of limiting my study were firstly that I could refer to a number of other finds within the same area, and secondly isolate any obvious differences within one site assemblage By analysing a representative sample from the whole site I believe that for the first time a detailed profile of the engraved non-figurative bones is been shown.

A brief consideration of the wider context of the site illustrated that Enlène and the other Volp caves are thought to have functioned as part of a much wider cave system. It is possible to see this site as belonging both geographically and culturally to Mellar's Southwestern region, notable for the range of finds, density of sites in restricted areas, and spectacular cave art. However if it is that cultural systems existed within these larger traditional areas, (Conkey, 1985, Gamble, 1986), then the Pyrénées may not have been on the periphery of the traditional focus of activity in the Perigord. The principal sites and their finds has been exhaustively researched by Bahn (1983) and the number and range of cave site in Ariège has been meticulously documented by Vialou, (1986a). Bahn proposes a model where the large cave site of Mas d'Azil provides a regional focus for a number of sites in its vicinity, including the Volp caves. The picture is then of patterns of social and cultural integration and interaction across the landscape.

The account of the Volp sites in this chapter was essentially descriptive, yet adequately demonstrated the range of finds within the cave system, and the timescale of their use in prehistory. The evidence of engraved plaquettes in the passage separating Enlène and Les Trois Frères indicates that the two caves were used contemporaneously. The wealth of cave art in Les Trois Frères and the density of habitation debris in Enlène has been cited as evidence that the successive populations inhabited Enlène as a dwelling, and Les Trois Frères as a sanctuary. Other sources of evidence to corroborate this hypothesis has yet to be found, but it appears certain that even if the people living in Enlène did not produce much of the cave art, they knew of its existence and used the cave. The relationship between Les Trois Frères, Enlène and Le Tuc d'Audoubert is more problematic, yet the range of finds and complex use of visual imagery within this geographically proximate site cannot be ignored.

The distribution of many of the Magdalenian finds in Enlène is thought to be continuous throughout the length of the cave, whereas the Perigordian V examples remain confined to EDG near the original entrance to the cave. The distribution of figurative and non-figurative art does not appear to be marked, as both are recovered from the floor of the cave, hearths and the pits in ESF. The only deliberately placed finds in the cave are the 'vertical' bones in ESF, or *os planté*. However the fact remains that over 2 000 bones from Enlène are known to have been engraved. This is in itself is a measure of intent, and the apparent neglect of the engraved and worked bones by the populations does not mean that they originally had no meaning and were not created for a specific purpose. However their position in pits, hearths and the cave floor does mean that all these bones are broken.

A number of characteristics of these bones have emerged which present a surprisingly homogeneous data set. Taking a minimum of 10% from all the sites within Enlène provided a large data set of 461 bones in total. Not all of these could be dated by association as they had come from the debris or collection of the earlier digs, notably E, E?, ESM, EYL, ECS and ELB. Direct dates were taken from ESF, EDG c4 and EDG c5, and EPV. The material from EPS was dated by stratigraphy, typology and association. The cave was utilised first in Perigordian V in EDG, and then in the Early Magdalenian, and then the Middle Magdalenian. Over 70% of the Magdalenian bones were in good condition, and over 75% for the Perigordian. Despite some formation of calcite within the caves only 32 of the bones in my samples had some traces of calcite which proved to be a feature of all areas of the cave. Although I required non-figurative bones, there were 4 iconic examples included within my data set: 1 from EDG c4 and the others from ESF which also contained a pierced example. Constant reference to the 'bones' is rather misleading, as there were 7 pieces of antler from ESF and 6 from EDG c5. An attempt to record the species of animal the bones were taken from and the bone name proved to be impractical, and so regrettably there are no real results from this area of enquiry.

The true purpose of the bones remains a mystery, perhaps partly because they are incomplete, but also because they do not fit the general classificatory division as being either 'useful' or 'decorative', that is tools or ornamental items. The *bâton de Commandment* in ESF and the *rondelles* fragments from ESF and ESM are notable exceptions, as is possibly the *os travaillé* also from ESF. A number of the engraved bones have been worked, with just over 12% of the sample worked, that is 11.4% for Magdalenian and over 19% for EDG c5.

The preliminary classification of *gravé* and *strié* was noted, although this merely refers to the nature of the engraved marks rather than their content. The results from this indicated that there was an increased proportion of deeply engraved bones in the Magdalenian, rising from 14% in the Perigordian to over 30%. Additional information possibly comes from the fact that a small proportion, 3.5%, of the bones were burned which could either indicate that they were used as fuel, or simply came into contact with the hearth on the floor area. It is less likely that the bones would come into contact with ochre and only a few of the bones, a total of 11 for the site, have any such traces.

Chapter VII

Order and Structure: The Engraved Lines.

7.1 Introduction.

The data presented in the previous chapter provides a good profile of the general nature of the finds of engraved mobiliary artefacts from the site of Enlène. Although the data are descriptive, and do not immediately provide an insight into the question of notation, they serve to illustrate both the level of variability within the 'class' of artefacts and the underlying homogeneity . Any standardisation in form could possibly relate to a particular use or selection of material on the part of the manufacturer. The primary link between all the portable artefacts in my sample from Enlène is that they are all engraved with lines, some deeply and some lightly. Other than illustrating a tendency for engraving on these surviving fragments of what are presumed to have been originally larger pieces of bone, this information does not give any real insights, although it does quantify aspects of this neglected body of data.

The principle source of interest is in the arrangement of the lines. Are they structured in some way, and is this structure common to a number of artefacts? The alternative is that they are in fact random configurations. My work on the theoretical principles of construction, summarised in Chapters II, III IV and V, concentrates on the conceptual difficulties of identifying the principles of order and symmetry present in most forms of meaningful representation. Such structural properties provide measures of regularity in translational symmetry which I have identified as critical to notation in these earlier chapters. So far the identification of symmetry has been by observation alone, although wherever 'visual systems' of representation exist, it is reasonable to suppose that their overall form was intended to be observed and interpreted. The subjectivity of the researcher is rarely eliminated and perception of order can vary from image to image and viewer to viewer. Any attempts by artists to limit the various interpretations of graphic representations, by adhering exactly to certain stylistic conventions, might detract from the image itself and render it or the style potentially meaningless and sterile. If an image is so standardised and devoid of style that only one interpretation is possible, or if a methodology is so rigid and exclusive it attempts to ignore or disguise areas of potential conflict, then systems of visual meaning represented could not be said to present a challenge or stimulation to the creator or interpreter. Thus a certain level of subjectivity is always present in descriptions of graphic representation, and my analysis of the data from Marshack and Paris in Chapter V cannot be without some level of personal bias.

7.2 The Broken Bones from Enlène.

The reason for recording the following data, was to try to establish in the most appropriate and objective way possible, whether or not the lines on the non- iconic bones have any pertinent and regular order in the way that they are formed (their length) and the manner in which they are placed relative to one another, (their distance and orientation). In the course of preparing and recording the bones from Enlène, I discovered that all the bones are broken, which means that only a minority of the engraved lines are complete. This means that are large proportion of the bones are unsuitable for analysis by conventional statistical techniques. By performing some basic quantitative analysis, this section briefly discusses what results can be gained from this data set, and from this suggests how some of the problems can be overcome, which is discussed fully in the following chapter.

7.2.1 Methodology: Problems in Practice.

The method that I devised involves measuring to the nearest 0.5 mm the length of each line, and the distance between it and its nearest neighbour. Thus there are two distinct classes of data: that relating to the lines themselves, and that relating to the distances between the lines. The former category is broken down into two groups, namely lines that are 'complete', that is, their length is not prematurely terminated by a break in the bone or by erosion, and 'incomplete' lines that are disrupted in these ways.

Although the outline of the methodology above is relatively straightforward, the actual marks on a number of bones presented a challenge which resulted in the following practices being adopted in the course of my fieldwork. Where the marks are on a natural or worked edge, or in the middle of the bone, they can be reasonably assumed to be complete. Similarly, when two marks are roughly parallel to one another, the distance between them is equal at every point, and is straightforward to measure. The problems I encountered were in dealing both with marks that were neither complete nor parallel in their alignment, and with overlapping marks. Thus it was necessary for me to devise the means of recording these variables features and yet incorporate them fully into my data.

The data sheets on which I recorded the measurements for each bone are structured into three columns: firstly one for **complete** marks; secondly, for the **average distance between**; and thirdly a column for **incomplete** marks, which referred equally to marks on an 'old' or a 'new' break. The column for recording distances between the lines is vital to the question of establishing whether or not the marks are made in a standardised manner, as the majority of the marks overlapped with a break, and therefore regularity in **length** would be unlikely or, if it existed originally, irrecoverable. Where two lines crossed one another, their 'distance' was recorded as 0.01cm, that is, the smallest possible distance using two decimal places. Although micro-wear analysis might have determined which line had been engraved first, and thus established a sequence, this was not attempted for two reasons. Firstly because I lacked the quality of equipment needed and I have no previous experience, although I am acquainted with the literature on the subject. Secondly my reading alerted me to the very real danger of my results being inaccurate, or at least considered so by the many critics who seem to be active in this area. Thus as the idea of a sequence built up from crossing lines was not necessarily what I was expecting to be able to classify, I decided to acknowledge the various instances of overlap but not pursue the problem of superimposition further.

Cases where the marks are not roughly parallel, or where there are two marks approximately the same distance from the one just measured, present further difficulties. In the former case, it is the distance from midpoint to midpoint between the two marks that is taken, which was judged by eye, and was relatively straightforward to measure. The problem of **direction** in measuring distances is not so easy, as often there were at each point a number of marks crossing and weaving, or at an equal distance away, that could reasonably have been selected. Although this obviously results in a number of potential resulting 'sequences' being discounted, there was no direct solution to this. One point that should be stressed is that the examples that did present the maximum number of 'choices' for the nearest neighbour were probably, of all the examples, the ones least likely to 'suffer' as the result of any mistaken interpretations in direction that I could have made. This is because the difficulty in recording arose where there was no obvious relation between one mark and the next, there was overlap, and extremely irregular spacing. Thus it is unlikely that my system of measuring corrupted and confused an orderly pattern of marks.

7.3 Initial Results from Enlène.

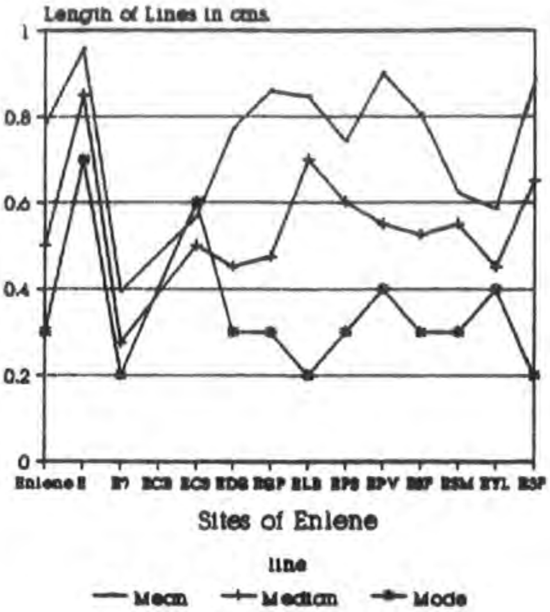
The graphs illustrated as Figures 7.1, 7.2 and 7.3, show the mean, median, and mode for both the lines and the distances as well as the range of the values for each site. The range could indicate the nature of the sample – a small range of values for the incomplete lines from a site could reflect a pattern of breaking, particularly if this is incompatible with the rest of the sample and the complete lines. Similarly a larger range could indicate the use of longer lines or differential preservation or selection of bones.

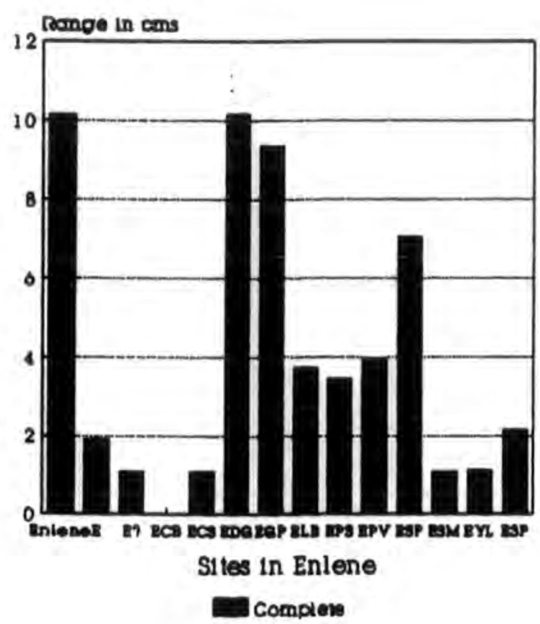
7.3.1 The Complete Lines.

These lines form roughly 42% of the sample of line lengths, and are found on bones all over the sites within Enlène. As can be seen from Figure 7.1 the overall mean for Enlène is 0.784 cms, the median is 0.50 cms and the modal value is 0.30 cms. When relating these values to the overall distribution it can be seen that the mean, median and mode all occur within the pronounced peak at 0.10 cms to 0.60 cms, which accounts for the modal value of 0.30 cms (263 occurrences). The slightly higher median and mean are the result of the relatively high range giving a maximum value of 10.20 cms, although they remain low as the greatest frequency of values is from 0.05 to 1.00 cms.

Considering the total range between the complete lines of 10.15 cms, the mean, median and mode cluster significantly. The variation in range for each site is quite marked – with the greatest at 10.15 cms (EDG) and the smallest at only 1.10 cms (sites E?, ECS and ESM). It is probably pertinent to discuss this result with regard to the relative size of the samples from the individual sites as those sites with the

Figure 7.1 — The Complete Lines from Enlène.





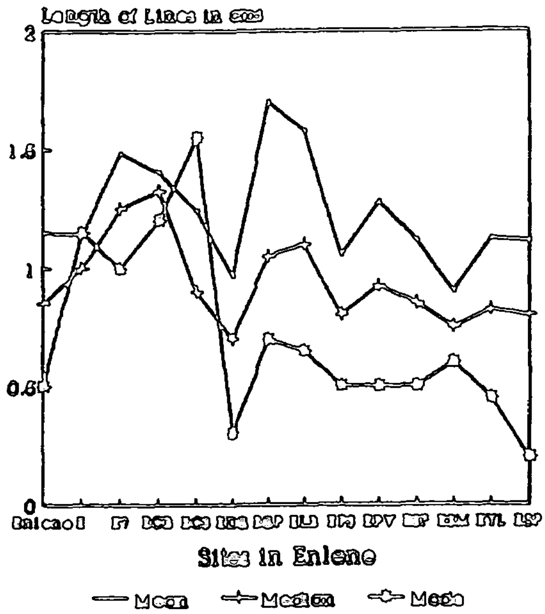
smallest range, namely E, E?, ECS, ESM, EYL and E3F, are all represented by less than 17 examples. Yet EPV only has 11 examples but a range of 4.00 cms and EGP only 19 and a range of 9.35 cms. Similarly the largest site sample taken from ESF of some 168 examples has a range of 7.05 cms, whereas the smaller sample from EDG (139 examples) has a higher range of 10.15. Undoubtedly the range for all sites is biased by only a very few high values, with the majority clustering around 0.30 - 0.60 cms. The appearance of some high values will be analysed further with regard to other factors, including artefact size.

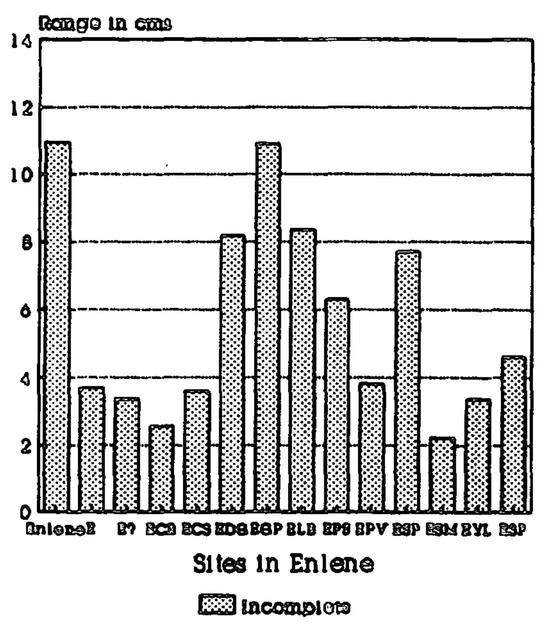
The most striking feature of the data from the complete lines is the surprisingly constant modal distribution at 0.30 cms for the sites of EDG, EGP, EPS and ESM despite the variation between their range, median and mean. Furthermore within 0.10 cms of this value the sites of E?, ELB, EPV, EYL and ESF can also be included. As I discussed, both the median and the mean can be skewed by the chance and isolated occurrence of high values which indicates for these examples at least, the mode is the most significant indicator of regularity.

7.3.2 The Incomplete Lines.

Figure 7.2 shows the mean, median and modal values for the incomplete lines, which form about 58% of the total, at 1.15 cms, 0.85 cms and 0.50 cms respectively. Interestingly these incomplete lines present a more broadly distributed range of values, as although from figure 6 it can be seen that there is a peak frequency at the mode of 0.50 cms (189 incidences), there are similarly high values at 0.40 cms (164), 0.30 cms (166), 0.60 cms (182), 0.70 cms (173) and 1.00 cms (118), although again the higher values have very low frequencies. This probably accounts for the fact that the sites within Enlène do not retain the exceptional modal distribution of the complete lines. However The sites of EPS, EPV and ESF do share a common mode, and EYL and ESM are within 0.10 cms, and so the mode does remain a significant common factor between the sites. The range of the values is 8.30 cms for Enlène, smaller than that for the complete lines, and although each site is different, the ranges span the lowest (ECB) to the highest (again EDG) at relatively regular intervals although predictably the range tends to be grouped around the lower values. Interestingly, here too the sites that have the lowest range are also the

Figure 7.2 — The Incomplete Lines from Enlène.





smallest samples – as ECB, ESM, EYL and E? are all below 4.00 cms – yet to counter this EGP, with 19 artefacts, has the highest range at 10.90 cms.

Initially it might seem strange that the incomplete lines are actually on average longer than the complete (1.150 cms compared to 0.784 cms), until this is compared with artefact size, and correlated with the fact that without exception *all* the artefacts from which these measurements were taken are broken. Longer lines are more likely to be incomplete as it is increasingly probable that they cross a broken edge of some kind. Furthermore longer lines are usually along the long axis of the bone, and it is the proximal ends that tend to fracture first. Conversely shorter lines are more likely to be away from the broken areas and, although appearing along both the short and the long axis, will not necessarily be located adjacent to the ends, and therefore will be classed as 'complete'.

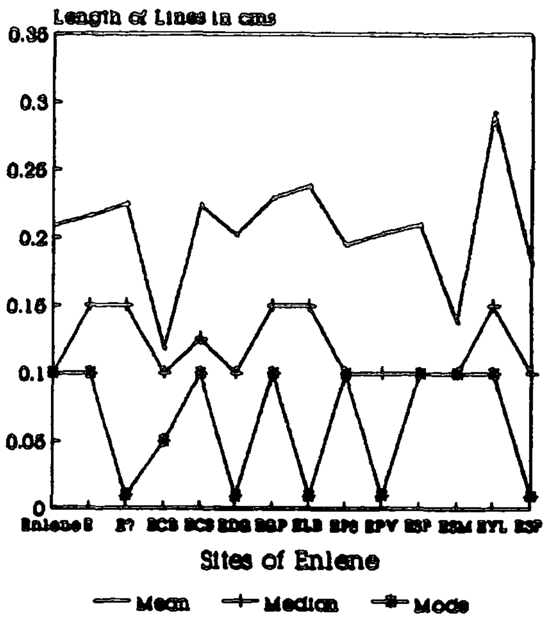
7.3.3 The Distances Between the Lines.

