The siting and layout of native settlements in the north east of England

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THE SITING AND LAYOUT OF NATIVE SETTLEMENTS IN THE NORTH OF ENGLAND

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PART 1 LITERARY TEXT

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ACKNOWLEDGMENTS

The maxim aptly displayed by the historian H.P.R.Finberg[1] that

> 'the truth is that early English history is not a study in which legal or mathematical certainty can fairly be expected, nor, as a rule, is strict proof demanded except in reaction against new ideas or controversial opinions. The best we can hope to do is to attempt to establish a weight of probability sufficient to persuade any one who approaches the subject with an open mind'

has been a guiding light in the production of this thesis. The kindling of this light has been the sole responsibility of Professor Eric Birley of Durham University who first introduced me to the fascinating possibilities that application of geographical techniques might have upon Iron Age settlement in the north of England. From the initial stimulation developed a period of research into the problems of siting and layout of native settlements. The results of this are set out in the following chapters. Any attempt to express my great gratitude to Professor Birley must be clumsy, but the hours of work to which I was introduced were all immense fun and I'm sure, worthwhile. Not least it made me humble in the realisation that the pursuit of knowledge only reveals the extent of the ignorance of the pursuer.

The thanks must also extend to my colleagues in the Archaeology Department who nobly put up with my spreads

of maps and apparently unnecessary questions.

Invaluable contact was made with Mr.George Jobey of the Department of Extra-Mural Studies in the University of Newcastle-upon-Tyne, who as the foremost authority upon native settlement in the north of England, by personal example of excavation and investigation, tendered me much advice upon the subject. His contribution to the amount of knowledge we have is aptly shown in the bibliography, where volume,as well as quality of works, is unrivalled.

I must not forget my companions in the Geography Department of Durham University. My thanks go to Professor W.B.Fisher for his rash decision in training me for three years, and his willingness in supporting my historical research. Special mention must also be made of the invaluable conversations between myself and Dr.Brian Roberts of the Geography Department, on the hills of Weardale and Teesdale, where many interesting thoughts pertaining to history were provoked, argued and discarded. His stimulative appreciation of the pros and cons of discussion were of great help during the writing of the thesis. His sensitive approach to history and its problems is a thing to be admired.

1 Finberg, H.P.R.,'Lucerna', p.2-3. (1964).

ABBREVIATIONS IN THE TEXT

AAn	Archaeologia Aeliana, nth.Series.
Ant.	Antiquity.
AJ	Archaeology Journal.
Arch.	Archaeologia.
BNC	Berwickshire Naturalists Field Club.
CAPC	Cambridge Air Photo Corporation.
ChT	Christianbury Trust (Cambridge).
DNAAS	Durham and Northumberland Architectural and Archaeological Society.
JKStJ	Information from J.K.St.Joseph.
NCH	Northumberland County History.
O.S.	Ordnance Survey.
PAI	Proceedings of the Archaeological Institute.
PSANn	Proceedings of the Society of Antiquaries of Newcastle-upon-Tyne, nth.Series.
RCHMW	Royal Commission on Historical Monuments: Westmorland.
TAAND	Transactions of the Architectural and Archaeological Society of Newcastle-upon-Tyne.
VCH	Victoria County History.
CWn	Cumberland and Westmorland Transactions, nth.Series.

INTRODUCTION

The discussion of any historical problem necessitates definition of the terms used in that discussion; and this thesis is no exception. Native settlements are best described as those which show characteristics of an indigenous development, from a pre-Roman or Roman origin, and which were probably occupied by the native element of the population as opposed to the Roman. The uncertainty of the Roman influence upon the native has led us to be wary when we discuss these 'native' settlements. In their siting and layout we may often conjecture a Roman influence. It is possible that pre-Roman native settlements were taken over by 'Romanized' natives as part of the Roman attitude towards colonisation of the provinces; or the pre-Roman elements may have derived some of their Roman characteristics from trade contacts with the militia in the north. In many cases then, we may have a deliberate policy of patronisation of existing settlements, especially the farmsteads, as providers of meat, corn and vegetables. However, this picture is only relevant for certain types of native settlement - those which indicate by their outward structure, finds from excavation, or associated agricultural or pastoral land, a primarily farm-based economy. In contrast, there are many settlements where

evidence of economy is lacking. Many of the defended settlements in the North Cheviot and Redesdale areas we must presume relied upon pastoralism as a livlihood.