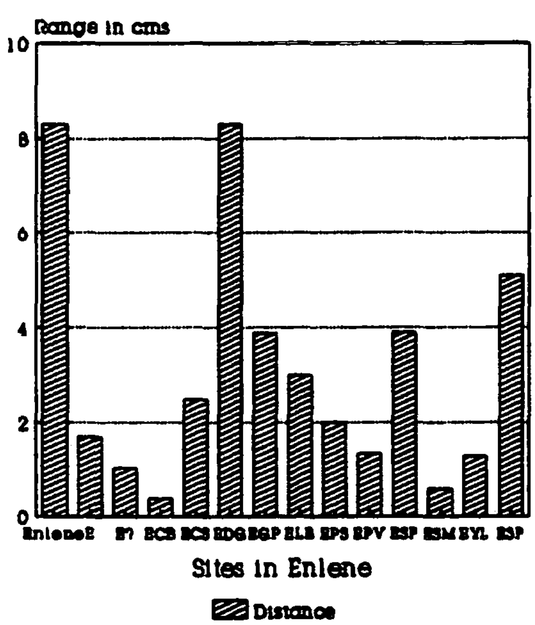
The mean value for the distances is 0.209 cms, and both the median and the mode share a value of 0.10 cms. The range is 8.30 cms, as there are a few exceptionally high values, but as Figure 7.3 shows these are anomalous to the sample as, apart from EDG, all the sites have a range of less than 5.00 cms. On a site by site basis there is a degree of homogeneity: sites E, ECS, EGP, EYL, EPS, ESF and ESM all share the same mode at 0.10 cms, and the latter three also have this as their median – in fact the median only deviates between 0.10 cms to 0.15 cms. The mode shows a definite trend, as the sites E?, EDG, ELB, EPV and E3F all have a mode of 0.01 cms, which is the default value given when the lines actually cross to indicate that in one sense there is no 'distance' between them.

7.3.4 Summary of Line Lengths from Enlène.

Firstly, although the range of the values would suggest that the artefacts have lines of varied lengths, the basic statistical tests indicate that only very few of the lines are over 5 cms long, and in fact the vast majority are under 2 cms in length. This has effectively confined the mean and the median values as less than 1 cm long, and the mode as still smaller. Although not showing identical values, the mean, median and mode for both complete and incomplete lines were similar, although, when reduced to individual sites, the complete data tends to be more clustered into

Figure 7.3 — The Distances Between Lines from Enlène.





bands and groups, whereas the incomplete data tends to broadly span the range. When amalgamated, the results provide a homogenous picture with convincing trend towards small lines. However as the average dimensions of the artefacts is 3 cms by 1.5 cms, this is likely to be a function of artefact size. This also represents a preference for lines roughly parallel to the short axis of the bone.

However as so many bones have broken lines, line length alone is not a true measure of variability or homogeneity. The distances between the lines provide a more effective measure of regularity, as to a great extent this is unaffected by breaks in the lines. Measuring this on a 'site' basis has the advantage of identifying broader trends, but as I aim to isolate *single* artefacts a further test needs to be devised. The question remains, were these marks made on these bones for a specific purpose or do they represent purely random accumulations of lines? No one factor will necessarily demonstrate that an example was the result of intent, yet a combination of certain factors might possible indicate that this was the case.

7.4 The Complete Bones: Further Analyses.

The following sections of this chapter explore the possibility of identifying and quantifying the structure of lines on portable artefacts. The data used in the following analyses comes from five sources. The first group of artefacts is referred to as the 'Ethnographic' collection, and consists of fifteen cases taken from thirteen recently documented examples of notation. Seventeen prehistoric artefacts from the museum of St. Germain-en-Laye, Paris form another data set. These examples are all dated to the Upper Palaeolithic and were included in the museum collections on the basis of the exceptional nature of the marks, which were interpreted as decorative, or non-random.

A selection of the artefacts used by Alexander Marshack in the Roots of Civilisation are represented, as he claims that the structure of their marks is evidence of notational sequences. Some of the examples from Enlène are included, thirty four in total. However as all the bones are broken, only a sample of those with complete lines have been included in the first run of statistical tests. The final group of data comes not from the Palaeolithic, but from a computer. After I presented a preliminary paper in 1991 on the artefacts from Enlène, concentrating on the difficulty of testing for 'randomness' in such material, Steven Mithen from the Mc Donald Institute, Cambridge, devised a program that generated any number of drawings of 'artefacts'. These are based on certain structural constraints derived from my Enlène data set, namely the average length, breadth and width of the 'bone', and the number of marks per example. Ten of these examples are presented here as randomly ordered line sets, in order to test the probability that lines on artefacts could be randomly arranged, rather than intended as notational sequences.

7.4.1 Regularity and Variation.

There are three sources of structural information that can be used for each line of each artefact, namely the orientation, length and the distance between the line and its nearest neighbour. All these properties can be measured and used in statistical tests to identify similarity, repetition and variance. The aim of this investigation is to isolate any potential regularities both within each artefact and between the data as a whole. Given the nature of the data it is anticipated that there will be variations, not only from artefact to artefact, but also deviations from a structurally ideal notational sequence in which all lines would have exactly the same length and orientation, and spaced apart equally. Only someone trained as an architect or in technical drawing could provide a data set with no variability. This study has a broader scope, and any positive results are those which convey an idea of consistency and standardisation among the majority of the lines – not so narrow as to avoid creating variability where none exists, but sufficiently well defined to acknowledge pronounced and consistent variation. We need a scale of values to be produced in order to assess the probability that prehistoric sequences are a) random, or b) purposefully structured. In assessing the latter I shall take variability within the Ethnographic sample as a guide.

7.4.2 The Methodology.

In a Normal Distribution the mean, median and mode share an equal value. However some degree of skew exists in many statistical populations, resulting in variation between these measures. As the calculation of the mean produces a figure that reflects the relative values of all the data, it is used in the following tests assessing the regularity of the length, distance and orientation for each bone. As the following tests want to assess the variability between examples the standard deviation from the mean is considered to be a more accurate measure. The actual value is not important, as this could simply be a function of artefact size rather than high variability. The deviation from the average of the values for each artefact represents the composition of the actual values used to calculate the mean, and therefore gives a more accurate picture of homogeneity, which can be used as a measure of both intra- and inter-artefact variability.

In order to test the accuracy of any results, two separate statistical tests are performed on the data –

- **Cluster Analysis (Multivariate)** – calculating the standard deviation from the mean for the length, distance, and orientation of the number of lines for each bone and plotting all three in form of a dendrogram. This method illustrates both examples with high internal variability and those with comparatively low variability, and the relationship between all examples.

- **Multi-Dimensional Plots** – of the selected variables of length, distance and orientation. The advantage of these is that a strong visual representation of the relationship between artefacts is given, but at the same time the display illustrates and identifies at what level standardisation and variability occurs, for example showing up examples which may have high variability in the length of the marks but regularity in orientation and distance.

The question arises of what exactly is 'normal' variability? In accepting that no variability is improbable, it is still necessary to state in advance at what level an example will be rejected as lying beyond the bounds of probability for a notational artefact. A level of rejection can be calculated statistically but it is also possible to provide data to act as a control. The documented ethnographic examples are known notations and tallies and as such their internal structure is necessarily ordered and regular within certain limits. Therefore it is plausible to assume that if it can be demonstrated that other examples share similar properties, then they too have the *potential* to communicate an idea of quantity through the order of their marks. The ethnographic data are hypothesised to exhibit 'normal' variability, and data from the examples from Paris, Marshack's data and some data from Enlène will be compared with them. The outer parameter is set by the ten 'random' examples generated on computer by Steven Mithen.

7.5 Multivariate Cluster Analysis.

Multivariate Cluster Analysis is used as a measure of the variability between cases. Essentially this method is useful in identifying any homogeneous groups that exist within a heterogeneous body of data. This test is stated as being suitable for a small to moderate data pool. For the purpose of this analysis the selected cases are coded in the following way:

- Engraved artefacts from Enlène: 001 – 461
- Upper Palaeolithic engraved artefacts (Paris): 600 – 613
- Documented examples of notation: 700 – 714
- Marshack's 'notational' examples: 800 – 807
- Mithen's random examples: 900 – 910

The three variables are the length, the distance between, and orientation of each line. At this stage, each of the five groups is analysed and made to cluster to illustrate the variation within each data set before being combined to form a single cluster.

7.5.1 Methodology.

The stated cluster method here is 'agglomerative', which is a hierarchical method of clustering. The data is made to form bigger and bigger groups until all the data are incorporated. The distance between the artefacts is partially calculated by the standard deviation from the mean of the length orientation and distance, which is entered as an initial value for each artefact. The proximity between the cases was here measured by the squared Euclidean distance, that is the distance between the cases is measured, squared and given as a final value. Therefore in the example presented as Table 7.1 below, the distance between the hypothetical cases of 1 and 2 is expressed as the coefficient value of '89'. The coefficient is recalculated in the first instance between all cases, and the smallest distance is recorded as the first cluster. This does not alter the relationship between the other cases, but once a case is combined in a cluster it remains within the group, although other cases are added and clusters can be combined. A relatively low coefficient indicates a high similarity, whereas a high value indicates high variability. In each instance the average linkage between groups is used, often called the '**unweighted pair group method using arithmetic averages**', or UPGMA. This method calculates at each level the average distances between all cases within the cluster, where St. Dev in the horizontal columns of the following table stands for the Standard Deviation for each case.

Table 7.1 — Calculating the Value of the Coefficient.

Cases	St. Dev. Length	St. Dev. Distance	St. Dev. Orientation
Case 1	32	67	21
Case 2	28	59	24
Differences	4	8	3
Squared	16	64	9

In Table 7.2 below illustrating the Ethnographic data, by Stage 4, two clusters have been formed; the first of (702, 706, 707, 7071) and the second of (701, 708). Therefore the average linkage between this and the next pair (their distance) is calculated from the average distances of all the cases, namely,

(701, 702), (701, 706), (701, 707), (701, 7071), (708, 702), (708, 706), (708, 707), (708, 7071).

The advantage of this method is that it uses all the available information.

Table 7.2 — The Ethnographic Data.

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2
1	702	706	1.719924	0	0
2	707	7071	2.656841	0	0
3	702	707	3.531692	1	2
4	701	708	12.246243	0	0
5	702	712	14.179588	3	0
6	702	709	18.456116	5	0
7	702	710	26.340155	6	0
8	711	7081	52.462799	0	0
9	711	713	73.901520	8	0
10	701	702	91.351646	4	7
11	703	704	253.207687	0	0
12	701	711	477.013397	10	9
13	701	705	604.127258	12	0
14	701	703	6444.375977	13	11

Figure 7.4 — The Ethnographic Data.

Dendrogram Using Average Linkage Between Groups.

Rescaled Distance Cluster Combine

```
Case        0         5        10        15        20        25
Label  Seq  +---------+---------+---------+---------+---------+
        702  -+
        706  -+
        707  -+
       7071  -+
        712  -+
        709  -+-+
        710  -+ |
        701  -+ +-+
        708  -+ | |
        711  -+ | +-------------------------------------------+
       7081  -+-+ |                                           |
        713  -+   |                                           |
        705  -----+                                           |
        703  -+-----------------------------------------------+
        704  -+
```

The numbers on the left (Case Label) refers to individual specimens.

7.5.2 Clustering Site by Site.

The Ethnographic Data.

As the Ethnographic examples number 15 there are 14 stages in this cluster analysis. The columns headed 'Cluster 1' and 'Cluster 2' illustrate the cases clustered at each stage, that is at stage 9, case 711 is clustered to case 713, whereas at stage 4 case 701 is clustered with case 708. These cluster columns are mirrored by the two columns labelled 'stage when cluster 1st appears' which identifies the stage at which the examples were first clustered to another case. For example at stage 11, the cluster between the two cases 703 and 704 , neither case has appeared in an earlier cluster, whereas at stage 5, case 702 has already been clustered at stage 3 with case 707, which means that the clustering at stage 5 between cases 702 and 712 is also linked to the cluster with case 707. When all examples are clustered, the operation is complete. This table clearly illustrates that the cases 702, 706, 707, 7071 and 712 are clustered to form a group of low variability. Other cases have higher coefficient, i.e. 704 and 703, and 701 and 711.

The highest variation is between example 705, a headman's tally, and the rest of the clusters at stage 13, which indicates that this example shares few common elements with the rest of the artefacts. However case 703, an aboriginal message stick, and 704, the Bushman's Cattle tally form their first cluster at stage 11 (253.207697), and are not incorporated into main cluster until final stage, so they also form an isolated group, with 704 sharing the fewest common characteristics with the rest of this data set. Case 701 evidently shares a number of common elements with other examples as it forms an initial cluster with 708, and joins the other cluster with 702 at stage 10, and then links up 711, 705, 703 and 704.

Although the table is informative, these links are best illustrated in the form of a dendrogram, shown below as Figure 7.4. This clearly shows the number of clusters as they are made and combined. The tally from the Naga Hills at 702 is linked with the Australian message stick 706, and interestingly both sides of the lamb tally are linked together at the next stage, (707, 7071) and then with 702 at the next. The Baker's Tally 708 is linked to another Baker's Tally 701, and then in stages 5 – 7, to example 702, and thus to 712, 709 and 710.

Table 7.3 — The Paris Data.

Stage	Clusters Combined		Coefficient	Stage Cluster 1st Appears	
	Cluster 1	Cluster 2		Cluster 1	Cluster 2
1	6052	6062	.024821	0	0
2	603	6052	.133633	1	0
3	606	609	.383892	0	0
4	613	606	1.252357	0	0
5	601	6093	1.471025	0	0
6	603	6072	5.244388	3	0
7	602	608	5.955325	5	0
8	607	611	5.955325	2	0
9	607	610	22.529903	0	0
10	603	6092	35.117115	0	4
11	601	605	39.303799	0	7
12	602	614	68.017921	11	10
13	604	607	74.590233	6	8
14	601	604	303.221039	12	13
15	601	603	854.619812	14	9
16	601	602	2316.327637	15	0

Figure 7.5 — The Paris Data

Dendrogram using Average Linkage (Between Groups).

Rescaled Distance Cluster Combine.

```
C A S E    0         5        10        15        20        25
Label  Seq +---------+---------+---------+---------+---------+
       606  -+
      6062  -+
      6072  -+---------+
      6052  -+         +-------+
       603  -+         |       |
      6092  -+---------+       |
       609  -+                 +-----------------------+
       610  -+-+               |                       |
       611  -+ +-----+         |                       |
       607  ---+     |         |                       |
       605  -+       +---------+                       +-----+
      6093  -+---+   |                                 |     |
       608  -+   +---+                                 |     |
       601  -----+                                     |     |
       602  ---+---------------------------------------+     |
       614  ---+                                             |
       604  -------------------------------------------------+
```

The numbers on the left (Case Label) refers to individual specimens.

The Paris Data.

The Paris data illustrate a more homogeneous data set than the Ethnographic as there are lower coefficients for a greater number of cases, for example by stage 8, examples 6052, 6062, 603, 606, 609, 601, 6093, 6072, 608, 607, 611 are all placed in the same cluster, yet the value is only 5.955325. This indicates that the Paris data set has a greater degree of structural consistency at this level than the Ethnographic data. The highest variability is between cases 601 and 602 (2316.327637), compared with 701 and 703, 704 (64444.375977), and to stage 13 the coefficient is below 100, (74.590233), compared to 604.127258 for the Ethnographic data. Case 601 acts in a comparable manner to 701 as it provides the link between more isolated cases and the main cluster. However the data does form a higher number of primary clusters as can be seen from the dendrogram on Figure 7.5.

Marshack's Data.

Marshack's data forms another homogeneous group, despite fewer examples and therefore stages, the coefficient of 3.254438 is lower than either Paris (5.538294) and the Ethnographic data (26.340155). Interestingly the cases all correlate with case 801, 'side 1' of Forneau de Diable rather than with other examples, see Table 7.4, stages 3 – 7, although they form a group with little variability overall. Cases 807 (Parpallo) and 806 (Barma Grande) share the fewest common links with the rest of the group.

The Data from Enlène.

The data from Enlène differs from the other data as the majority of artefacts are broken, and so there are a significant number of lines that are terminated prematurely. Although the majority cannot be included in this three variable analysis, 17 examples have been isolated as near complete, and are illustrated on Figures 7.8 to 7.9. Table 7.5 illustrates that this data set is heterogeneous, as although the final value between 003 and 058 is as high as that for the Ethnographic examples at 4821.271484, there is higher variability at all levels from stage 1 onwards. Again it is a single case, case 003, that clusters with the others cases to form the eventual cluster at stage 16.

Table 7.4 — Cluster Analysis: Marshack's Data.

	Clusters Combined			Stage Cluster 1st Appears	
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
1	805	8012	3.523638	0	0
2	803	805	5.008608	0	1
3	801	802	9.366042	0	0
4	801	803	39.561146	3	2
5	801	804	160.574463	4	0
6	801	806	1541.253906	5	0
7	801	807	2853.228271	6	0

Figure 7.6 — A Dendrogram : Marshack's Data.

Rescaled Distance Cluster Combine.

```
C A S E      0         5        10        15        20        25
Label  Seq   +---------+---------+---------+---------+---------+
       805    -+
      8012    -+
       803    -+-+
       801    -+ +-----------------------+
       802    -+ |                       +---------------------+
       804    ---+                       |                     |
       806    ---------------------------+                     |
       807    -------------------------------------------------+
```

The numbers on the left (Case Label) refers to individual specimens.

Table 7.5 — The Data from Enlène.

Stage	Clusters Combined		Coefficient	Stage Cluster 1st Appears	
	Cluster 1	Cluster 2		Cluster 1	Cluster 2
1	227	304	1.356448	0	0
2	058	203	15.532321	0	0
3	300	384	23.209911	0	0
4	003	300	44.353271	0	3
5	003	386	99.899841	4	0
6	021	087	143.786423	0	0
7	003	387	171.164246	5	0
8	303	315	186.205826	0	0
9	042	227	238.717377	0	1
10	003	306	318.460327	7	0
11	034	303	353.689484	0	8
12	003	034	706.590332	10	11
13	021	042	944.735657	6	9
14	003	021	1546.781250	12	13
15	058	234	1601.154297	2	0
16	003	058	4821.271484	14	15

Figure 7.7 — The Data from Enlène.

Dendrogram using Average Linkage (Between Groups).

Rescaled Distance Cluster Combine.

```
C A S E     0         5        10        15        20        25
Label  Seq  +---------+---------+---------+---------+---------+
       227   -+-+
       304   -+ +-----+
       041   ---+     +-------+
       021   -+-------+       |
       087   -+               |
       300   -+               |
       384   -+               +-------------------------------+
       003   -+               |                               |
       386   -+-+             |                               |
       387   -+ +---+         |                               |
       306   ---+   +---------+                               |
       303   -+-+   |                                         |
       315   -+ +---+                                         |
       034   ---+                                             |
       058   -+---------------+                               |
       203   -+               +-------------------------------+
       234   -----------------+
```

The numbers on the left (Case Label) refers to individual specimens, see Figures 7.8 and 7.9.

Figure 7.8 — The Complete Bones from Enlène.

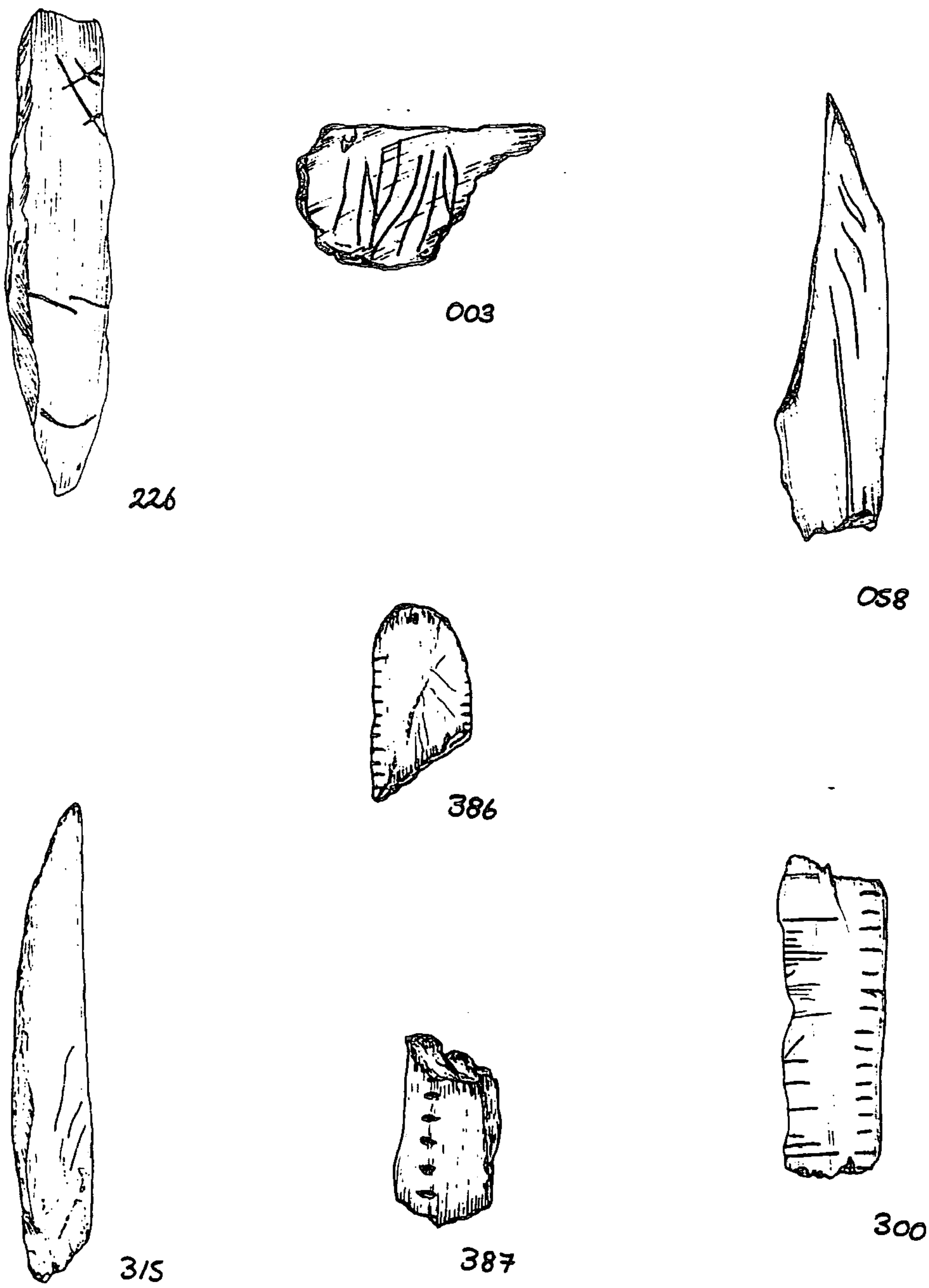


Figure 7.9 — The Complete Bones from Enlène.

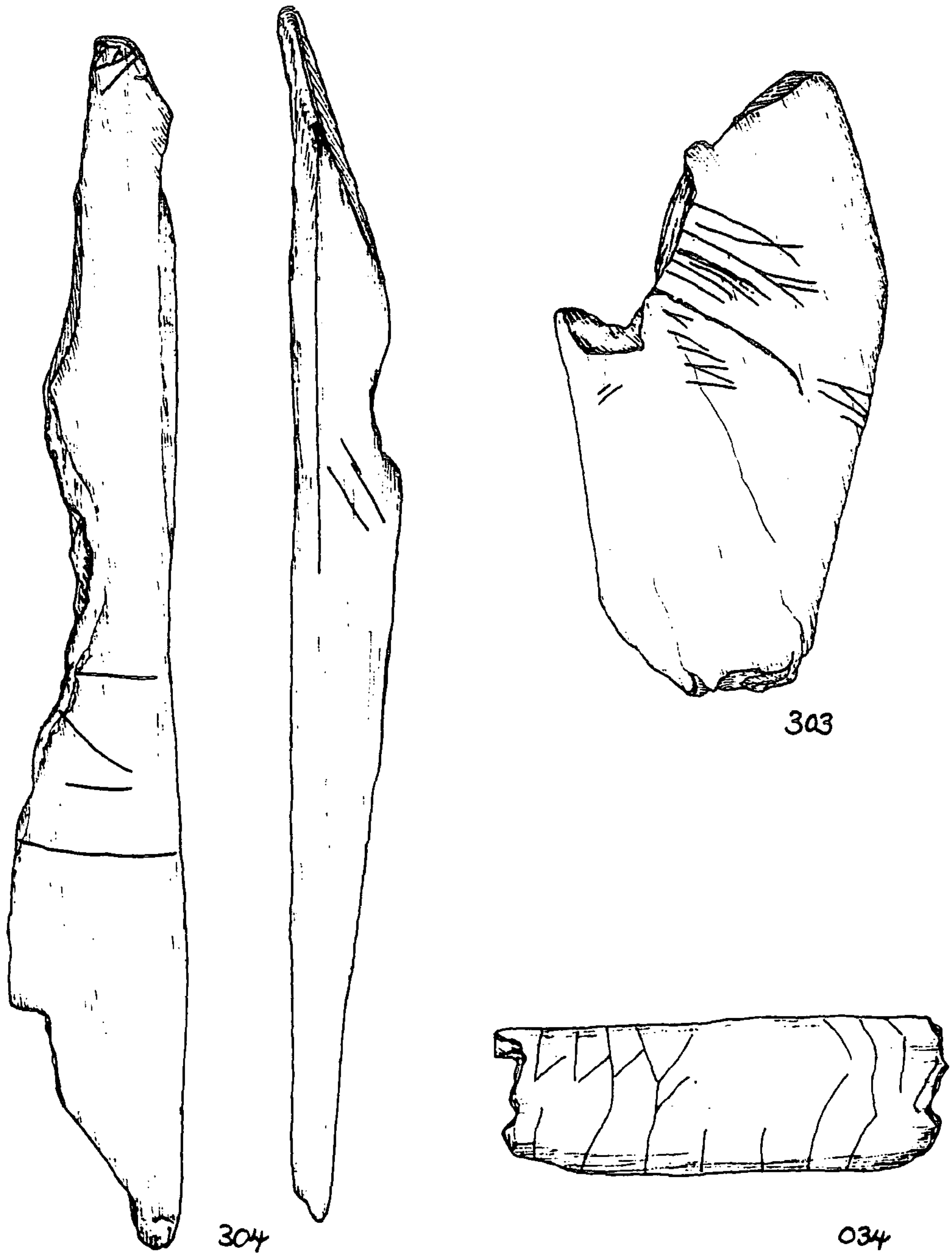


Figure 7.10 — The Complete Bones from Enlène.

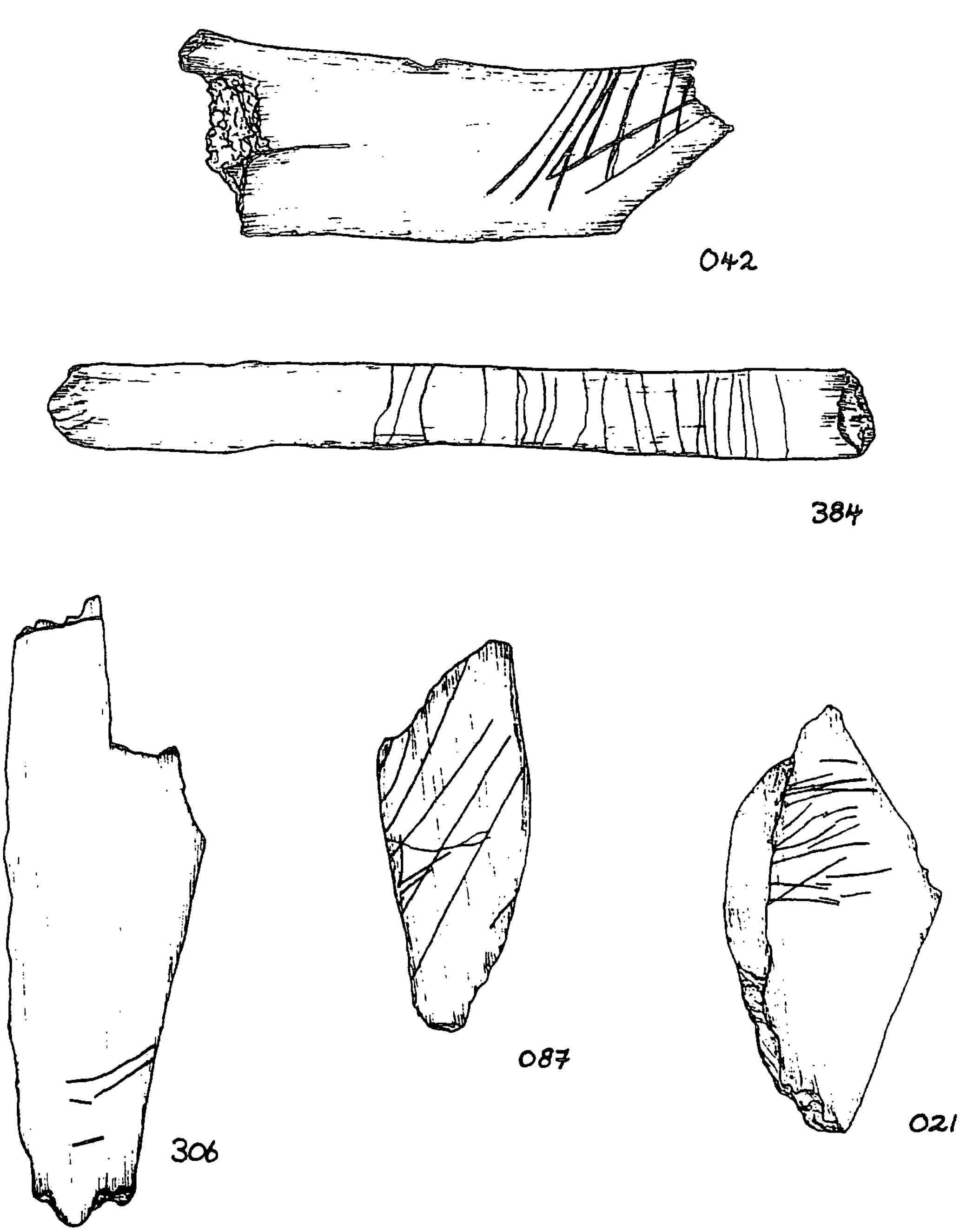


Table 7.6 — The Random Examples.

Stage	Clusters Combined		Coefficient	Stage Cluster 1st Appears	
	Cluster 1	Cluster 2		Cluster 1	Cluster 2
1	905	908	41.361984	0	0
2	902	905	213.296753	0	1
3	901	909	308.075043	0	0
4	906	907	478.497070	0	0
5	901	902	759.808777	3	2
6	906	910	889.461304	4	0
7	901	904	1345.914795	5	0
8	901	906	1715.912598	7	6
9	901	903	3784.219727	8	0

Dendrogram using Average Linkage (Between Groups).

Rescaled Distance Cluster Combine.

```
C A S E      0         5        10        15        20        25
Label  Seq   +---------+---------+---------+---------+---------+
       905    -+-+
       908    -+ +-----+
       902    ---+     +-------+
       901    ---+-----+       +-----+
       909    ---+             |     |
       904    -----------------+     +-------------------------+
       906    -----+-----+           |                         |
       907    -----+     +-----------+                         |
       910    -----------+                                     |
       903    -------------------------------------------------+
```

The numbers on the left (Case Label) refers to individual specimens.

The Random Data.

This data set shows exceptionally high internal variability: not only forming a number of discrete clusters, but achieving consistently high values for the coefficients. Even the initial cluster between 905 and 908 has a value of 41.361984, compared to 1.1719924 for the Ethnographic data, 0.24821 for Paris, .000081 for Marshack, and 1.356448 for Enlène.

7.5.3 Summary of Data.

Clearly the most homogeneous data set comes from Marshack's collection, followed by the examples from Paris. However the Ethnographic data forms a number of clusters at a low level and only the Enlène and random data exhibit patterns of consistently high variability. This illustration of intra group variability is useful in demonstrating the kinds of patterns of clusters that can emerge, and shows that on this basis, the groups from Paris and Marshack show low internal variability. However this is not a measure of the actual *values* that generate the coefficients. It is possible that the Paris data has high values for each case which overall results in low variability in average linking. In order to investigate this possibility, and also to see whether or not the data sets are discrete, the following table illustrates a multivariate cluster of all five data groups, numbering 66 cases.

From Tables 7.7, 7.8 and 7.9 it is evident that the final correlation coefficient is high, 6955.951172, yet not perhaps as high as it would have been had the data not proved to be broadly comparable as the recalculated average distance shows slow incremental increases rather than sudden jumps. Each time the distance is calculated it includes all the available data, and therefore the numbers in the clusters are necessarily larger and larger. Certainly the data appears to be intermixed, and at no point is one data set completely isolated from another. However there are a number of patterns that emerge from closer observation of the clusters. The examples are coded as before,

- Engraved artefacts from Enlène: 001 – 461
- Upper Palaeolithic engraved artefacts (Paris): 600 – 613
- Documented examples of notation: 700 – 714

Table 7.7 — All The Data Combined: Stages 1 – 22.

	Clusters Combined			Stage Cluster 1st Appears	
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
1	606	803	.547436	0	0
2	710	802	1.078389	0	0
3	709	8012	1.191711	0	0
4	606	6072	1.372896	1	0
5	707	801	1.376716	0	0
6	702	706	1.719924	0	0
7	707	7071	2.060367	5	0
8	606	6062	4.156675	4	0
9	611	905	4.305717	0	0
10	387	702	4.353908	0	6
11	606	805	4.609661	8	0
12	387	707	6.823427	10	7
13	606	709	7.100610	11	3
14	601	711	8.567492	0	0
15	384	386	9.329941	0	0
16	300	708	9.609227	0	0
17	300	701	11.329982	16	0
18	003	807	13.887996	0	0
19	387	712	15.235662	12	0
20	058	203	16.968075	0	0
21	611	806	19.125669	9	0
22	034	304	20.837967	0	0

Table 7.8 — All The Data Combined: Stages 23 – 44.

Stage	Clusters Combined		Coefficient	Stage Cluster 1st Appears	
	Cluster 1	Cluster 2		Cluster 1	Cluster 2
23	021	058	21.539490	0	20
24	608	713	22.241764	0	0
25	387	606	22.252312	19	13
26	610	908	25.414612	0	0
27	387	710	33.116718	25	2
28	601	7081	38.827499	14	0
29	603	6092	39.758415	0	0
30	003	604	42.559162	18	0
31	610	611	44.553085	26	21
32	605	6093	50.835117	0	0
33	234	910	58.294022	0	0
34	607	901	62.301750	0	0
35	804	6052	62.443520	0	0
36	306	384	64.953857	0	15
37	300	387	78.091469	17	27
38	614	902	81.220207	0	0
39	603	609	85.307625	29	0
40	315	704	86.399673	0	0
41	021	705	88.160561	23	0
42	034	234	88.574387	22	33
43	605	608	92.625610	32	24
44	042	703	117.775963	0	0

Table 7.9 — All The Data Combined: Stages 45 – 66.

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2
45	300	804	154.143509	37	35
46	306	601	155.261932	36	28
47	303	315	171.452682	0	40
48	021	055	173.504974	41	0
49	003	907	202.449997	30	0
50	607	610	270.262756	34	31
51	602	904	283.113373	0	0
52	607	614	300.886414	50	38
53	021	034	318.379272	48	42
54	306	605	350.841217	46	43
55	042	303	435.481415	44	47
56	300	306	444.886383	45	54
57	003	227	566.412537	49	0
58	003	021	673.821472	57	53
59	607	906	733.199219	52	0
60	603	909	796.993103	39	0
61	602	607	864.384460	51	59
62	300	603	1051.942383	56	60
63	003	300	2096.888428	58	62
64	003	602	2241.375000	63	61
65	003	042	5885.937500	64	55
66	003	903	6955.951172	65	0

- Marshack's 'notational' examples: 800 – 807
- Mithen's random examples: 900 – 910

From the tables the clusters with the lowest variability are made up of examples only from the Ethnographic, Paris and Marshack data. The first eight clusters include four examples from Marshack, three from Paris, and six from the Ethnographic, with repetitions from cases 707 (x2) and 606 (x3). The data in this cluster are the artefacts 606, 6062, 6072, 702, 706, 707, 7071, 709, 710, 801, 8012, 802 and 803. However clearly a slight readjustment has taken place, as although examples 606, 803, 706, 707, 7071, 702. 801, 8012 and 6062 all occurred in the earliest clusters in their separate groups, 710, 709, 6072 do not. Some examples, such as 804 which clusters at stage three within its own data set, are not represented in this combined cluster until stage 34. Evidently there is a realignment of the data, which will be investigated further.

The Ethnographic examples continue to occur in clusters of low variability, with 13 of the 16 occurring in the first 28 clusters of the total 66. The first clusters are formed with Marshack's data (see stages 2, 3 and 5), and then 702 and 706 are clustered at 6, and 707 and 7071 at stage 7. Interestingly 708 and 701 both cluster with the same example, 300 from Enlène, at stages 16 and 17, and 712 clusters with 387 at stage 19, which brings this example into the cluster formed earlier of 707, 702, 706, 7071 and 801. At stage 28, 7081 clusters with 601, and also case 711, which here is clustered at stage 14 whereas in the first cluster it was amongst the three most variable artefacts. Another case that exhibited high variability in the initial cluster of the Ethnographic data is case 705. Here it also clusters at a higher level than all the other Ethnographic examples, stage 41, joining with examples from Enlène, 021, 058 and 203. Examples 704 and 703 also repeat their patterns of relatively high variability, clustering with data from Enlène at levels 40 and 44 respectively.

The other control was Steven Mithen's randomly generated examples, which should cluster in a different manner from the Ethnographic examples, since the latter are known have been created to communicate information by the structuring of their engraved lines. From the table of results it is evident that this is the case, as the ten random examples each occur only once throughout the table and none are used to form larger and larger clusters.

The examples do not cluster together, and they cluster only with examples from Paris or Enlène, which, within their group clusters, showed the highest variability. The Enlène example 003 is perhaps the exception, as it occurs in this cluster first at level 18, and in the group cluster at stage 4. It is possibly that this example is highly variable, or perhaps possesses 'linking' elements that are sufficiently common to examples with high and low variability. Most notably this example forms the basis of the final clusters from 63 – 66. The pairing of the random examples with those from the Paris collections is also notable. Other than examples 606, 6072 and 6062 which formed a cluster with 803, 805 and 709 by stage 8, and 601 and 711 which pair at stage 14, the other examples either pair with random examples or each other, scattered throughout the table. 605 and 605 pair at 32, and then 609 and 603 (and 6092) pair at stage 39. The highest cluster occurs at stage 64 where 602 clusters with the Enlène case 003.

This clustering of the Paris and Random data relates to a point made earlier, which stresses that consistently low coefficient values within a group, such as the Paris data in section 7.5, could indicate either low *or* high variability. As the coefficient is calculated as the average distances between groups, this value is high only between examples of low and high variability. Therefore the clustering of Paris data with the Random data could be by chance, but it thought more likely to occur as the result of the high structural variability of a number of the Paris examples.

The cluster formed at stage 9 between 611 and the Random example 905 next includes one of Marshack's examples, 806 at stage 21, and then links this example with 610 and 908, 607, 614 and 906 and eventually 602 at stage 61. Clearly here there is some association between examples of high variability. The other example of Marshack's that showed a relatively high level of variability in the initial intra-group clusters is 807, which clusters with 003 at stage 18. The latter example of course goes on to cluster in the very highest areas of variability at the last stages of the clusters. Despite the very low correlation coefficients present in Marshack's data, example 804 does not cluster until stage 35 with 6052 from Paris, and not again until stage 45 with 300 from Enlène. The examples from Enlène occur evenly

Table 7.10 — The Incorporation of the Random Examples.

Site	Clustered Case	Random Example	Level of Cluster
Paris	611	910	9
Paris	610	908	26
Enlène	234	910	33
Paris	607	901	34
Paris	614	902	38
Enlène	003	907	49
Paris	602	904	51
Paris	607	906	59
Paris	603	909	60
Enlène	003	903	66

throughout the data. Clearly case 003 is of note, and 300 and 021 occur at a number of stages to form the link between clusters. Case 387 forms the initial cluster with 702, but other than this they do not really occur in a particular pattern although do cluster with each other in over 50% of incidents.

7.5.4 Summary of Results.

Despite the fact that the Ethnographic data showed some areas of high variability compared to Marshack and Paris, the examples occur principally in the first 28 stages, and even the most variable cases are included by stage 44, although these do form more isolated clusters. The Paris data have some examples which cluster with the Ethnographic examples at the early stages, but are more scattered and tend to cluster either with each other or the Random examples. This is true also for the data from Marshack, which showed very highly levels of homogeneity in the initial intra-group cluster, but some high levels of variability when the data are clustered with that from other groups.

Figure 7.11 — 3-Dimensional Plot of Ethnographic Data.