All these suggestions become shaky when we come to assessing evidence for their foundation. So few sites have been investigated and even fewer have been excavated. To date, the writer has identified a possible 859 sites which might have been occupied during the northern Iron Age. This number includes a few ancient references to earthworks where hypothetical occupation must be assumed for the period. In reality, it is probable that a great many more settlements existed between 500 B.C. and 500 A.D. A hint of a possible high site density, comes from Dr.N.McCord's air photographs of the east Northumberland plain, where he has brought out settlement outlines with associated enclosures. The exact age, use and date of these can only come with excavation.

The 859 sites in the north are divided between the counties as follows. Northumberland has produced the greatest number of known sites with approximately 576, Westmorland has 101, Cumberland 109, Durham 50, and Lancashire-North-of-the-Sands 23, although one must always qualify apparantly factual statements with the provisor that they can only be approximate. Air photography has produced so far, a possible 26 extra sites of Iron Age date, and the evidence from

place-names adds a possible 47 sites of Roman or native date. In view of the very apparant lack of positive concrete evidence, the only reasonable course that we can follow is to assimilate the evidence that we have for the north, and try to read into it some sort of meaning relevant to the known history of the northern area.

We may consider the north of England to be that area north of a line from the Tees to the Ribble, and south of the Tweed-Eden upland massif. Delimitation of any area is always arbitary, especially with a historical discussion, but we can divide the area within these borders into a number of rough groups. In the Eden valley area, we have a wide conglomeration of farmstead settlements, significant in their structure and siting. Further to the west, the Cumbrian massif yields a general spread of defended sites and scattered settlement remains. The Furness area of the southern Lake District yields a distinctive hill fort settlement of pre-Roman Iron Age origin with possible continuity of occupation. A great gap is noticeable in the southern and central Pennines and the east Durham plain. Various settlements appear to be aligned along the trans-Pennine routes and fringing the foothills of the east, but density is not apparant until the area north of Hadrian's Wall is examined. The county of Northumberland exhibits the densest area of native

settlement and this may be areally divided according to settlement siting and structure. Redesdale appears to favour rectilinear settlements, the North Cheviot area defended curvilinear settlements, and the eastern coastal plain a combination of the two in a distinctive pattern. These broad categories are supplemented by other significant distributions of settlements according to regional siting preferences and relationships with the Roman settlements in the area.

The problems of siting and layout of native settlements in the north of England are partly realised in the text. No conclusion or summary is ever final and therefore the suggestions arrived at are always to be critically examined. We should constantly be attempting to reappraise the picture we have of native settlement in the north. One method is excavation, and application of the gathered information to the general outline of northern prehistory. This thesis is an attempt to answer in part some of the questions how much, how many, why and where were native settlements sited, and how significant was the shape of the particular settlement?

The division into eight chapters is a matter of a systematic approach to the subject. The first four chapters are concerned with the relationship between Iron Age man and his enviroment. This basic concept of geographical thought has been applied to a historical study, with the result that a systematic

examination of the available evidence has produced some interesting correlations between areal siting and landscape structure in the widest sense. The geological and soil structures of the area in detail, have yielded occasional pointers towards Iron Age man responding to the differences in landscape properties of flora and fauna, and his adaption to economically more favourable conditions. In other cases of siting, it appears that the reverse response has taken place and it becomes obvious that we must look for some other factor which has influenced this siting. The second chapter deals with evidence for climatic change and the relationship between climate and vegetation, using pollen analysis as a medium, and the possible affect of altitude upon settlement. Chapters three and four complete the physical background of the thesis and the relationship with Iron Age settlement, by examining the land qualities of Northumberland and Durham and relief effect upon settlement layout and distribution in specific areas.

The last four chapters are primarily concerned with examining the techniques which may be used to produce new relationships between factors of siting and Iron Age settlement. The use of maps, diagrams and statistical methods are discussed, and applied directly to three different areas within north England - North Cheviot, Bellingham/Kirkwhelp-

ington, and Crosby Ravensworth and Asby, The relative importance of the three siting pulls for the latter areas are assessed and the degree of association measured statistically. The thesis ends with a comparative study of the relationships between Roman and native in north England, using many of the methods discussed in the previous chapters.