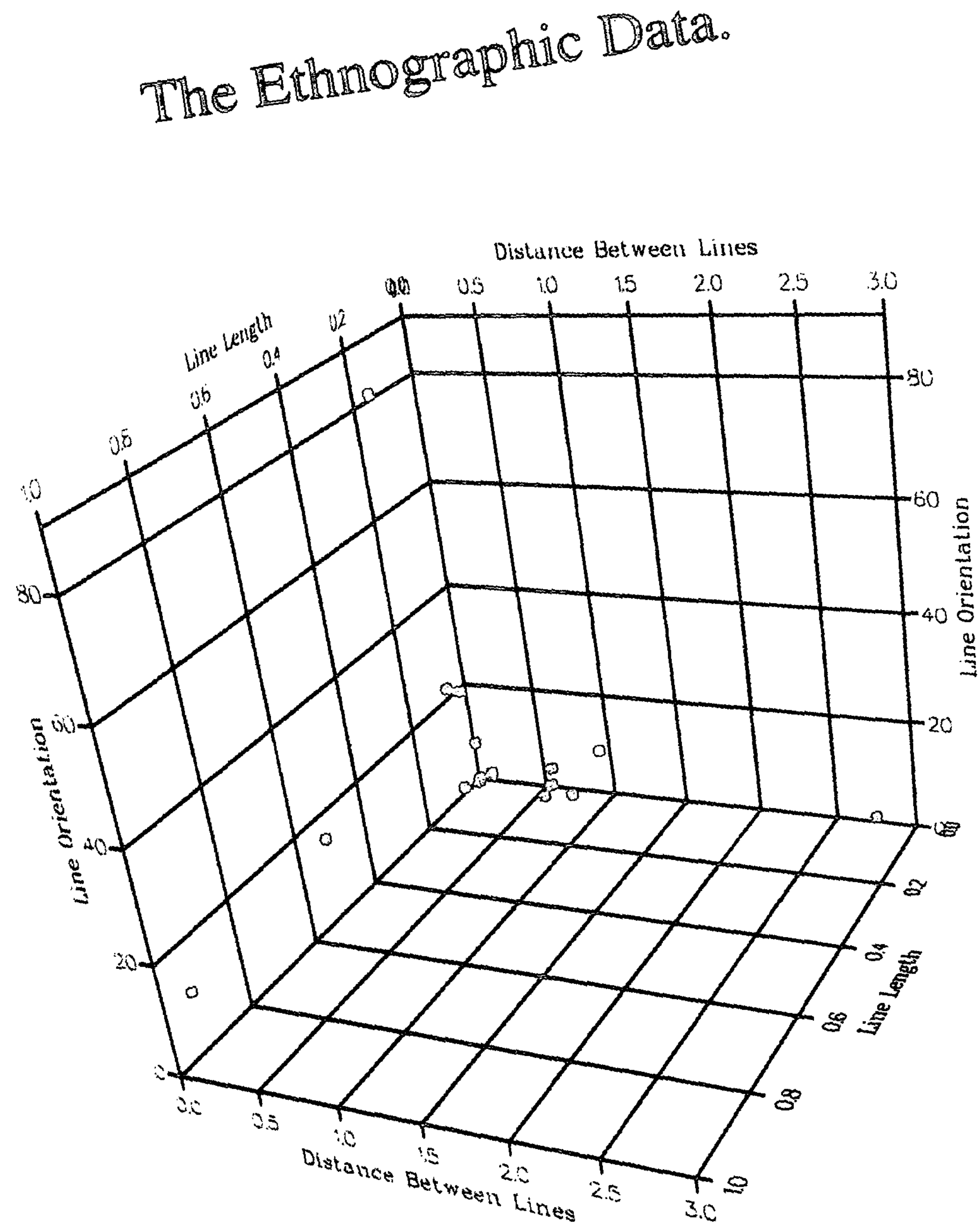


Figure 7.12 — 3-Dimensional Plot of The Random Data.

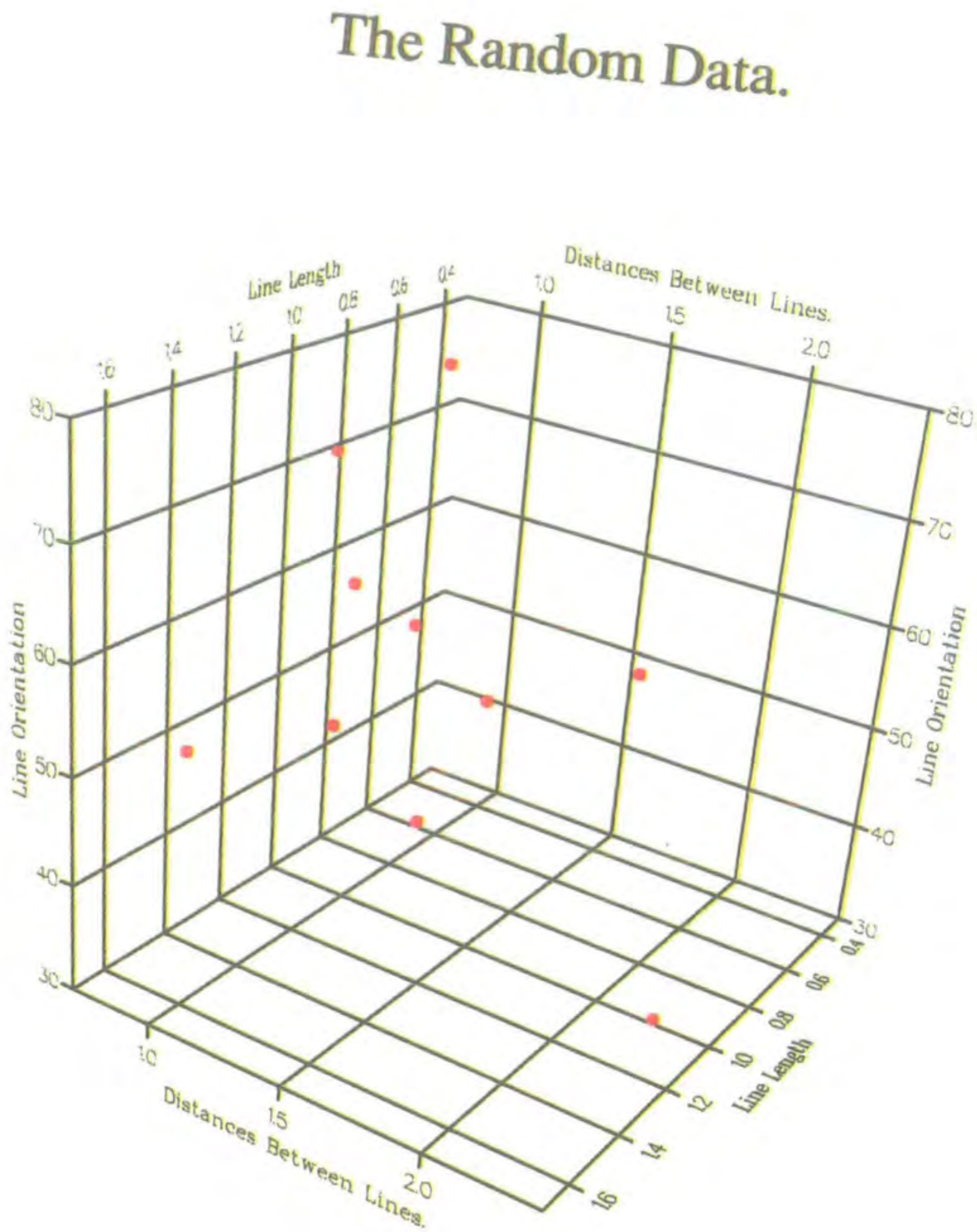
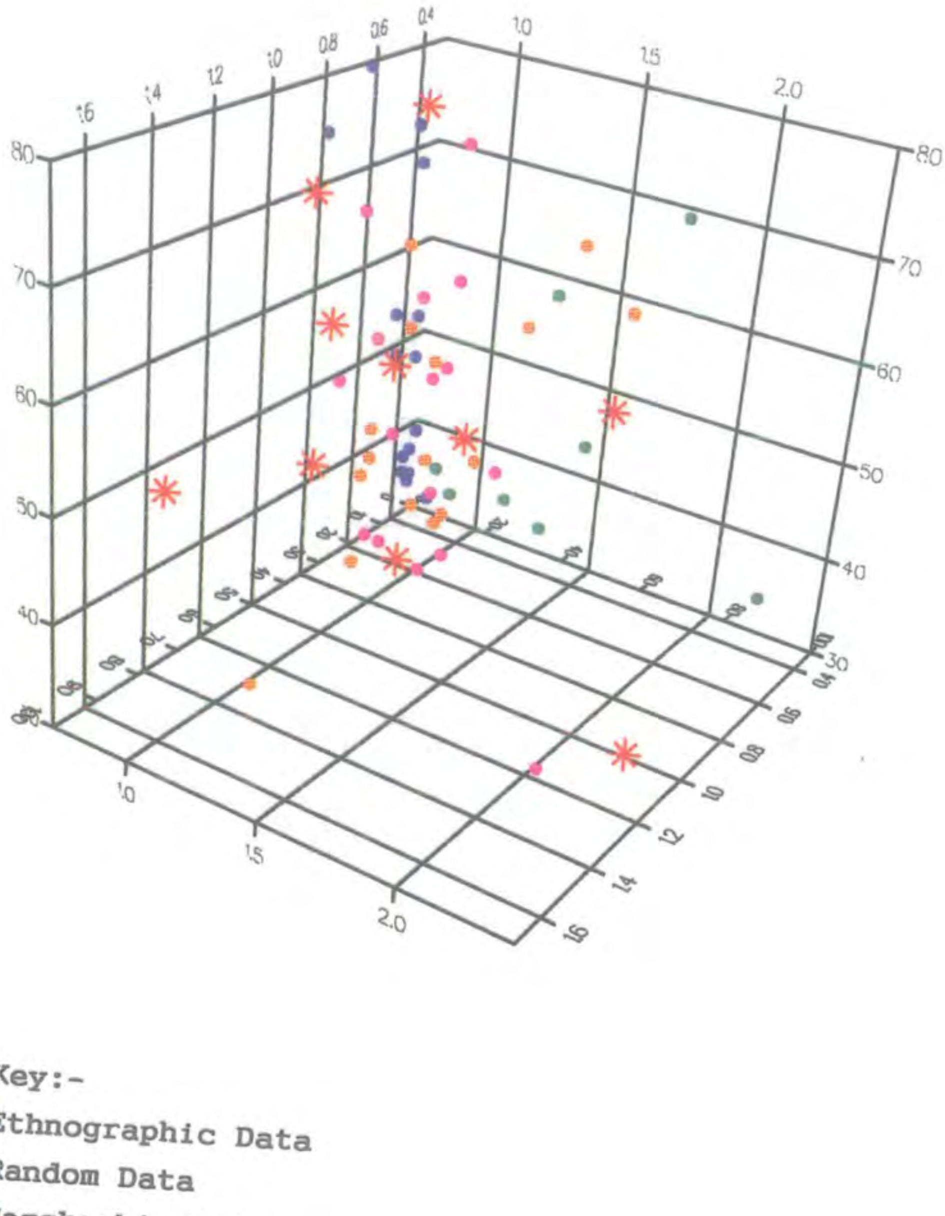


Figure 7.13— 3-Dimensional Plot of All Data.



Key:-

Ethnographic Data

Random Data

Marshack's Data

Paris Data

Enlene Data

7.6 The Multi-Dimensional Plots.

In order to test and visualise whether the clusters identified in the analyses above present an accurate reflection of the cases with low and high variability, the same five groups of data are plotted on graphs. These graphs are constructed using Unigraph on the Uniras database, and using Cricket Graphs on Macintosh. The three coordinates which are calculated from each bone are the standard deviation from the mean for the length, breadth and orientation of all the lines for each of the artefacts. These measures should reflect the presence or absence of standardised repetition associated with translational symmetry. There are evidently a number of ways in which these derived coordinates can be presented, either site by site, or any combination of the same, in two or three dimensional plots. Figures 7.12 and 7.13 illustrate the distribution of the two 'control' examples, from the Ethnographic data and the Random data. Although the coordinates of the individual cases are more difficult to read, the two dimensional plots that follow are easier.

As the aim in this instance is to illustrate the potential relationships between examples, Figure 7.11 presents all the data on a single illustration. The Ethnographic data (coded blue) clearly clusters along the central axis showing low distance and orientation variability. The Paris data (pink) follows the same sort of pattern, but has examples of higher variation in line length. Marshack's data (green) follows a completely different pattern, exhibiting higher levels of variability in orientation and distance, matched only by the Enlène data, which in addition has examples of higher line length variability, (orange). The Random examples (red stars) are predictably scattered showing a high level of variability in length, distance and orientation. These results confirm the findings of the Multivariate Cluster analysis, as those examples with a higher coefficient occur in groups that also demonstrate higher levels of variability in this three dimensional plot. The main cluster appears to be around the Ethnographic data in areas of low line length and distance variability, continuing into areas with higher angle variability.

The advantage of using three dimensional plots with cluster analysis is that the source of the true variability can be isolated. The graph shows the nature of the variation, and the cluster builds up a picture of how this variation can be measured and the artefacts grouped according to similarities in their constituent coordinates. The composition of the three dimensional plots can be built up in stages, by comparing each of the three variables to one another in turn, in this instance Length/Distance, Length/Orientation and Distance/Orientation, illustrated as Figures 7.14, 7.15 and 7.16. In common with the cluster diagrams, examples plotted on a scatter plot will cluster together according to similarities in their constituent coordinates.

7.6.1 Looking at 2-Dimensional Plots.

Length / Distance.

This indicates that the majority of examples cluster in the areas of low variability. However there are a number of examples that show higher levels of variability in all the data sets. The Ethnographic examples are scattered, but have high variability only in the measure of distance between lines. The example with a distance value of over 2.5 cms can be explained, as this gardener's tally has only five marks: four clustered together at one end of the stick, and then a single mark at the other end. Similarly the case with a value of over 1.5 cms has only six marks: two 'crosses', an adjoining mark again separated by a broad distance from the final mark, hence the high standard deviation from the mean. The Random examples are predictably scattered, with six occurring outside the parameters set by the Ethnographic data, and if the two exceptional Ethnographic cases are discounted, there are eight (out of ten) random examples outside the parameters set by the Ethnographic data. Conversely only few examples of the Palaeolithic data occur outside this theoretical boundary: one case each from Enlène and Paris, and two from Marshack's data, cases 806 and 807.

Length/Orientation.

This graph shows a similar distribution, but the random examples are clearly isolated from the cluster around the lower coordinates, leading to the conclusion that the principle source of variation between this group of data and the others lies in the high variation in line orientation. The statistical parameters set by the Ethnographic data encompass examples from all the other data sets, but here exactly half of the Paris data occurs outside, as do a quarter of the cases from Enlène. The same two cases from Marshack's data also occur outside these parameters.

Figure 7.14 — 2-Dimensional Plot of Length/Distance.

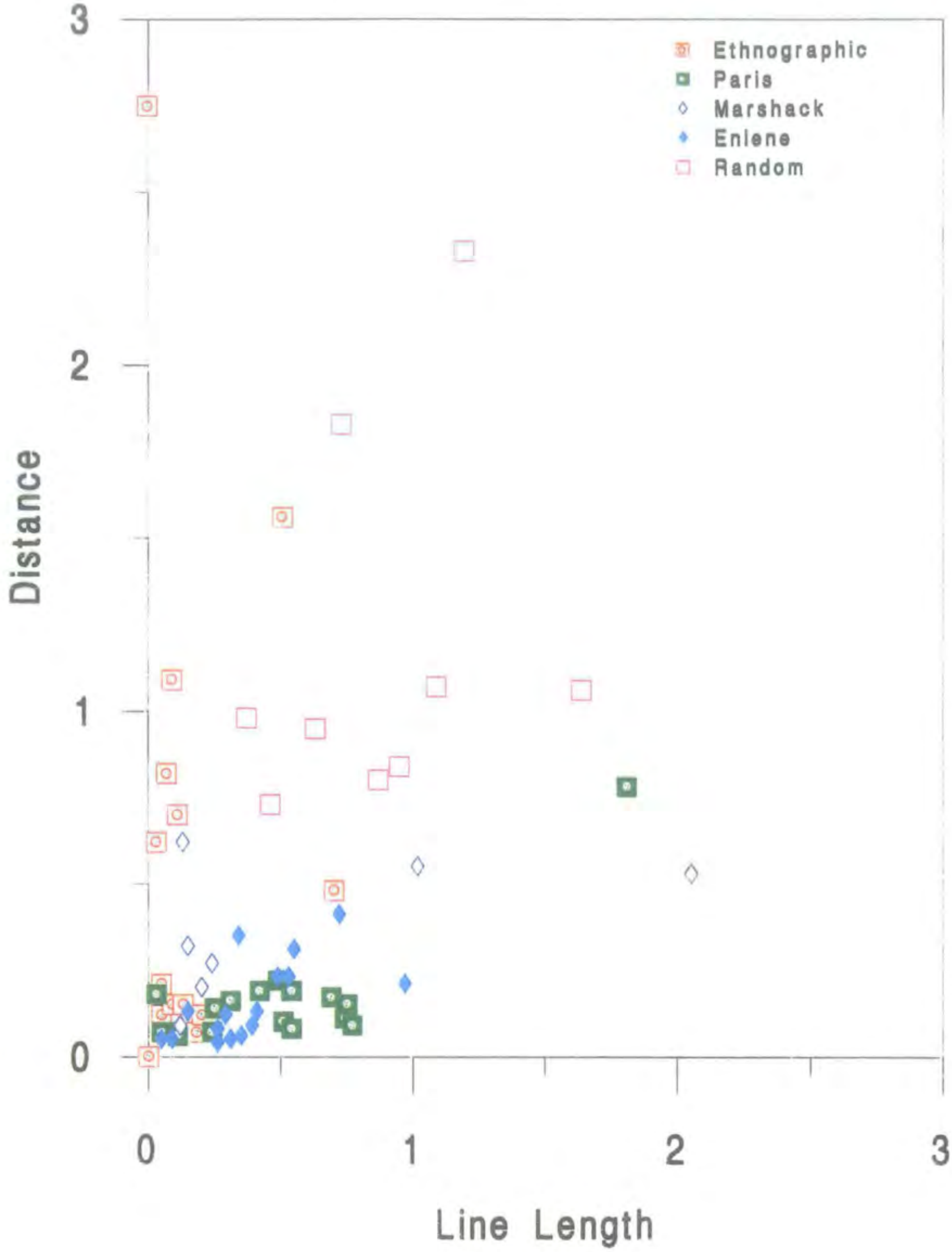


Figure 7.15 — 2-Dimensional Plot of Length/Orientation.

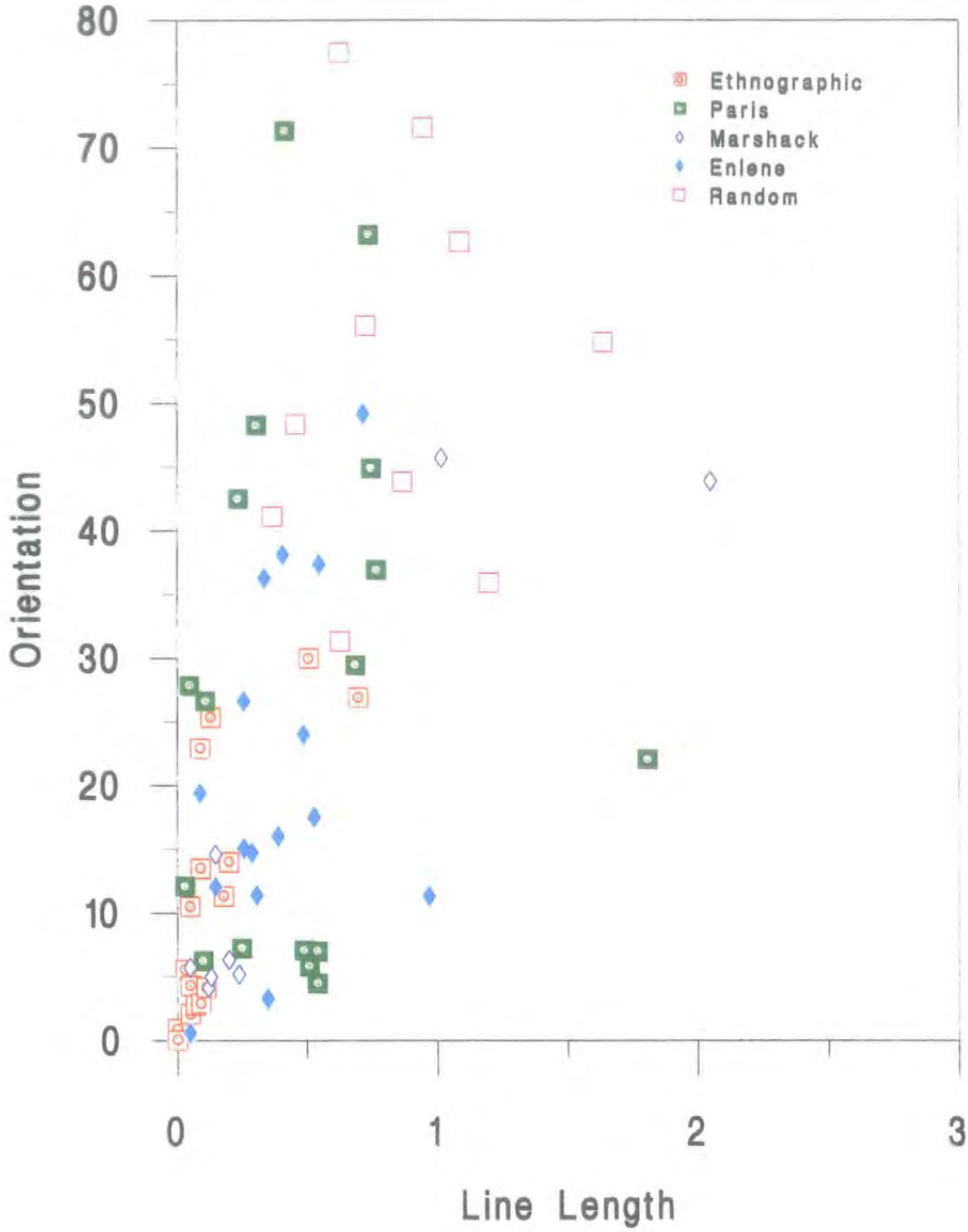
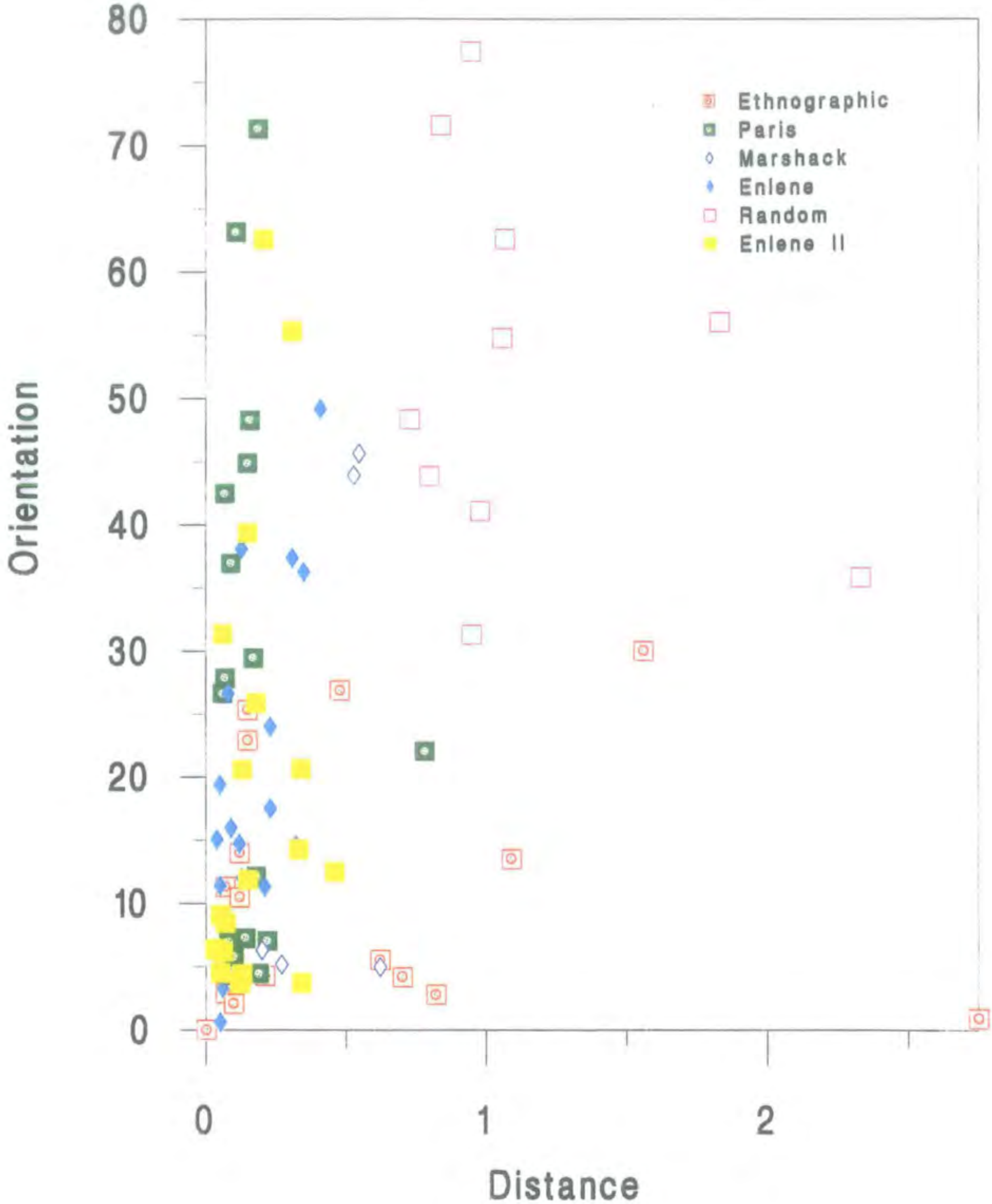


Figure 7.16 — 2-Dimensional Plot of Distance/Orientation.



Distance/Orientation.

In this plot of Distance and Orientation only *one* of the Random examples occurs within the statistical parameters of the Ethnographic data. If the two Ethnographic cases with high distance variability are temporarily discounted, *none* of the Random examples occur within the limits of Ethnographic variability. Over half of the Paris cases, and over a quarter of Enlène cases occur *outside* this boundary. The same two cases from Marshack's data again exhibit a high level of variability. For the first time *incomplete* examples from Enlène have been included, with only four out of eighteen examples exhibiting high level of variability.

7.6.2 Summary of Results.

The two dimensional plots show more accurately how the three dimensional plots are constructed, and identify the sources of any variability. The length of the lines in all groups shows relatively little variability. It is only when these data are combined with distance and then orientation that the true patterns emerge, the same patterns that appeared in the three-variable plots and multivariate tables. It is possible to isolate 'length' as the least volatile variable, with more variation in 'distance', and then 'orientation'. This method of breaking down the three dimensional plots provides a valuable insight into the way in which orientation seems to be the key to the variability, which was already interpreted from the three variable cluster analyses. If it is the case that orientation and distance are the primary source of differentiation between examples of known order, and examples on which the lines are known to be random, then the data pool can be extended.

7.7 Isolation of Variables: Distance and Orientation.

The analysis of the data recovered from the site of Enlène revealed that *all* the bones are broken, although the nature of the break varies from artefact to artefact. This means that only a restricted number of the examples could be included in the three variable cluster analysis and plots, as any with lines prematurely terminated by a break were excluded. However the results from the three dimensional plots indicates that variation in line length is possibly not the prime variable for distin-

Table 7.11 — The Ethnographic Data.

	Clusters Combined			Stage Cluster 1st Appears	
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
1	702	706	1.719038	0	0
2	707	7071	2.546048	0	0
3	702	707	3.500539	1	2
4	701	708	12.205412	0	0
5	702	712	13.040510	3	0
6	702	709	18.196827	5	0
7	702	710	26.147726	6	0
8	711	7081	51.919643	0	0
9	711	713	73.588745	8	0
10	701	702	91.094795	4	7
11	701	711	476.716522	10	9
12	701	705	603.787842	11	0
13	701	704	5449.465332	12	0
14	701	703	6691.795410	13	0

Figure 7.17 — Two Variable Clusters of Ethnographic Data.

Dendrogram using Average Linkage (Between Groups).

Rescaled Distance Cluster Combine.

```
C A S E    0         5        10        15        20        25
Label  Seq +---------+---------+---------+---------+---------+
       702  -+
       706  -+
       707  -+
      7071  -+
       712  -+
       709  -+-+
       710  -+ |
       701  -+ +-+
       708  -+ | |
       711  -+ | +-----------------------------------+
      7081  -+-+ |                                   |
       713  -+   |                                   +-------+
       705  -----+                                   |       |
       704  -----------------------------------------+       |
       703  -------------------------------------------------+
```

The numbers on the left (Case Label) refers to individual specimens.

Table 7.12 — The Random Examples

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2
1	905	908	12 41.062946	0	0
2	902	905	213.143463	0	1
3	901	909	306.655853	0	0
4	906	907	477.758698	0	0
5	901	902	759.270203	3	2
6	906	910	888.677490	4	0
7	901	904	1345.568115	5	0
8	901	906	1715.294556	7	6
9	901	903	3783.545898	8	0

Figure 7.18 — Two-Variable Clusters of Random Data.

Rescaled Distance Cluster Combine.

```
C A S E     0         5         10        15        20        25
Label  Seq  +---------+---------+---------+---------+---------+
       905   -+-+
       908   -+ +-----+
       902   ---+     +-------+
       901   ---+-----+       +-----+
       909   ---+             |     |
       904   -----------------+     +-------------------------+
       906   -----+-----+           |                         |
       907   -----+     +-----------+                         |
       910   -----------+                                     |
       903   -------------------------------------------------+
```

The numbers on the left (Case Label) refers to individual specimens.

Table 7.13 — The Data from Enlène.

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2
1	227	304	1.308430	0	0
2	304	203	14.971565	0	0
3	300	384	23.201265	0	0
4	003	300	44.306160	0	3
5	003	386	99.879250	4	0
6	021	055	143.784332	0	0
7	003	387	171.141937	5	0
8	303	3154	186.144653	0	0
9	042	227	238.613892	0	1
10	003	306	318.256805	7	0
11	003	303	353.612244	0	8
12	003	034	706.464233	10	11
13	021	042	944.628967	6	9
14	003	021	1546.669067	12	13
15	058	234	1600.971191	2	0
16	003	058	4821.069824	14	15

Figure 7.19 — Two Variable Cluster of The Data From Enlène.

Dendrogram using Average Linkage (Between Groups).

Rescaled Distance Cluster Combine.

```
C A S E        0         5        10        15        20        25
Label   Seq    +---------+---------+---------+---------+---------+
        227     -+-+
        304     -+ +-----+
        042     ---+     +-------+
        021     -+-------+       |
        055     -+               |
        300     -+               |
        384     -+               +-------------------------------+
        003     -+               |                               |
        386     -+-+             |                               |
        387     -+ +---+         |                               |
        306     ---+   +---------+                               |
        303     -+-+   |                                         |
        315     -+ +---+                                         |
        034     ---+                                             |
        058     -+---------------+                               |
        203     -+               +-------------------------------+
        234     -----------------+
```

The numbers on the left (Case Label) refers to individual specimens, illustrated on Figures 7.20 and 7.21.

Figure 7.20 — The Incomplete Bones from Enlène.

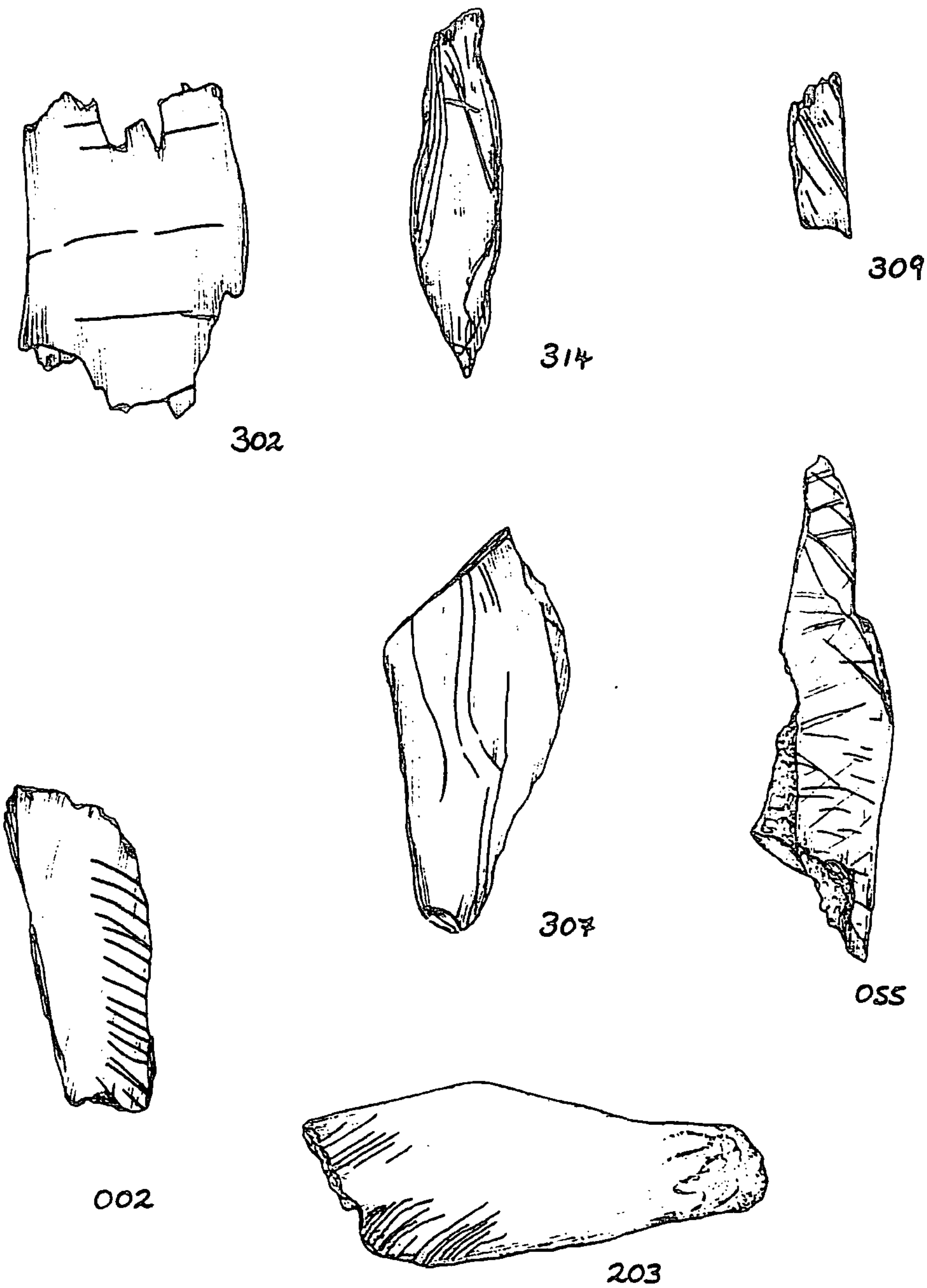
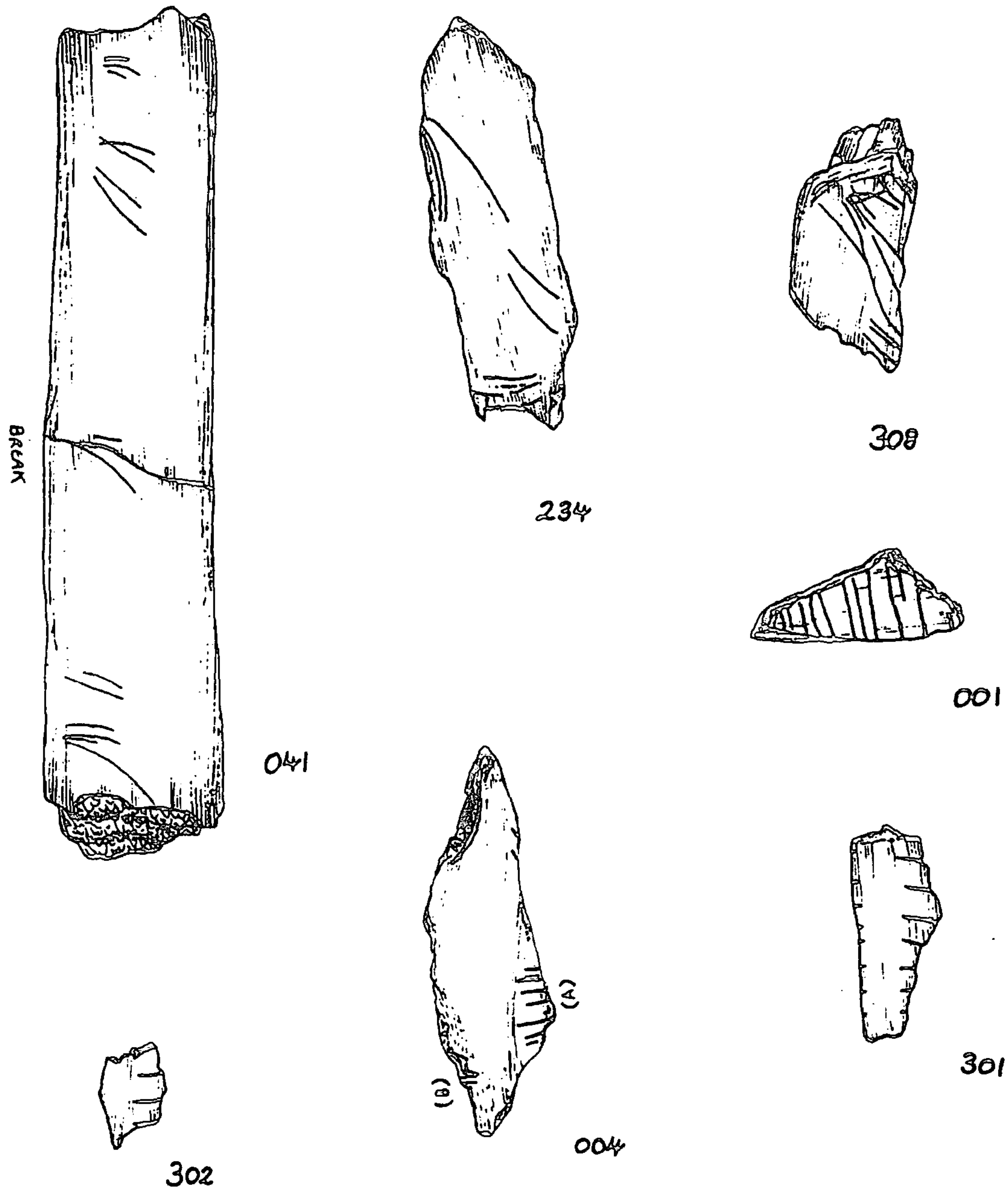


Figure 7.21 — The Incomplete Bones from Enlène.



guishing between examples with low and those with high variability. If this is the case, then more data from Enlène can be included in Upper Palaeolithic samples.

As an initial test, a sample of 17 cases is included in the two dimensional plot of all the other data and these bones are illustrated on Figures 7.20 and 7.21. Interestingly the distribution is not dissimilar to the distribution of the complete examples from Enlène, and is fairly evenly distributed over the scale, thus indicating that there are cases of both high and low variability within the wider body of data. In order to test this further, a two variable cluster analysis with only distance and orientation will be run on three of the groups of data. If the results of this new run are broadly comparable to the three variable tests then this will demonstrate the validity of the hypothesis that these two variables are the real source of variability, as these represent a divergence from the rules of strict translational symmetry, and line length is not such a diagnostic factor. The groups selected are the Ethnographic data and the Random data, both of which will continue to act as 'controls' to the test, and also the other data from Enlène, as any emergent structural properties from this group will in theory relate to the rest of the data from this site.

7.7.1 Two Variable Cluster Analyses.

The results from the cluster of the Ethnographic data in Table 7.11 and Figure 7.17, are encouraging. Although the coefficient in the final cluster is marginally higher and there is some minor variation in the coefficients, the order and clusters of the cases remains unchanged from stages 1 to 10. The only true variation occurs at stage 11, when 701 pairs with 711, which occurred at stage 12 in the initial cluster. The other change is that 701 is the base link between all the examples from stage 11 – 14, which means that 704 does not cluster with 703.

From Table 7.12 and Figure 7.18 it can be seem that the Random examples follow exactly the same pattern illustrated by the Ethnographic data, namely that despite removing one variable from the analysis, they remain virtually unchanged from the original three variable cluster shown as Table 7.6 except that the cases in the clusters remains the same at each stage. The calculated coefficients in the two variable analysis correspond to within 0.8, and so the evidence here points strongly to support the hypothesis that the selection of the two variables does not essential change the nature of the groupings. The data from Enlène presented in Figure 7.19 again mirrors the three variable clusters almost exactly. There is no variation in the order of the clusters, and little in the values of the coefficients.

7.7.2 All Data in Two Variable Cluster Analysis.

The results from this two-variable cluster analysis confirm the findings of the two dimensional plots and the other two variable cluster analyses conducted on the Ethnographic, Random and Enlène data. The number of cases is increased but the cluster coefficient has not markedly altered. As the two dimensional plot of all data suggested, the Enlène data is interspersed amongst the other groups with some values showing high and others low incidences of variability. This suggests that the Enlène data cannot be simply divided into two sets, one probably notational and the other not. Instead the evidence suggests that the distribution is continuous over the scale from high to low variability.

However this data does not exhibit the same distribution as the Random data and so the fact that a number of examples cluster with the Ethnographic data suggests that within all the engraved bones from Enlène, there are a number of examples that are possibly examples of notation. The cases listed in the lowest stages of variability are much the same, with a high representation from the Ethnographic data, and some from Marshack and Paris. The cluster at stage 2 of 300 and 312 is new, as is 227 and 304 at stage 6.905 remains the lowest level for a random example at level 9. The examples 704 and 703 continue to show variability, as does example 705.