The thesis leaves many questions unanswered, but any academic study should pose more questions after completion than existed before. The writer does not claim that any of the work set out is revolutionary in aspect, or that any new basic ideas have been evolved, but the examination of known material has revealed that a new approach can be stimulating and exciting. To view a problem from 'the other 'side' ', 'side' being the realm of the geographer, must have a value in its application. Even a negative argument is positive compared with no argument at all. If all the possible Iron Age sites were examined from the point of view of each of the three chosen siting factors, at least 2557 relationships would have to be discussed. That sort of detail is not the aim of the present thesis. One might sum up the study as an experiment in the application of geographical techniques to historical evidence, in an attempt to throw a fresh light upon the historical development of north England. If this study has succeeded in any part in stimulating new

thought on the subject or in posing new questions on the Iron Age, then it has gone a little way towards the furtherance of our quest after the theoretical ultimate: the truth.

CHAPTER 1 GEOLOGY AND SOILS

GENERAL BACKGROUND

A detailed account of the Solid Geology of North England is not necessary in the study of settlement siting but rather, an examination of the effect of solid geology upon the formation of soils and drainage patterns, this being more relevant to the relationship between man and his enviroment during the Iron Age[1].

Many of the soils of North England are strongly leached and devoid of mineral salts, and since they are mainly derived from rocks that are non-calcareous, they tend to be acid. The high rainfall in the north, compared with the southern lowlands of England, tends to impart the soils with 'gley' characteristics of waterlogging. In the uplands, and especially the plateau areas of central north Pennines and the Cheviot massif, the gently sloping landscape, plus the high rainfall has led to extensive development of peat. The past tense is used, as the majority of peat areas today are relics from past climates.

Throughout the north, parent rocks that yield a large amount of detritus in weathering are widespread, but they do not disintegrate to form good drainage below the surface soil. This applies to areas both drift covered and free from drift. The only exceptions to this are the porphrytic slopes of the Cheviot and the outcrops of Carboniferous limestone. The

relationship of these areas to native sites will be examined in more detail later in the chapter. The massif limestones of the west are well drained, but the soils are thin and rich in alkalis. The dry loams are much more fertile than the acid soils of the uplands which require heavy liming to become manageable.

The soil pattern of the north is complicated by the rapid variations in the depth of drift, its derivation and texture, and the conditions of subsoil drainage, plus the occurrence of irregular patches of fluvio-glacial deposits. Hence the main characteristic of many areas of the north is the variability of soil conditions.

Carboniferous rocks in the north yield boulder clay soils which may be termed heavy loams. The values of these clays depend largely upon local drainage conditions. In north-east Durham and south-east Northumberland, the clays are badly drained and extremely heavy. In contrast, the western part of the limestone plateau of east Durham is covered by thin, dry, stony loams; coastwards the soils become heavier.

LAKE DISTRICT

The great variety of terrain in north England, from exposed high plateaus in the north Pennines, to the rocky interior of the Lake District, and to the flat eastern coastal plain of Northumberland and Durham, poses the question of the

relationship between various aspects of this landscape and the settlement of the Iron Age population. T.Hay[2] examined the Lake District from this point of view and concluded that the differences between the hilltop and the valley bottom and the differences in the character of the rocks plus the glaciation factor, were enough to influence the siting of natives within the Cumbrian block.

Glacial erosion and sub-areal weathering remove material and re-deposit it as ground moraine, often dense and hard because of the pressure of the ice. Thirlmere and the upper Ullswater valleys were plastered with this compact material and little inhabited where it occurred. The settlements around Patterdale and in Glencoyne Park are either above the level of the ground moraines, or in tributary valleys which received none of this deposit. In direct contrast are the lateral and terminal moraines, much looser in texture and more porous to water, the permeability attracting settlement. In Glencoyne Park[3] there are seven settlement groups on the drier, rounded slopes which fall gently down to Ullswater at heights between 550 and 1000 feet. Most of the settlements are indistinct, but a total of 42 hut circles, or possible hut circles, are scattered along the slopes. Associated with the circles are enclosure walls close to Swan Beck, and the remains of others to the north-west of Ormathwaite Burn. Rectangular buildings

of probably later date were observed 300 yards west of Glencoyne Cottages. Dr.Spence at Kinniside[4] took the average of 15 huts and found the diameter to be 20 feet 6 inches. The average for 38 of the 42 circles in Glencoyne Park is 22 feet[5] which compares favourably with hut circles of known Iron Age occupation at Crosby Ravensworth and Crosby Garrett, in Westmorland.