7.8 Summary of Results.

In this chapter, I have shown a number of ways of breaking down data obtained from measuring the engraved lines in a number of bones. The initial analysis of line length and distance from the Enlène material showed only that I was potentially dealing with a homogeneous data set. Whether this homogeneity came as a result of regularity or consistent *variability* could not be demonstrated. The decision to include a number of different data sets effectively provided additional scope for my analysis, particularly as this allowed me to include a 'control' of variation

Table 7.14 — Two Variable Cluster Analysis: Stages 1 – 21.

	Clusters Combined			Stage Cluster 1st Appear	
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
1	606	803	.475308	0	0
2	300	312	.903897	0	0
3	710	802	1.015743	0	0
4	709	8012	1.191084	0	0
5	707	801	1.251907	0	0
6	227	304	1.308430	0	0
7	606	6072	1.313944	1	0
8	702	706	1.719038	0	0
9	307	705	1.966944	0	0
10	707	7071	2.004351	5	0
11	611	905	3.342892	0	0
12	606	6062	4.116904	7	0
13	387	702	4.230072	0	8
14	301	805	4.463921	0	0
15	387	707	6.733695	13	10
16	606	709	7.563970	12	4
17	601	711	7.868557	0	0
18	004	302	7.928298	0	0
19	315	609	9.102129	0	0
20	701	7081	9.113522	0	0
21	384	708	9.252044	0	0

Table 7.15 — Two Variable Cluster Analysis: Stages 22 – 42.

	Clusters Combined			Stage Cluster 1st Appear	
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
22	301	606	9.963281	14	16
23	034	605	10.926806	0	0
24	387	712	13.965060	15	0
25	058	203	14.971565	0	0
26	303	6092	16.625290	0	0
27	611	806	18.265820	11	0
28	003	701	18.497482	0	20
29	300	384	20.133875	2	21
30	608	713	21.928345	0	0
31	004	710	22.346270	18	3
32	610	908	23.872372	0	0
33	301	387	26.393131	22	24
34	034	3112	28.248371	23	0
35	034	6093	32.641998	34	0
36	003	300	33.334476	28	29
37	087	310	39.946808	0	0
38	042	6052	41.115799	0	0
39	610	611	43.806728	32	27
40	604	807	50.356983	0	0
41	042	804	56.158417	38	0
42	002	603	60.638927	0	0

Table 7.16 — Two Variable Cluster Analysis: Stages 43 – 63.

	Clusters	Combined		Stage Cluster	1st Appear
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
43	607	901	61.340912	0	0
44	227	313	63.859802	6	0
45	001	004	65.560120	0	31
46	234	909	66.646362	0	0
47	003	386	75.979164	36	0
48	614	902	79.706367	0	0
49	308	604	82.587738	0	40
50	306	307	85.696609	0	9
51	003	301	96.793510	47	33
52	601	608	97.253647	17	30
53	001	003	108.758240	45	51
54	303	315	122.564499	26	19
55	055	910	126.897087	0	0
56	314	906	127.495529	0	0
57	602	704	128.537109	0	0
58	306	309	176.950180	50	0
59	002	303	180.794128	42	54
60	034	042	186.597778	35	41
61	021	306	205.987778	0	58
62	602	904	222.257248	57	0
63	227	610	226.761185	44	39

Table 7.17 — Two Variable Cluster Analysis: Stages 64 – 83.

	Clusters Combined			Stage Cluster 1st Appear	
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2
64	055	308	242.382751	55	49
65	041	314	272.305328	0	56
66	227	601	274.529968	63	52
67	058	311	296.233032	25	0
68	607	614	299.336243	43	48
69	234	316	368.016541	46	0
70	001	034	409.118317	53	60
71	055	907	460.857513	64	0
72	055	087	598.936096	71	37
73	227	607	609.483643	66	68
74	041	227	745.910950	65	73
75	001	002	828.944580	70	59
76	021	055	891.464172	61	72
77	234	903	1171.946411	69	0
78	041	602	1540.711304	74	62
79	041	234	2019.788330	78	77
80	003	021	2172.865967	75	76
81	003	041	2349.050293	80	79
82	003	058	5259.598145	81	67
83	003	703	7528.683594	82	0

by setting parameters using known examples of notation and communication and randomly generated examples.

The multivariate cluster analysis clearly isolated 'groups' within the data, and the three dimensional plots also isolated cases of comparatively high variability. In this concluding section the results from these two groups of tests will be compared, to see whether or not the *same* cases have been isolated, and if this is the case, how do the results from these tests compare with those derived from my criteria, first shown in Chapter V.

7.8.1 Correlation of Results.

The following table isolates the first thirty examples in the two variable cluster analysis, which includes all but two examples from the Ethnographic data namely cases 703 and 704, which cluster at levels 83 and 57 respectively, with cases 003 and 602. Any examples that clusters within this statistical parameter are considered to exhibit potentially low variability, based on their relatively low cluster coefficient and association with the Ethnographic data. This makes them plausible candidates for notational artefacts. In the table below there are 9 examples from Paris, 6 from Marshack's data, 16 in total from Enlène, and only one Random example.

The decision to use the examples from the two dimensional cluster is sustained by the inclusion of both the 'complete' and 'incomplete' examples from Enlène. However, in order to compare the results from this two variable analysis and the original three variable analysis the cases from the first thirty clusters were also recorded. For the most part the cases occurring within the clusters were unaffected as virtually the same Ethnographic examples were included. However there were some differences in the other data sets as some examples included in the two variable analysis were *not* included in the three variable test, whereas other examples only occurred in the three variable test, here called 'additional' examples, noted on Table 7.19.

The results from three tests between three and two variable tests on the data from Enlène, Random and Ethnographic data appeared to confirm that distance and orientation were the principle sources of variability, and the absence of the variable 'line length' did not appear to affect the results from the clusters. However the

Table 7.18 — Two Variable Cluster Analysis:The First 30 Stages.

Ethnographic	Paris	Marshack	Enlène	Enlène II	Random
710 711	608 606	803	300 303	307	
709 701	6072	8012	003 203	302	
702 7081	611 6092	801	315 304	004	
707 708	601	802	387	301	905
706 712	609	805	058	302	
705 713	6062	806	034	301	
7071	605			384	

Table 7.19 — Three Variable Cluster Analysis: The Variations.

	Ethnographic	Paris	Marshack	Enlène	Random
Examples not Included	705	609 605		315 303	
Additional Examples		610 604 603	807	384 386 021	908

results above from the first thirty stages of the tests demonstrate the possibility that different principles are in operation. Some of the variability must also be due to the inclusion of additional data from Enlène in the two variable test which must have affected the ranking in the first thirty stages and caused new combinations of clusters.

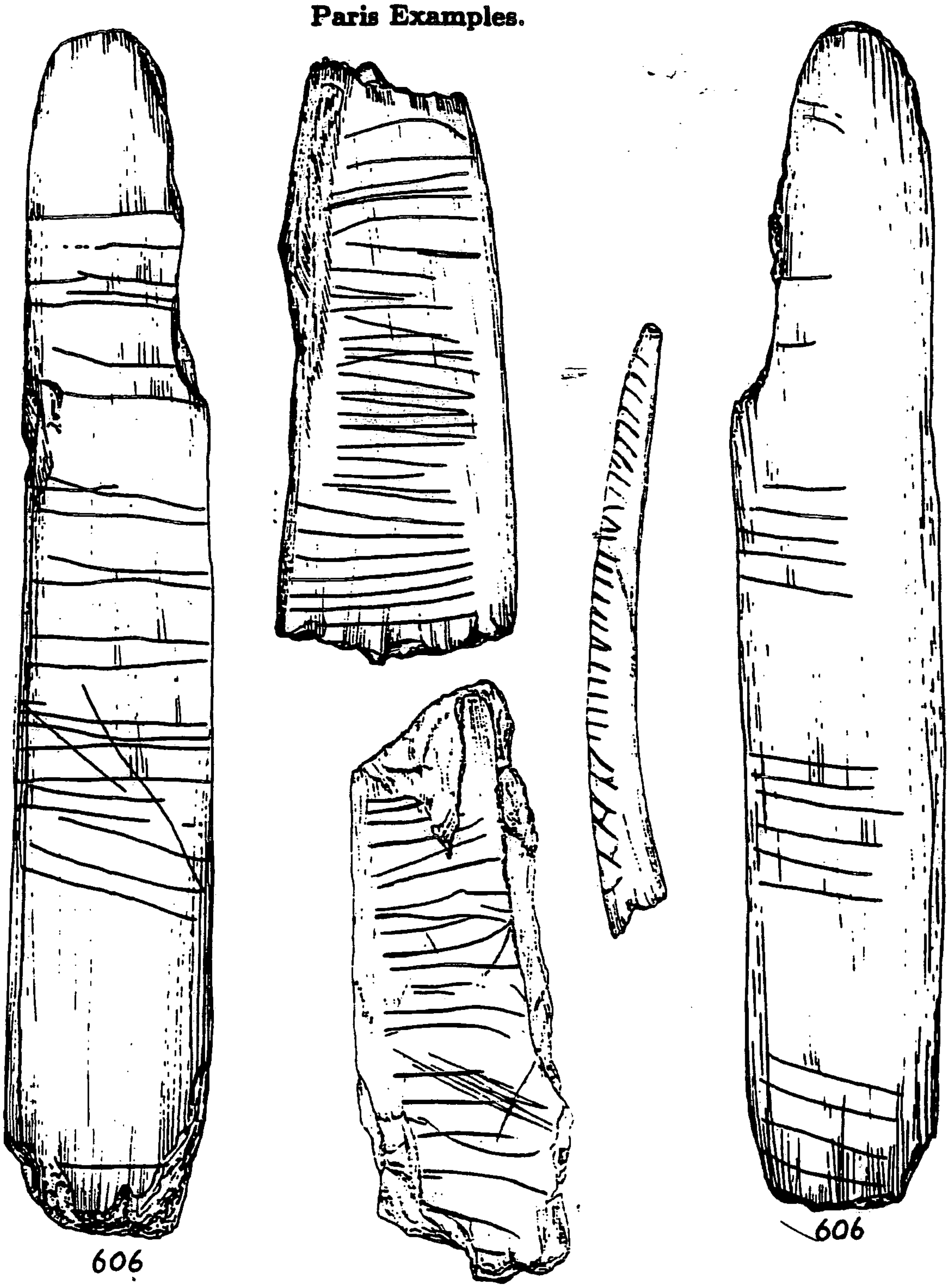
This possible variation between the results of the multivariate analysis makes the two and three dimensional plots doubly useful, as they act as a complementary test on the same data. The cases isolated *consistently* within the theoretical parameters of the two dimensional plots of line length, distance between lines and orientation are as follows, illustrating first Line Length and Distance, then Line Length and Orientation, and finally Distance and Orientation. Although a number of examples occur both inside and outside the Ethnographic parameters, depending on the graph, only those which occur *consistently* within the areas on all three graphs (except data taken from the broken bones from Enlène, referred to as Enlène II) will be included in the next stage of the analysis.

Table 7.20 — Scatter Plots: Examples Outside the Parameters.

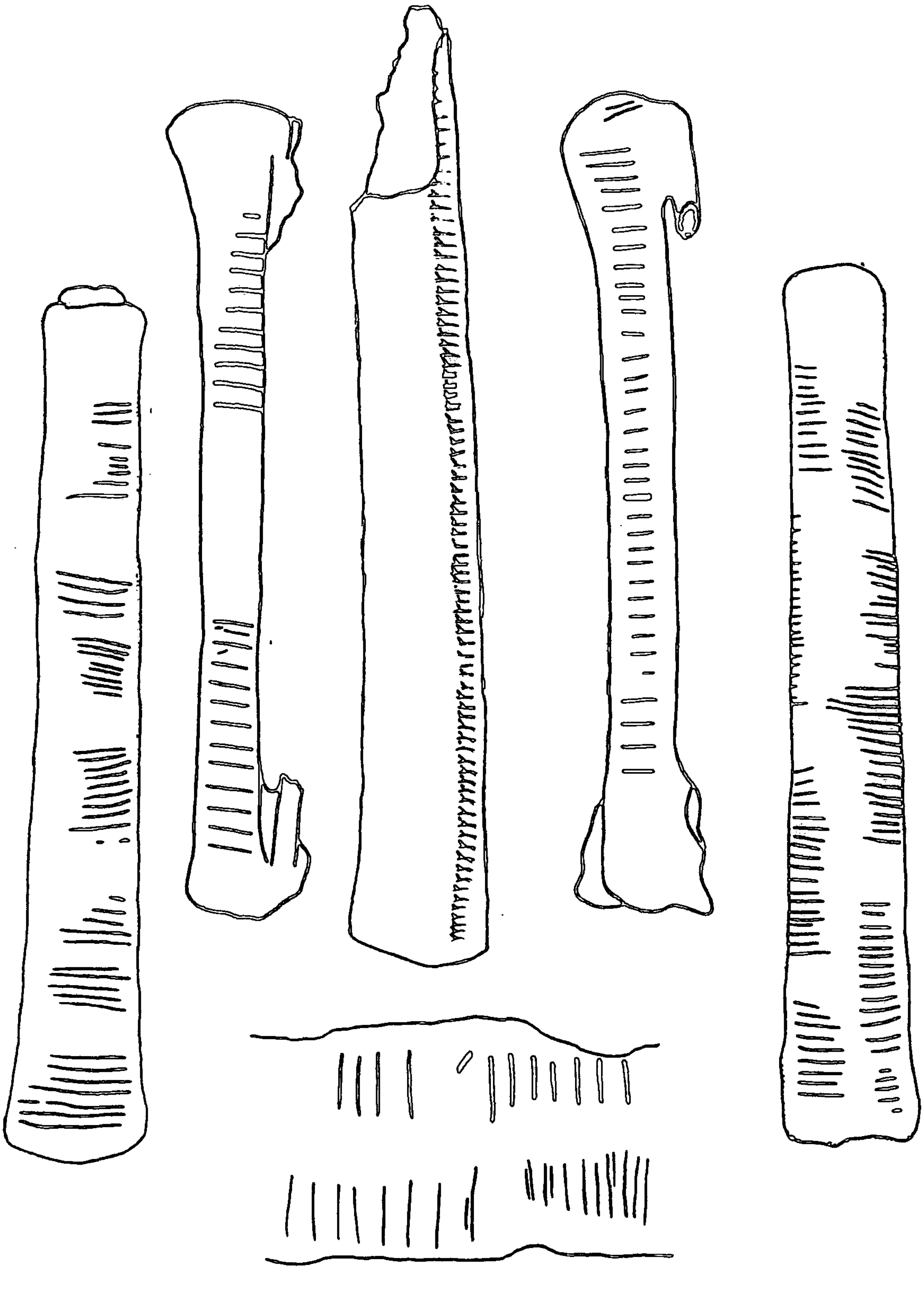
Paris	Marshack	Enlène	Enlène II	Random
605	806	058	–	902 903
	807			905 - 909
602 604	806	304 042	–	901 - 910
607 611	807	227		
613 614		234		
601 602	806	304	308	901 - 910
604 607	807	055	313	
609 610		058	314	
611 613		234	316	
614		386		

Figure 7.22 — Cases from Cluster Analysis and Scatter Plot.

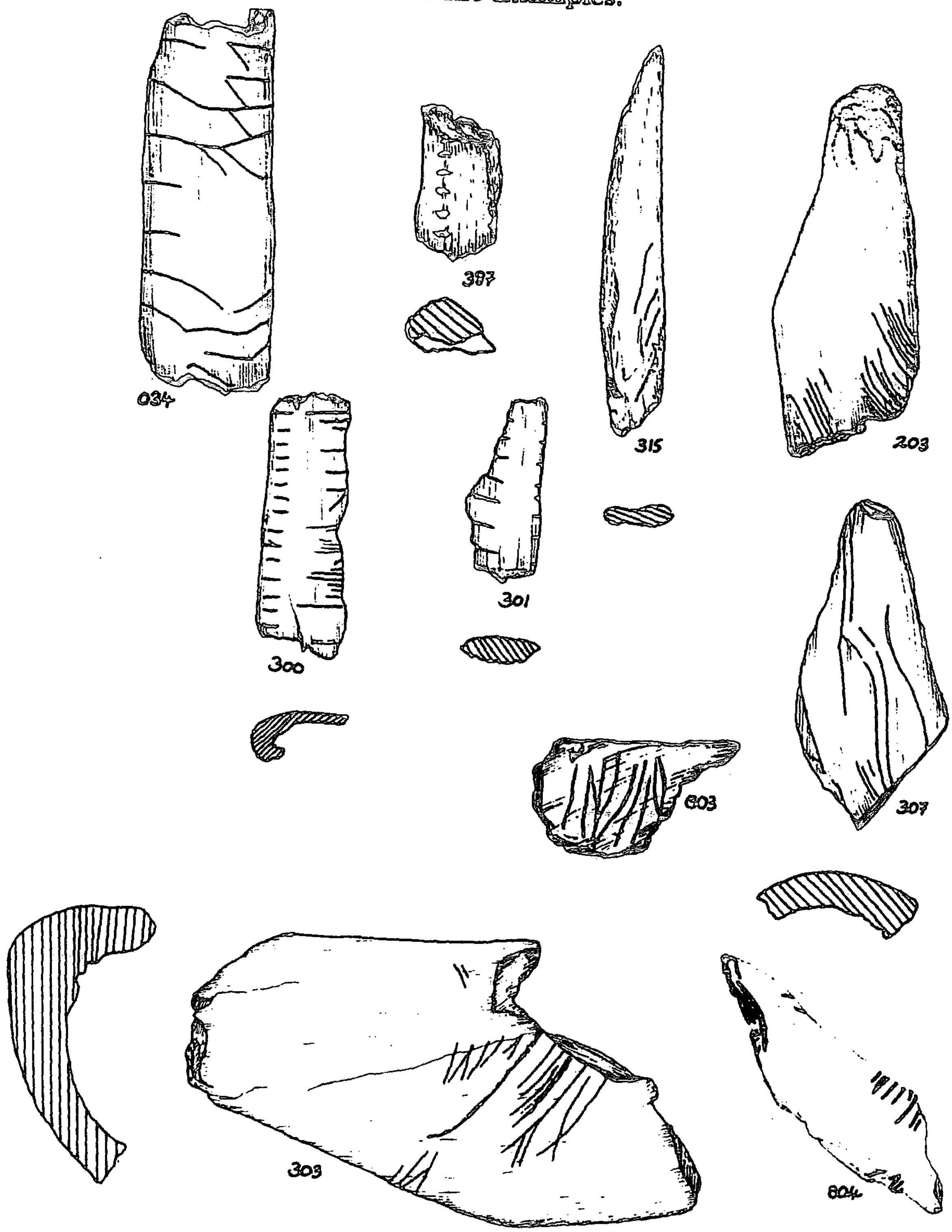
Paris Examples.



Marshack's Examples.



Enlène Examples.



Although the same examples are not always isolated in each graph, there are a number of examples that occur at each stage, notably 806 and 807, two of Marshack's examples that were rejected when tested against by criteria to distinguish between convincing and unconvincing examples, and all the randomly generated examples, except 904, 901 and 910. A number of the Paris examples occur both in the graphs showing Orientation, namely examples 602, 604, 607, 611, 613 and 614. The examples that occur only *within* the parameters set by the Ethnographic examples are shown in the table below.

Table 7.21 — Scatter Plots: Examples Within the Parameters.

Paris	Marshack	Enlène	Enlène II
603 605	801 8012	300 003	001 002 309
606 6062	802	315 021	004 041 310
608	803	034	087 301 312
6092	804	387	302 307
6093	805	203	311 3112

At this stage there are more examples from the incomplete bones from Enlène than from any of my other data sets. Also notable is the complete absence of any of the Randomly generated examples. All these examples are illustrated on Figure 7.22. In comparing the two data sets, the first from the Multivariate Cluster Analysis and the latter from the 2- and 3-Dimensional Plots, the following examples are consistently cited. The 'complete' bones from Enlène are the most numerous category, with only three from the 'incomplete' data set of Enlène II.

Table 7.22 — Examples *Within* All the Parameters.