On the left bank of Grisedale Beck at the foot of a steep slope covered with terminal and lateral morainic mounds and ridges, one good hut circle survives with the remains of several others. They have been attacked by stream erosion and tree uprooting, possibly started during the period of occupation, as there seems to be a re-entrant arm protuding from the circle, sited as if to divert stream flow from above.

Despite the compactness of some of the moraines in the Lake District, even the toughest of the boulder clays weathers downwards, the top 18 inches forming a looser covering supporting a coarse vegetation of grass. The region between the lower drift-covered slopes and the rockier slopes above, parallel to the valley, therefore were probably the areas where most of animal grazing took place. The margin of survival in the central Lake District was therefore very small, may-be one reason for the sparsity of native sites in the region.

The structure of the settlements depended to a great

extent upon the local materials available. In the north-east Lake District much local stone was readily at hand for the construction of orthostats with a rubble infill, but outwards from Borrowdale, Skiddaw slate on the north and Silurian rock on the south were not satisfactory for this type of construction[6]. Limestone fringes the Cumbrian massif on three sides and many fringe settlements, especially those in the Eden valley, have limestone blocks incorporated into the structures. Hay noted that most sites in the Lake District were situated on platforms with good natural drainage, above the valley bottoms[7]. He agreed with Fox in his 'Personality of Britain' that the lower parts of the valleys were heavily wooded. This, plus the flatworm fasciola hepatica, may have been responsible for the drift of people to the higher, better drained hills. The flatworm affects sheep and cattle by laying eggs in the animal's body, which eventually pass out and develop in badly drained conditions.

Closer examination of the Solid Geology of the north-west[8] and comparison with known native sites[9], brings out some interesting observations. Whereas there is no apparant difference between settlement in the volcanic Borrowdale region and the Silurian series, there seems to be a strict avoidance of sandstone regions on the south-west coast. A reason may be the high silica content of arenaceous beds

which weather to sand, plus the formation of iron-pans preventing adequate drainage. It is only reasonable to assume that Iron Age man would have been sensitive to differences in drainage qualities of different types of land. Avoidance of water-logged and damp areas would become general.

The fringing limestone that has already been mentioned, yields good soils and therefore good pastures, and this is reflected in the concentration of settlements along the southern slope of the Eden valley. The slates of the north-west central massif are largely avoided because of the rough topography that they produce. The granite area of central west Cumbria weathers into good fertile soil, which is inclined to be acid, but bad drainage is often too much an associated feature. The shales of the northern area, one would expect to have been more densely peopled, but the reverse is true, and one must turn to other evidence to establish the answer to this problem.

The inadequate supply of soil maps for the whole of the northern area has limited close correlations between native sites and soil types. It is doubtful whether this specialised analysis is useful in the wider context because of the many other factors which enter into the siting of settlements. An example of this may be seen in the analysis of a soil texture map of the area east of Carlisle[10]. The fluvio-glacial sands of this area vary from light sands with little humus, to

loamy sands, which are typical of the drift derived from Triassic sandstones along the south-west coast of Cumberland, as well as of the terrace strips along the river valleys. The outstanding points of these soils are their good natural drainage and the ease with which they are worked. This in itself may be a contributary factor to the relative absence of known native sites in the area. They may well have existed, but agriculture has since erased all surface features. The seven sites on the map are situated close to rivers in every case. Two are sited on heavy loams, two on light loams, two on loamy sand and one on light sand. Five of these sites are defended. The settlement three miles to the south of the Irthing on the junction between the light loam, heavy loam and light sand on Tower Tye[11], is a circular site with two ramparts and containing internal buildings. The two sites on the heavy loam to the south of the Gelt at Cumrew[12] and Castlecarrock[13] are both defended, the former by ramparts and the latter by ramparts with flanking banks at the north-west entrance projecting on both sides - a feature more in character with southern hillforts[14] as demonstrated by C.F.C.Hawkes. In the Irthing valley between the Gelt and the Upper Irthing, the Iron Age site at Old Brampton is situated on loamy sand. Comprehensive excavations by Blake[15] revealed a palisade trench within a ditch, with a square main building constructed of untrimmed cobbles packed

with smaller stones and weather-proofed with turf. The find of a spindle-whorl indicates some degree of sheep rearing, possible on the hills to the south. The site favours the use of water-worn stones for building construction, but the siting factor which may have over-ruled other factors may well have been the closer proximity of the Stanegate and the Roman Wall to the north. Pottery evidence from the site points towards the end of the third century, early fourth century A.D. for occupation, but the palisade trench may point towards a pre-Roman Iron Age origin.

NORTHUMBERLAND AND DURHAM

Boulder clays, Sands and Gravels

Glacial deposits of boulder clays made directly by the action of moving ice, and the sands and gravels carried by the ice and sorted by water resulting from the melting of the ice, are spread across Northumberland from the middle Tweed basin to Alnmouth[16]. Boulder clay gives rise both to featureless ground and to ridges and hollows, depending upon the pre-glacial landscape. The former is characteristic of much of the landscape of Durham and Northumberland where glacial action resulted in a smoothing process upon the detritus. A glance at the Rothbury Geological Drift Map[17] shows the widespread nature of boulder clay, enhancing the probability of native settlement siting upon the glacial detritus. In fact, 16 out of the 29 sites on the map are upon boulder clay. Ridges and hollows are more

apparant in west Cumberland where boulder clay masks the outcrop of Coal Measures[18], in the form of these undulations.

The principal topography of sand and gravel country is much more diversified than that of boulder clay. Flat-topped lenses with steep sides are characteristic of deltaic origin. Kames, pitted irregular ridges, were formed directly from the debris-laden ice along its melting margin[19]. A glance at Map 4 leaves us in little doubt that in north Northumberland, fluvio-glacial sand and gravel did not attract native settlement. The only prominent cluster of sites on drift is the North Middleton/Ilderton group, but here the major siting factor seems to have been a continuation of the peripheral Cheviot massif distribution characteristic of the region.

In the Tyne corridor is a strike valley corresponding with the axis of the synclinal trough between the North Pennine massif and the Bewcastle and Cheviot domes of the north[20]. In the west, the light sands and sandy loams provided by the extensive spreads of fluvio-glacial drift and the gravelly haughs, have long been suitable for intensive cultivation. Elsewhere in the corridor, the boulder clay gives heavy soils, but the low height of the area makes possible more extensive farming compared with other dales in the north.

The distribution of alluvium is unconnected with both modern and ancient settlement; but the sand and gravel ridges

have proved ideal for modern settlement. Native sites appear liberally spread along the corridor edges to the north. This may be a reflection of the intensity of agriculture on the central ridges, but may not be so as a high percentage of the north corridor sites are also sited upon good quality farmland. Only a few in the north and north-west are beyond the limits of modern farmland. The density of ploughed land varies little throughout the farmed area.

The Drift Geology Map of Durham[21], only shows eleven native sites, but it may be significant that five of the possible sites occur on glacial sand and gravel deposits which cover a very small percentage of the area, and five appear on boulder clay deposits, which cover the majority of the area. Of the latter five it must be noted that three of the five are on the junction between the boulder clay and glacial sand and gravel. The two most easterly sites at Catcote and Dalton Piercy are of this latter type. The earthwork at Dalton Piercy[22] is said to resemble Iron Age enclosure embankments elsewhere in the north; the site at Catcote is 'an unenclosed Iron Age settlement site of the Roman period'.(C.Long 1966). The latter site also indicates the possibility of continuity of occupation throughout the Bronze Age and into the Iron Age period, with evidence in the form of a series of pre-Iron Age ditches. The site has produced three possible huts, ditches, gullies, pits, hearths,

stone foundations and an iron forge. There are no other known Iron Age settlements in the immediate area.