Paris	Marshack	Enlène	Enlène II
606 608	801 805	300 003	004
605	802	303 315	301
6062	803	034 203	307
6092	8012	387	

7.8.2 Summary

The results summarised here show the systematic isolation of a number of examples from the data sets which have *consistently* demonstrated low variability. The fact that the Random examples are not represented at this final stage is encouraging, as it strongly suggests that they performed their function as a *negative* control. These examples were consistently separated from the other data sets in the two dimensional plots except 901, 904 and 910 in the Length and Distance Plot. In the three variable cluster analysis, the Random examples form clusters only with examples from the Paris data that occur *outside* the parameters set by the Ethnographic data in the two dimensional plots, shown in Table 7.10. The sole exception is case 603, which is shown at Table 7.19 *within* the parameters set by the Ethnographic data. However this example is discounted by a comparison with the multivariate analysis. Case 234 from Enlène also clusters with the Random examples but is similarly discounted by the results from the 2 dimensional plots. Two of the Random examples cluster with case 003 also from Enlène. This example *does* occur within the parameters set by *all* the tests. It is an example that clusters freely with examples in all the data sets, and from its free association, an example perhaps on the border line between the Random and the ordered examples.

Despite this single anomaly the results at this stage provide further corroborative evidence that these two statistical methods of analysis provide comparable results at each stage, and if used in combination, isolate examples showing potential variability. The plotting of the Standard Deviation from the mean from each example permits a relatively easy identification of those examples showing high and low variability. Using the squared Euclidean distance between cases to calculate the most like examples proved to be an effective measure of both similarity and variability. The agglomerative method of clusters allows the researcher to identify patterns of similarity and isolate groups should this prove to be appropriate for the study.

7.9 Analysis by my Criteria.

The first part of this thesis concentrates on devising an objective means of testing whether or not the lines on engraved bones are ordered and structured in some way, specifically, translational symmetry, or whether they represent purely random accumulations of lines. This study attempted to avoid using and subjective and imprecise terms in the classification of non-figurative bones, and equally tried to stress that at all levels *any* such classification including my own, is dealing only with probability. The resulting set of criteria are tested against some of Marshack's examples and some of the data from Paris in the latter half of Chapter V. Each example is analysed in detail and the presence or absence of certain structural properties noted at each stage, with an overall assessment. A number of these examples were included in the statistical analysis and the results from the criteria can be compared to the overall results from the statistical tests.

By my criteria the bones from Ishango, Forneau de Diable, Le Placard, were considered to be possible examples of notation. The examples were included here as 803, 801, 8012 (side 2), and 802 and *all* occur in the final examples of low variability in Table 7.22. From an examination of the engraved pebble from Barma Grande, I concluded that this was unlikely to be an example of notation, and this was corroborated by its isolation (Case 806) as an example with a relatively high variability in all areas. There are positive results for examples from the Paris data, as by my criteria example 610 was rejected as an example of notation, and 606 and 6062 were convincing examples of notation. All these results were confirmed by the statistical tests.

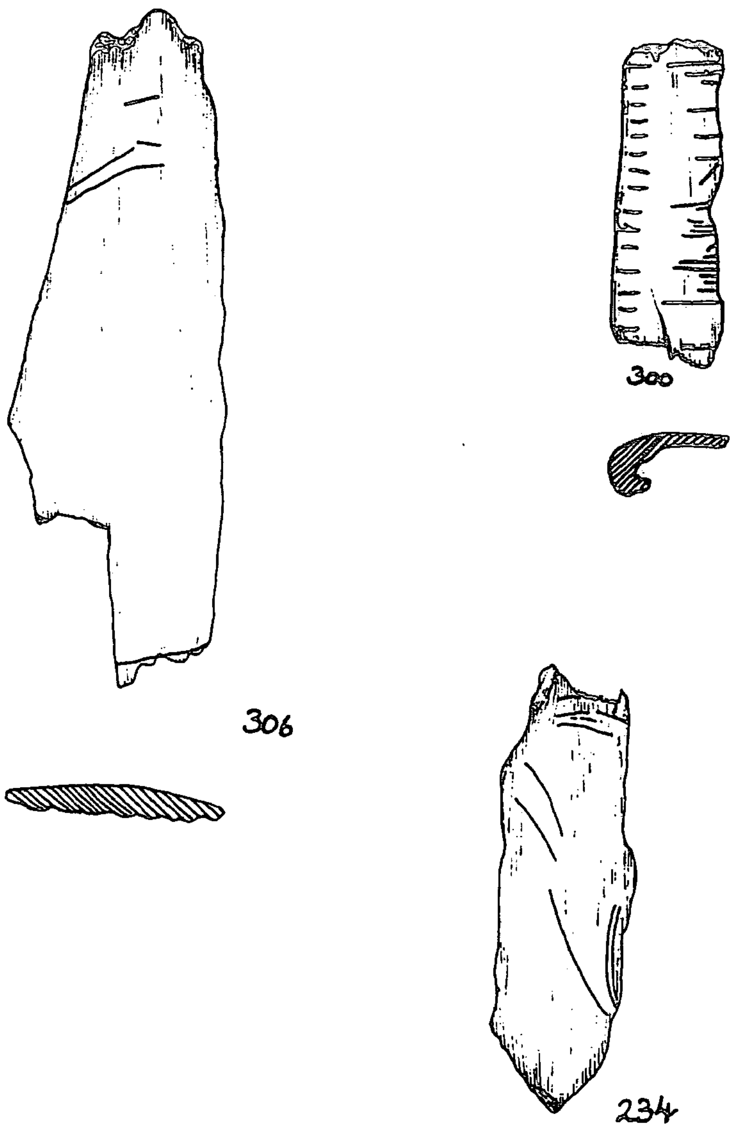
Example 601 was considered 'decorative' by my criteria, as was 605. Case 603 was isolated by the three variable cluster as an examples of low variability, but not in the two variable clusters or the two dimensional plots, although I identified it as an example of low variability in the tests against my criteria. Case 605 was isolated as an example of low variability in the statistical tests, whereas case 601 was not. Clearly the criteria are interpreting certain visual properties which the statistical analysis either does not detect, or translates as 'variability' for some 'decorative' cases. Example 804 was concluded to be a possible example of notation as although the length, distance and spacing of the marks varied overall, it occurred within groups, which by my criteria made it pertinent variation. These examples illustrate the anticipated need for the essentially visual mode of structural assessment of the criteria to be used in conjunction with the statistical tests outlined above. Case 804 draws attention to the possibility that the pertinent variation that is thought to be characteristic of 'notation' will be interpreted in the statistical analyses used here simply as 'variability' and so any possible consistencies within each artefacts would not be isolated by these tests alone.

Although this comparison of the results from the two sections is encouraging, there are a number of points raised by the limitations of the statistical techniques. If it is possible that these statistical tests of variability *exclude* certain examples that are classified as 'decorative' or 'notational' by my criteria, then these tests cannot be used in isolation. Equally the statistical tests could be selecting examples that would be classified by my criteria as 'random' or 'non-notational'. In order to explore this possibility, 6 examples are 'selected' from the Enlène data, and briefly assessed according to my criteria; three from the 'complete' examples, and three from the 'incomplete'.

7.9.1 In The Final Analysis.

This section concentrates on testing six examples from the Enlène data against my criteria. The systematic identification of examples of consistently low variability occurred in stages. This final analysis will isolate firstly an example rejected at the level of the two variable cluster analysis; secondly one rejected from the two dimensional plots, and thirdly one from the final group of low variability which is then repeated to include both sets from Enlène. A brief description of the context of the bones is given, as the main source of information for excavated sites within Enlène is given at the beginning of the previous chapter.

Figure 7.23 — Three Bones from Enlène: 306, 234 and 300.



The 'Complete' Examples.

306, EDG.

This example comes from the area known as the 'diverticule gauche', which is close to the location of the original entrance to Enlène. This bone was recovered from the earliest levels which have been dated to Perigordian V. The bone is broken on all sides, although breaks occurred in prehistory and do not appear to have prematurely terminated the lines.

Decoration. As there are only five lines on this bone, there is limited scope for a full analysis. The two longer lines adjacent to the edge show the elementary principles of translational symmetry, but as this is not repeated such an alignment is not conclusive evidence that this was the intent of the maker. There is no evidence of any other form of symmetry.

The marks are not made 'rhythmically' as there is no standardisation in their length, spacing or orientation. As a result of the absence of symmetry this is not a balanced composition.

Notation. There is no real standardisation in the marks although two are longer and three shorter. The marks are distinguishable as they do not cross one another. Although the marks are confined to one area of the bone there is no evidence of a 'path'.

There is no evidence of grouping, positional notation, or cipherisation, and as there are only five marks in total this example will not be tested for characteristics of lunar notation.

Summary. This bone has very few marks, yet even these were sufficient to indicated both in the course of this test and the multivariate analysis that there is no evidence to suggest that there is order and regularity in these marks. This confirms the findings of the statistical tests, as this was identified as an example of consistently high variability in the two variable cluster analysis.

234, EPS.

This bone was also recovered from a site close to the entrance of Enlène, but this bone comes from EPS, Enlène, Porche Superieur, to the right of EDG. Recovered from the Magdalenian levels this example has a combination of old and new break, although none of the marks are terminated by a break.

Decoration. Of the ten marks on this bone there is no evidence of translational or rotational symmetry. The marks on the upper portion of the bone, as it is orientated in my drawing, give a possible incidence of slide reflection but this is neither standardised nor convincing. This variation means that there is no rhythm or balance in the composition of the lines.

Notation. There is no single repeated element, nor any regularity in the spacing although all the marks are clearly identifiable. Their distribution over the bone does not follow an identifiable path.

In common with the bone 306 there is no evidence of grouping, cipherisation or positional notation. Again, there are too few lines to even consider this as an example of lunar notation.

Summary. This example is not an example of notation by my criteria. There is no observable symmetry in the marks or evidence that they are structured in any way. In the two dimensional plots this example occurred outside the statistical parameters of the Ethnographic data.

300, EDG.

Also from EDG in the Perigordian V layers, this bone is intact on one side with an old break with some new damage on the other. As a result the measurements for this analysis cane only from the complete side where all the lines are believed to be complete.

Decoration. There is strong evidence of translational symmetry in all areas of the lines, and some mirror symmetry as the length of lines is standardised along the long axis of the bones. There is no evidence of rotational symmetry or slide reflection. There is rhythm in the repetition of the single straight lines, each parallel to the next which gives balance to the overall composition.

Notation. A single element is repeated with no pertinent variation. As the spacing is even between each mark there is no overlap, and their alignment is clearly along the long axis of this bone close to the complete edge.

There is no evidence of grouping or cipherisation, or positional notation. There is no reason to suppose that this is an example of lunar notation, as the marks are evenly spaced with no differentiation that could correspond to a lunar period. Also the length of the bone is terminated at each end and so is incomplete.

Summary. This bone does conform well to both the criteria for decoration and notation. The use of translational symmetry and the rhythmic repetition of a single element along the long axis of the bone makes this a structured composition. This example was isolated as an example of consistently low variability in both the multivariate analysis and the two dimensional plots, which correlates the results of both my criteria and the statistical tests.

The 'Incomplete' Examples.

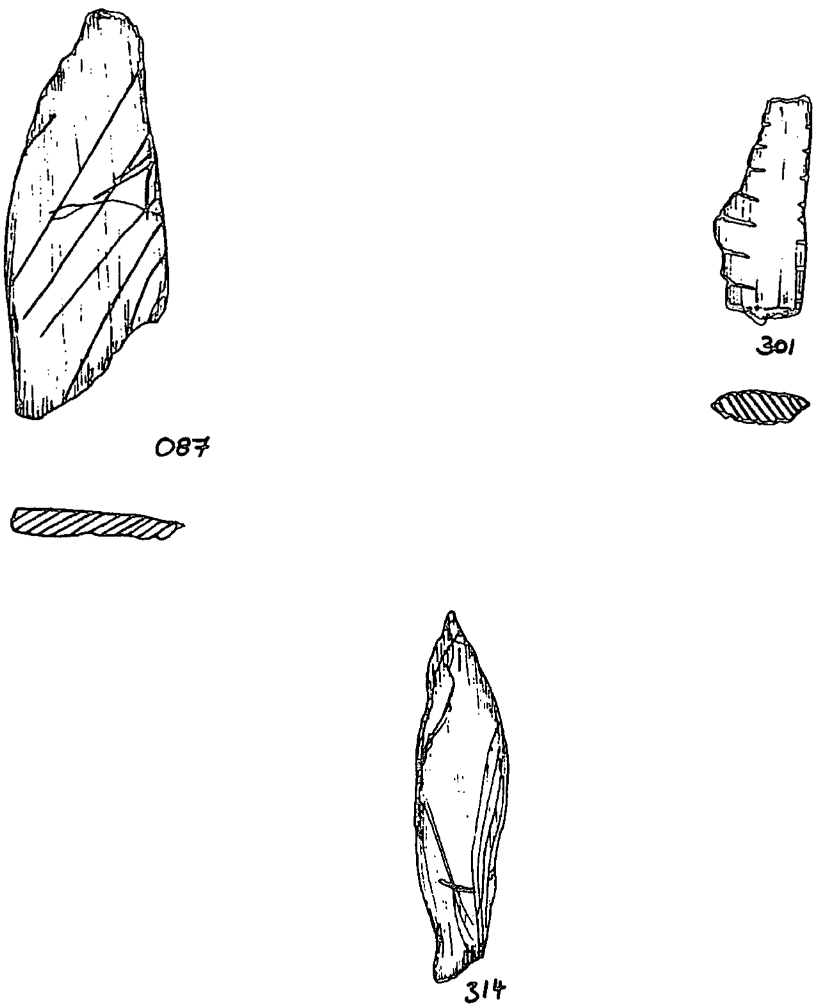
087, ESF.

This example was recovered from the Middle Magdalenian layers in ESF the large chamber in the rear of the cave. The example is broken with evidence of an 'old break' on all the edges of the artefact.

Decoration. There is evidence of translational symmetry in the repetition of a series of roughly parallel lines diagonal to the long axis of the bone, although there are a number of lines elsewhere that do not conform to any principles of symmetry. There is some rhythm in the repetition of the longer lines, but none in the shorter lines. The presence of these shorter lines means that the overall composition is unbalanced.

Notation. There is no standardisation in the length of the lines, although the orientation of the longer lines could be interpreted as the repetition of a single design element. The shorter lines are not standardised in either their length, orientation or spacing and therefore do not represent pertinent variation. This means that only the spacing of the longer lines indicates an apparent intention to regulate the overall structure of the lines as a whole.

Figure 7.24 — Three Bones from Enlène: 087, 314, and 301.



There is no evidence of cipherisation or positional notation. The variation in the form of lines could represent 'groupings' although this would be more convincing if the shorter lines were standardised in any way.

Summary. The translational symmetry, and relative regularity in the orientation and spacing of the longer lines apparently relates to some design on the part of the maker. However the shorter lines are so irregular that unless this representation is divided into two separate compositions on stylistic grounds there is no overall order in the representation of the marks. This example was isolated as an example of high variability in the two variable cluster analysis.

314, EDG.

This example comes from the site of EDG near the original entrance to Enlène. All the sides of this bone are incomplete although the break is thought to have occurred during the prehistoric occupation of the cave.

Decoration. There is no real symmetry in the way the marks are represented on this bone, although there is possibly some translational symmetry recognisable in the series of lines on the right of the bone in my illustration. There is no evidence of rotational symmetry, or mirror reflection. The lines on the right of the bone possibly show some rhythm in their rendition although this is not really evident in the number of lines and their relation to the rest of the lines on the bone. As a result, there is no real balance in the arrangement of the lines.

Notation. The only possible design element comes from the form of the longer lines although the break in the bone makes it hard to determine whether their length as well as their orientation is standardised. There is no recognisable 'path' and although there is some evidence of using space to distinguish between marks this is not consistently repeated.

There is possibly some grouping of the marks as the alignment of the longer lines on the right compared to those on the left shows a significant shift in orientation Although there is one line parallel to the short axis of the bone which is clearly definable, this is not thought to be evidence of positional notation or cipherisation.

Summary. There is some regularity in the way that the marks are ordered but this is not consistent or standardised enough to be considered an example of either notation or decoration by my criteria. This example occurred outside the statistical parameters set by the Ethnographic data in the two dimensional plots.

301, EDG.

This example comes from the Perigordian levels of EDG, in Enlène. This example is incomplete, with a recent break terminating all the edges prematurely.

Decoration. This bone shows a consistent use of translational symmetry along the 'edges' of the bone as they appear to us now. There are three longer marks, perhaps the result of the fact the bone is wider at this point, the last of which appears to be slanted. As a single incidence this is not taken as evidence of the use of rotational symmetry. There is some mirror symmetry about the long and short axis of the bone, although this does not include the longer lines.

Notation. There are two design elements here: three incidences of a longer line and the rest of a proportionately shorter line, on a ratio of at least 2:1. This disparity is thought to be the result of the break in the bone and therefore not necessarily representative of pertinent variation although of course this cannot be ruled out. The spacing between each line is standardised and repetitive. The 'path' of these lines is along the long axis of the bone with no real deviation.

It is possible that the longer lines represent positional notation or a stylistic division of the elements into two groups. It is considered to be unlikely to represent the use of ciphers in this particular form and context.

Summary. This bone provides a convincing example of either notation or decoration by my criteria. As the increase in line length occurs at a point where the width of the short axis increases there is a strong probability that all the lines were originally the same length. The repetition of this single element along the long axis of the bone using translational symmetry demonstrates both order and consistency within the sequence. This use of translational symmetry corresponds to the identification of this example as one of low variability in all of the statistical tests.

7.10 The Identification of Translational Symmetry.

This aim of this chapter is to isolate an independent means of testing whether or not a number of engraved lines were made sequentially or represented a purely random group. Chapter II discusses the problem of maintaining objectivity in the perception of a visual image and concludes that a degree of subjectivity is bound to exist in any method that relies on a personal interpretation. The list of criteria summarised in Chapter II and tested against actual images in Chapters III and V effectively confine the scope of an entirely subjective interpretation by forwarding a list of 'checkpoints' through which a researcher must pass before making an identification. This chapter focused on the physical properties of the individual lines, and the ways in which the overall composition was constructed, namely the length of each line, its orientation relative to the longaxis of the bone, and the distance between each marks and its nearest neighbour.

Taking the standard deviation from the mean as a suitable measure of regularity allowed the use of hierarchical cluster analysis and two and three dimensional plots to display and correlate the results from the five data sets. This chapter has demonstrated the effectiveness of these methods for testing for both the presence and the absence of variability and homogeneity in the order of lines within a single artefact. By representing each individual artefact on a scale of values both statistical methods proved to be an effective means of assessing the *degree* of variability and homogeneity, relative to all the other bones within all the data sets. The comparison of the results of the two tests showed that they could be used to correlate one another. The amalgamation of the results from the two tests also provided a useful way of selecting those artefacts that *consistently* showed either high or low variability. This method also proved to be suitable for broken bones as well as complete examples, as distance and orientation were isolated as the major indications of variability.

However any series of statistical tests can only test for variability within the data, and unless the programming is minute and specific, such a reliance on the tests to detect and interpret all the patterns of variability is unwise. The discussion on notation in Chapter II admits the possibility of standardised variation and intervals in spacing to order and structure any information. If such data is used in these tests, they will appear as a case of high variability as the consistent presence of both high and low measurements leads to a high value for the standard deviation. Equally a decorative sequence may use a number of principles of symmetry in the repetition of a design element which again would appear as an example of high variability. Therefore although these tests are useful and have thus far provided good results, it is necessary to test the results against the criteria of Chapter II. The previous section performed this test of corroboration, and in all cases the results of the test did correlate. The only exceptions come from the Paris data, as examples 603 and 601 were identified as possible examples of 'decoration' by my criteria whereas the statistical tests included them as examples of high variability because of the variation in the orientation of their lines.

Chapter VIII

Conclusions to My Analyses.

8.1 A Summary of My Approach.

Any research on the subject of notation and possible recognition of number during the Upper Palaeolithic presents a number of challenges to the researcher. The fact that no single interpretation of the marks on these engraved artefacts has gained acceptance in the academic community has left the question effectively wide open. From my introduction in Chapter I it is evident that a careful consideration of a theoretical approach, the implementation of an explicit and objective methodology and a deliberate selection of data to test the model against are essential preconditions. The final discussion of this study assesses how well I have met these challenges, and concludes what my research has contributed to the debate surrounding the existence of notation during the Upper Palaeolithic in Europe.

8.1.1 Locating a Source of Data.

If notation existed within the Upper Palaeolithic it formed part of a wider sphere of social systems and communication evidenced by the discovery of number of decorated caves, and cave and open air sites with dense accumulations of habitation debris. These sites demonstrate thousands of years of occupation by groups of individuals who hunted and gathered the available resources and were also painters, tool makers and sculptors. The movements of these populations over the landscape is difficult to map, but the presence of a number of stylistically comparable tool and art forms over sites thousands of miles apart, stretching from the northern coast of Spain to the Russian Plains, implies long distance communication networks. Within these archaeological assemblages are the remains of a lithic technology and engraved and carved objects of bone and antler that are standardised throughout Europe.