The cluster of four sites around the city of Durham points to occupation during the pre-Roman Iron Age on the sand and gravel tracts at Old Durham to the east-south-east of the town. Richmond, Romans and Wright[23] during the excavation of the Roman bath-house, found a native hand-made cook-pot, heavily coated with soot and of a crystalline gritted fabric of possible 1st.century date, plus three or four flints.(Corder compares the sherd with the Corder and Kirk 'Langton' sherd fig.7 nos. 22 and 23, from the early ditch). On Air Photo BT 16 a trapezoidal enclosure with a ditch is visible in the field above Old Durham farm; slightly higher than the sand and gravel deposits of the valley bottom but still retaining riverine gravel contents. Cade in 1765[24], Stukeley in 1776[25] and Hutchinson in 1794[26] referred to a circular site close below Old Durham farm. This would be directly on the old river gravel terrace of the Wear. The last site in the area of Durham City is Maiden Castle[27], a pre-Roman[28] defensive site towering on the sand ridge above the valley, which Steer parallels with Eston Nab and Bothby Scar in Yorkshire dated by Elgee to the Bronze Age[29]. Maiden Castle is the only one of the four possible sites which is obviously defensively sited. The other three avoid the alluvial flood-plain of the Wear valley and the plateau top further away

from the river. Their situation upon the gravel and sand terraces may reflect the use of the friable dry soils, the close proximity of water and the valley as a route from the coast to the interior of the Pennines. The incised meander on which the modern city stands may well have been a focal point for north-south east-west traffic in the Iron Age, as it is today.

Seven miles to the south of Durham two earthworks stand upon extensive glacial sand and gravel deposits. As at Maiden Castle, closer examination reveals that Mount Narbon, Mainsforth, mentioned by Cade in 1785[30] is again a defensive site on a small eminence, although about 16 acres in size. The Little Skerne stream seems to have been diverted to form a deep ditch around this high circular site. Unfortunately Hutchinson[31] and Surtees[32] found no trace of occupation. The evidence for a site at nearby Chilton rests merely upon the report of Lewis in 1831 of an earthwork[33].

A fair summing up of the situation with reference to sites upon sand and gravel, might be that only in the Wear valley at Durham may there be any importance attached to settlement upon these deposits. At other places in the county, the other siting factors must operate.

The Alnwick-Rothbury Map of Drift Geology[34] shows sand and gravel deposits in the bend of the Breamish on Ilderton Moor, and in the area of North Charlton to the north of Alnwick.

of the thirteen known native sites on these deposits, it is interesting to note that eight of them are circular sites, three irregular, and two classed as possibly medieval in date. Three of them have more than one rampart, and eight have a single rampart. Can there be any significance in the dominance of these circular, single-ramparted sites?

On the north side of Happy valley around Middleton Hall are two ring sites in Camp Field[35] and at Scotch Camp[36]. A third site on Castle Hill is probably a motte[37]. The rolling country to the south of Wooler Water around South Middleton is liberally spread with sand and gravel deposits and native sites. The sites make up part of the chain around the north and east sides of the Cheviot massif and are unlikely to have been influenced in their siting by considerations of soil texture. The large circular site at Roseden Edge with its two ramparts and ditch seven yards wide[38], is on the northern tip of a steep sand and gravel ridge "very visible and distinct"[39]. In contrast to these Cheviot peripheral sites, the four sand and gravel settlements to the east, four miles inland from the coast, appear deliberately to choose the north-south line of deposits north from Alnwick. The sites do not occur on any ridge, but rather on a natural route leading from the River Aln towards the coast below Tweedmouth, now occupied by the A.1 Trunk Road. This route fringes the coastal plain. The

northward extension of native settlements might be expected along this natural boundary. The belt is clear on Map 4.

Ordovician

The four main groups of this system, the Ashgill, Coniston Limestone, Borrowdale Volcanic and Skiddaw Series, are not exposed to any important extent outside the Lake District. These shales and sandstones are covered in the east by younger rocks, and in Teesdale and the Upper North Tyne by coverings of drift.

Silurian

There are a few small outliers of Silurian rocks on the south side of the Cheviot and near the border with Scotland. Grits, greywackes and shales surface on the south side of the Breamish valley[40], and are all steeply folded and cleaved, but for the most part are again drift covered which hides the excellent quality of drainage that the system has to offer. Native settlement in this area is confined to the cementstone outcrops.

Old Red Sandstone or Devonian

The age of the Cheviot Hills igneous complex is Lower Red Sandstone. Despite extensive denudation, the lavas still occupy an area of 230 square miles. Into this, a large mass of granite intruded, now appearing as a core of plutonic rock surrounded

by the lavas and tuffs which dip away from it[41].

The central granite area has poorer drainage than the surrounding lavas and agglomerates[42] and has attracted fewer native sites. Only New Burn in Selby's Forest[43] and Threestone Burn[44] near Ilderton have yielded any traces of native occupation, and then only in the form of hut circles, which have since become lost.