To locate likely notational examples amongst this material is no easy task, but other researchers have worked on this problem and claimed to be able to detect notational artefacts, often described as 'tallies'. The studies of Lartet and Christy, 1875, Absolon, 1937, and De Heinzelin, 1962, are based on the chance find of single artefacts in the course of their excavations, and Marshack's own studies begin in the same way, (1972). This is not an acceptable means of systematically locating possible sources of data as, to be useful, the past researchers should provide a full explanation of their various aims in locating, selecting and interpreting 'tallies' in the archaeological record.

Frolov (1974), looks at the entire range of engraved material from a number of sites in eastern Europe, and distinguishes notational examples by the number and structure of their marks. The work of Couraud and Lorblanchet (1986) is also systematic as they concentrate on looking at a data set from a single site, in this case engraved limestone pebbles from Rochedan. However all these researchers distinguish notational examples by their structure and by the number and arrangement of their lines and claims have been made of lunar notations and number counts in Base seven. Certainly the favoured approach is to observe any regularities, collect together a number of such artefacts, and then infer their purpose (Absolon, 1937, De Heinzelin, 1962, Frolov, 1974 and Couraud and Lorblanchet, 1986, Marshack, 1992). The number of artefacts and claims of a widespread tradition further support such claims.

Some researchers have used physical evidence to demonstrate the specific properties of notational artefacts. Marshack claimed to be able to distinguish changes in tool type, and hypothesised that frequent tool changes mean that the marks were made cumulatively and were therefore notational. Couraud and Lorblanchet also used the microscope to distinguish groups of marks to isolate numerical regularities. D'Errico's challenge to Marshack's work is most effective, although he relies on questioning the validity of Marshack's results rather than the soundness of his interpretations. D'Errico still follow's Marshack's claim that if a number of marks are made in rapid succession, then an example is not notational. It is possible that a number of notations were made over time, but here I conclude that notations and tallies can be made in a single sitting, depending on the context within which they were required. On this basis, microanalysis of the tool changes is not an acceptable means of testing whether or not an example might have been used as a notational record.

These approaches highlight the need for a more objective approach to test whether or not a system of notation existed. It is more productive to look for notational examples in whatever form they may exist, rather than searching for meaning by hypothesising their use as calendars or number games. It is possible to identify a common source of data from all these enquiries, namely the non-figurative engraved artefacts from the Upper Palaeolithic. The reasons for my decision to continue using these artefacts to test the hypothetical existence of notation are twofold: firstly it enables the analysis of the same class of data as used by previous researchers and therefore the comparison of any results; secondly it follows the work of Conkey (1978), Gamble (1983) and Wobst (1977), in the identification of engraved mobiliary artefacts as likely sources of cultural information. As portable artefacts they would provide an easy and effective means of transmitting certain ideas, had such a need arisen.

8.2 Notation in Theory and in Practice.

Non-figurative engraved bones are found in large quantities on the majority of excavated sites towards the later stages of the Upper Palaeolithic. The lines have been described variously as 'decorative', 'random' and 'notational', although few researchers have ever explicitly defined how they discriminate between these potential groups. This consideration of theoretical and methodological approaches lead to the conclusion that a model should be devised to attempt to eliminate such subjective interpretations. From a detailed discussion of the structural properties of representational, decorative and notational systems of visual representation, a list of criteria was devised to distinguish accurately, explicitly and consistently between these categories.

Certain terms, such as 'art' are discarded in favour of 'systems of visual representation', (Munn, 1967). The problems of individual and subjective assessments of the technical virtuosity of the artist, and the quality of the image produced are similarly dispensed with, specifically any ideas associated with the possibility of a universal system of 'aesthetics'. There are a number of problems in the interpretation of representational, or iconic, imagery during the Upper Palaeolithic. Certain animal species are easily identifiable by their outline, for example the detailed outline of a horse is distinctive from that of a bison or mammoth. However this identification is facilitated by the used of characterising details, such as the long trunk of a Woolly Mammoth, or the more pronounced hump of a bison. In this way a stag can be distinguished from a stallion by the presence or absence of a full set of antlers, and again from an ibex as this will possess characteristically long curved horns. Further details can be supplied by colour, attitude, marks to indicate a coat or hair, and details of the eyes, nostrils and feet. If an image is identifiable by both its outline *and* by the use of characterising details, it is convincingly iconic.

However if the form of an iconic image is ambiguous, and there are no characterising details, it is necessary to refrain from arbitrarily assigning it the name of an animal species. If a classification is made for convenience, then it should be preceded by an 'x' to denote inferred meaning. Some 'abstract' lines have been described as 'serpentine', or as 'claviforms', or 'stars' on the basis of their form. Such references should be proceeded by a '!' to reflect this association of form, but not of meaning (Layton, 1990). These latter phenomena are usually referred to as 'signs' or 'symbols', and their production may even have been governed by a 'syntax' (Sauvet, 1990). The distinction between a 'symbol' or a 'sign' follows Saussure, (1907) as signs represent the signifier, whereas symbols have an additional level of meaning. The probable meaning of signs and symbols in the Upper Palaeolithic systems of visual representation can only be deduced by their form, variations, repetitions and associations with other signs and symbols.

The structural properties that orderly decoration are based on depend on the repetition of certain design elements. Washburn relates this process to the principles of symmetry, namely translational, mirror and rotational symmetry and slide reflection (Washburn, 1983). This interpretation of decoration can be combined with Boas' recognition of rhythm and balance as the underlying basis of decorative and harmonious compositions (Boas, 1955). Notation is also concerned with structural regularities, as it encodes actual as well as cultural and stylistic information which is 'decoded' by the same or other individuals. It is possible that mnemonic tallies were used in the Upper Palaeolithic, but if their form does not conform to wider principles which order the information, they will not be recognised by this model. As this thesis is testing the existence of a *system* of notation, their possible elimination is not a problem for my methodology.

In its most recognisable form, the notation follows a path, with spacings between each mark to prevent overlap and allow for easy identification. The maker may use a specific design element to indicate the incidence of each record, and vary it should the quantity change. Such pertinent variation should be recognisable by repetition and standardisation. Unless observable differences can be recognised in this way, they are concluded as not being pertinent to the overall meaning of the message. As these definitions concentrate on structural regularities of the way in which information is organised the boundaries between the classification of certain artefacts is rarely exclusive. From a discussion of the structural organisation of notation compared to the regularities and repetition of certain decorative sequences, I conclude that these two categories share a number of structural properties.

8.2.1 The Use of the Ethnographic Record.

The difficulty of distinguishing between decorative and notational examples is clarified by testing my criteria against actual notational and decorative artefacts taken from Ethnographic collections in four museums. The decision to test these criteria against known examples of notation reflects certain theoretical considerations. The indiscriminate comparison of ethnographic material to artefacts recovered from the Upper Palaeolithic levels, on the basis that they are both products of hunting and gathering societies is no longer acceptable, and any such 'piecemeal' analogical references should be avoided. If such comparisons are made they should exist within an acceptable framework which concentrates on locating any common observable *structural* properties between the two artefacts in question.

If a resemblance in their form can be adequately demonstrated, then it is within the bounds of probability that they were used for a comparable purpose. However any further interpretations that these artefacts were conclusively used for the same identical purpose in two identical societies is not acceptable. The use of flints tools by contemporary Aboriginal populations for hunting and food processing allows researchers to compare their use of lithic technology to the flints recovered from the archaeological level in the Palaeolithic. To then postulate that the two cultures are comparable in *other* ways, and to conclude that the past populations also had a patriarchal egalitarian society, lived in camps and had system of beliefs based around totemic species is unverifiable.

Therefore the testing of my criteria against examples of notation from the present does not reflect an underlying assumption that the societies these examples came from resembled Palaeolithic society, any more than does our own. Every effort was made to assemble a collection of tallies, notations and calendars from a number of cultures, including England and France from the last century. By testing such examples against my criteria I am able to formally identify the shared properties of notation and decoration. According to my criteria, translational and rotational symmetry are present in both decorative and notational examples, whereas complex use of mirror symmetry and slide reflection occur only in compositions where the overall form of the composition is intended, rather than the constituent part. In the Australian Message Sticks the information is known to be transmitted both by the nature and construction of the design on the stick, which often shows an elaborate use of symmetry, and by an explicit verbal message which translates the exact meaning.

Furthermore I found that the spacing and line length in the elements used in tallies can be irregular, as it relates directly to the quantity recorded rather than ideas of overall harmony. Certain examples use long spaces to indicate a qualitative change in the information recorded, such as the tally of the members of a community from Pokokku, Chin Hills, Burma. The gardener's tally from Sussex uses both a long space and a change in the form of the mark to distinguish between the month and the crop planted. The Café Counter tallies from France show a consistent use of a cross, but this does not occur a regular intervals, as might be expected from a harmoniously designed composition.

The testing of my criteria demonstrates not only their ability to discriminate between likely and unlikely examples of notation, but provides additional information about the conventions used in the present and recent past construction of tallies. These observed principles do not represent absolute rules, and it cannot be assumed that all cultures have followed these conventions. However they provide a useful insight into the possible ways in which decoration and notation are structurally distinct, which can be used in the analysis of artefacts from the Upper Palaeolithic. The results of this analysis effectively demonstrated the rôle of the ethnographic record and other sources of information in the understanding the artefacts recovered from the archaeological record of the Upper Palaeolithic.

8.2.2 The Location of Notation.

The starting point for testing my criteria against engraved artefacts from the Palaeolithic was to look at some of the examples forwarded by Marshack as examples of lunar notation. Certain specific criteria are forwarded as diagnostic of systems of lunar notation. In common with other forms of notation a single element should be repeated along a recognisable path, with some spacing to isolate each mark. Any groupings must be either stylistically discrete, using pertinent variation in line length, the distances between lines, or by orientation. Any divisions detected by microanalysis are treated as additional physical information, *not* as a defining property of notation. This is based on the hypothesis that if such groupings are visible only under a microscope then they are not pertinent to meaning.

Any examples with these properties could be notational, so in order to distinguish between notation and *lunar* notation further properties must be isolated. The marks must be shown to correspond to an identifiable pattern in a convincing and repetitive manner. This means that each example must have a minimum of 28 marks, and preferably 56, that is 'two months'. However, as Couraud and Lorblanchet concluded, even repetitive groups of seven on pebbles with around thirty lines is not necessarily evidence of lunar notation.

A truly convincing example would indicate the lunar periods, such as the full moon, or the half moons in a *consistent*, *invariant* manner. Only this would demonstrate conclusively that an isolated example possibly related to the phases of the moon rather than anything else. The calendars presented in Chapter III evidenced such regularities, and Marshack's work on the Winnebago Calendar stick clearly identified the use of signs to consistently indicate the waxing and wanings of the moon over a two year period. Any claims of lunar or solar notation, or of number games, or base counts, must corroborated by such independent tests. Should a number of examples be recovered from a single site, showing consistent characteristics then the probability of a hypothesis is greater enhanced, see Couraud and Lorblanchet, 1986. According to these criteria, none of the examples that Marshack forwarded are plausible examples of lunar notations.

8.2.3 Systems of Notation.

If claims of the existence of a 'system' of notation are to be verified then the area of the study must be confined to one site. To postulate links between artefacts from different sites from possibly different timescales is considered unjustifiable *unless* the structural similarities between the artefacts are indisputable, and there is supporting evidence of links between these two areas from another source of data. My study rejects the view of strict unilinear patterns of change, from crude to complex forms and questions the use of the term 'evolution' by some researchers to describe such change. Criticism is directed at researchers who systematically seek the origins of things found in the present. Such an approach inevitably implies that more recent populations have invented nothing new and that people in prehistory had everything that we have now. This argument effectively ignores the possibility that processes of reinvention have taken place over time. The possibility remains that past populations may have used artefacts, tools and cultural concepts with no parallel in *any* more recent known society.

'Evolution' properly describes non-directional change over time. In organisms, such change occurs constantly in the form of random genetic mutations. A specific mutation is selected in response to an alteration in conditions that renders that mutation adaptive. Non-organic forms do not mutate, but variation may also be 'selected' in response to variations in their 'environment', whether social or ecological. Variations in 'style' reflect changes in cultural information, or the value of transmitting the same information in a new way. Such changes are not progressive or directional and simply reflect a new need. Any attempt to order stylistic change from crude to complex without considering any external social or ecological factors is unlikely to contribute to an understanding of variation.

If any tradition of notation is evident in the archaeological record it seems reasonable to hypothesise that it represented an adaptive advantage to the populations, that is, its use reflected a need to quantify and record information of whatever nature. According to Marshack, a system of lunar notation was in use throughout Europe, and was therefore part of the wider culture of the Upper Palaeolithic. If this is the case, then it should be present at the site of Enlène, Ariege. Marshack also claims that there is evidence of the 'evolution' of certain traditions of notation over the entire Upper Palaeolithic and if is the case, such traditions should be evident in both the Perigordian and Magdalenian levels of Enlène. However a closer analysis of the stratigraphy of Enlène highlights the impossibility of identifying any direct continuity, as the Perigordian layers are distinct from the Magdalenian. Equally the Magdalenian occupation lasted over 800 years, and so even if two artefacts are recovered side by side they could be chronologically and culturally separate.

To identify a tradition of notation in such a site as Enlène, a substantial number of artefacts would need to be recovered showing standardisation and stylistic variation over time. Unfortunately the chance find of a few artefacts at this stage would not establish the system of notation that Marshack claims. Another approach to examining the evidence of a widespread tradition of notation is to demonstrate the existence of a 'type' that is, the identification of a certain number of common physical and structural properties which are common to all items within this group, and distinguish them from other artefacts *outside* the group.

If such a typology can be established, then a researcher can extend the identification of artefacts to another site. My analysis of artefacts from the Upper Palaeolithic did not present conclusive evidence of this, as no truly discrete subset falls within the ethnographic parameters. The continuous scatter of data from Enlène is consistent with a purely random distribution, and this possibility cannot be discounted. Yet the engraved bones from Enlène present a varied data set, and my criteria confirmed the presence of translational symmetry in examples isolated by the statistical tests as examples of low variability. It is possible then to locate possible examples of notation within a broad category of engraved notational artefacts, although the boundaries between these examples and the random examples are continuous rather than discrete.

The material recovered from Enlène is associated with long occupation and use as a home base for a number of people. There is evidence of tool making, and bone and antler working. Further evidence to support a claim that these populations made records of some kind would come from an understanding of the material deposited over time, and the use of the cave and adopted subsistence strategy. Frolov advocates looking at *all* the engraved artefacts from each site, as only then can any variation and characteristics be identified. By examining each bone in the sample individually and recording all the physical properties of each bone is an effective way of building up a profile of the data. Detailed studies of the number of lines, dimensions of the bones, what percentage are burnt, and how may sides are engraved provides a frame of reference for researchers and material that can be used to compare to material from other sites.

My own data set was of broken artefacts, without exception, but in good condition and so the number of marks I recorded are accurate. There was no evidence that the engraved non-figurative bones are deposited away from the living areas, and they are found in association with a number of other finds. As they are scattered over the living floor, those that are burnt could have been used for fuel, but equally may just have burnt by physical proximity to the fire sites which are made directly among the habitation debris. From looking at a sample of all the non-figurative bones at Enlène I concluded that there was no evidence to suggest any evolutionary trends in the manner Marshack suggests. Although there is a higher number of more deeply engraved artefacts in the Magdalenian as a percentage of the whole sample, there is no additional evidence in their form or location to suggest that they had been systematically modified over the period.

8.3 Conclusions from Statistical Analyses.

What was evident in the sample of non-figurative bones from Enlène was the sheer number and variation of the number and organisation of the engraved lines. Merely measuring all the lines proved to be unproductive as it is evident that a number of lines are prematurely terminated by a break. Such examples are termed 'incomplete'. However a number of the lines on some artefacts were not affected, and so these are termed 'complete'. As all the bones are broken, there are no true 'totals' to be derived from merely counting the lines. This is contrary to Marshack's methodology in which all the lines, even from broken bones, are carefully totalled to give 'lunar counts.' For such a large data set the systematic application of my criteria to each of the engraved bones would be unnecessarily time consuming, and so statistical tests are used to isolate likely and unlikely examples of notation and decoration.

Both the Multivariate Cluster Analysis, and the two and three dimensional Scatter Plots proved to be an effective means of testing for consistency and regularity in the three variables of line length, distance and orientation. The two methods provided a good visual presentation of the results, and the Multivariate analysis calculated a measure of distance between each case. The use of the Ethnographic and Random data as a control also proved to be effective. The results agreed with my hypothesis, that the known examples of notation and visual communication would show consistently low variability, and that the Random data would show consistently high variability. There is a some probability that a Random example would show order and regularity, and so occur within the parameters set by the Ethnographic data, and this proved to be the case for a single occurrence in the Multivariate analysis and for two examples in the Scatter Plots.

The results from the statistical tests correspond well with the results from testing my criteria against some of Marshack's data, and some of the examples from Paris. In each case, with a single exception, the cases isolated as possible examples of notation and decoration were confirmed as examples of low variability in both statistical tests. These results were confirmed as the examples from Enlène that were identified as either examples of high, or as low variability by the statistical analyses, were also identified as such by testing these same cases against my criteria. Thus the two methods, my criteria and the statistical tests used here, can be used in conjunction with one another. The primary advantage of using the statistical tests is to isolate cases within a large data set for further analysis by my criteria.

These statistical tests do not provide a substitute for my criteria, as it is possible that some examples of notation will not demonstrate consistently low variability in the three variables of line length, distance and orientation. The testing of my criteria against known examples of notation highlighted the use of space and line length to order and differentiate between groups and areas of varying information content. Also non-repeated variation in line length and distance in notational sequences may not affect the overall meaning of the message, and such regularity is diagnostic only of possible examples of decoration. Thus these statistical tests for high and low variability have their limitations, and are most suitable to use either with my criteria, or for isolating cases of possible notation or decoration.

These statistics also identify distance and orientation as the principle sources of variability. This confirms the earlier conclusion in the discussion of the nature of notational sequences that stressed the need for regular spacing to differentiate the marks, and consistency in orientation to prevent the marks from overlapping one another. High levels of variability will not be confused by a high incidence of rotational symmetry. If the change in orientation is consistent and repetitive then this will not result in a high standard deviation, which is the value used in the three dimensional plots.

8.4 Was There Notation in the Upper Palaeolithic?

The existence of a system of notation during the Upper Palaeolithic remains a possibility. The evidence presented in this thesis does not support the claim that there are artefacts which appear to be notations of the phases of the moon, or 'lunar tallies'. However the testing of my criteria against a number of artefacts from the Upper Palaeolithic does suggest that there are a number of engraved bones which evince the same sort of patterns in the structure of their information as known examples of notation from the recent past. This does not mean to say that such artefacts *are* notational, merely that they conform to certain criteria devised to identify possible notational artefacts.

The deciding factor to confirm or deny the existence of notational artefacts is whether or not notation is known to have been used by the people of the Palaeolithic, as this certainly has not been demonstrated by any field of research to date. Merely to say that it would have been useful, and that the people were *capable* of inventing it, and that we know of its use elsewhere in later prehistory is to present plausible arguments, but no more. If notation was used by the people of the Upper Palaeolithic to order and interpret information, it may have represented an adaptive advantage. To be able to quantify, record and predict are useful skills used today in a number of tasks, including hunting, food procurement, and social organisation. However they do not necessarily result in the production of a tally, or permanent record, and so the absence of such artefacts does not indicate absence of such ideas.

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Table 1

Establishing a Context for the Artefact.

1. The site location and approximate date of the artefact.

2. Some knowledge of the associated finds and context.

3. Whether or not the artefact is complete and the general state of preservation.

4. Grounds for assuming that all the marks are man-made, with recognition of any that are not.

Criteria for Iconicity.

5. A resemblance to a known natural form by the basic outline and/or form.

6. The presence of any additional characterising detail.

Criteria for Decoration.

The characteristic properties of design, following Washburn (1983),

7. Symmetry
   i. Translational
   ii. Slide reflection
   iii. Mirror reflection
   iv. Rotation
8. Balance
9. Rhythm

Criteria for Notation

Key Characteristics:

10. The repetition of a single element, with pertinent variation.
11. The identification of pertinent and non-pertinent variation
12. Each mark should be clearly definable
13. Recognition of the 'path' of the sequence.

Subsidiary Characteristics:

14. Any apparent divisions should be recognised
15. Positional notation
16. Cipherisation.

Criteria for Lunar Notation.

17. Fit with a lunar/ solar/ astrological sequence by,

a) An established, consistent and repetitive pattern

b) Clear indication of any characteristic points relative to the sequence

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