The number of settlements found upon the lavas and agglomerates of the Cheviot massif point not so much towards the particular soil characteristics of the parent rocks, but more to formation of escarpments at the edge of the deposits. Erosion by the rivers Glen, Wooler, Till, Breamish, Aln and Coquet have facilitated the sharp gradation between the igneous rocks and the surrounding deposits. The fact that native settlements do not penetrate the interior lends weight to the theory that strategic siting factors must have been more important than considerations of the rich soils of valley sides further into the massif. The height and exposure factors apply equally to many of the hilltops on the north settled rim, south of the River Glen.

On the Alnwick/Rothbury Geological Drift Map, Map 9, a group of 18 sites are clustered on either side of the River Breamish in the extreme west. Every one of these sites is on pyroxene andesite or ash and agglomerate, despite the considerable

extent of boulder clay to the north of the Breamish and the alluvium within the valley. The explanation to this lies in the conformity of the rock strata. The sites take strategic advantage of hilltops as well as close connection with the main river valley and its tributaries. The focal point of the area may well have been Brough Law[45] or Greaves Ash[46] further to the west.

Carboniferous

The Carboniferous system is divided into the Carboniferous Limestone, Millstone Grit and Coal Measure Series. In the north-east the upper part of the Limestone is split into individual limestones seperated by shales and sandstones. The Millstone Grit changes between more shaley and more sandy beds. The Lower and Middle Coal Measures differ due to changes in the distribution of land and water, in depth of water, and to the influence of the rivers bringing in sediments caused by uneven movement of the sea bottom[47]: hence the characteristics of the rocks of the Carboniferous Series in the north differ from those further south, with a resulting effect upon weathering and upon settlement.

Carboniferous Limestone Series

Cementstone Group - The Cementstones, being peripheral to the lavas and agglomerates of the Cheviot massif, are mainly outside the densest area of native population[48]. The sites

tend to avoid the Group because of the more favourable siting characteristics of the less erosive rocks.

On the south side of the Cheviot massif the cementstones are thin and often mixed with shales and sandstones, The material is easily weathered but the soil is littered with rounded water-worn pebbles and is difficult to cultivate. The settlements on the cementstones are dominated by other siting characteristics. Robert's Law[49] (now destroyed), is on a southern extension of a cementstone ridge in the south-west corner of the Alnwick/Rothbury Drift Map. Two miles to the north, Blackchester Hill[50] and Whitchester[51] are place-name evidence of the possible existence of native sites. The remaining four sites on cementstone to the east of the latter, are likewise on valley spurs and along the edge of ridges - hence geomorphologically they are more dominant.

The general tendency is reflected on the Rothbury Drift Map[52]. The four sites on the cementstone, of which one is a place-name[53], are all much lower in elevation than the Rothbury hillforts to the east. Tosson Burgh[54] is ramparted with double ditches and is on a promontory on the lower slopes of the northern Simonside Hills, but the other two sites are both on valley bottoms and single-walled.

Fell Sandstone Group - This coarse and massive sandstone forms bold escarpments across much of the country around the

Cheviots and along the Border country to the north. These beds have a high arenaceous content and hence weather down to sand, and as in the west, the iron-pans interfere with the drainage pattern. Generally, therefore, it is the physiography of the fell sandstone landscape which attracts the settlement.

In north Northumberland[55], the fell sandstone outcrop stretching southwards from the mouth of the Tweed to Doddington Moor and the Till and down to Weetwood Moor, forms a fine platform for settlement above the flat river valley of the Till. This effect is brought out by the lack of sites on this flood plain. After a gap of eight to ten miles, the sandstone continues from Alnwick Moor bending westwards through the Coquet valley at Rothbury to Upper North Tyne and Upper Redesdale. Native settlements utilise this great sweep of rock, by siting on the many high defended places that the conformation offers.

In more detail, we find that the majority of native sites on the fell sandstone of the Alnwick/Rothbury area[56], are extremely defensive in type. Old Bewick[57] a unique double-ramparted, double-ditched site lies on the edge of a steep cliff above the Breamish, facing southwards. Ross Castle[58] an oval hilltop site is on the western escarpment of a fell sandstone block. Hepburn Crags[59] is a cliff site a mile further to the south. The Eglingham Burn has cut down through the sandstone ridge south of Old Bewick, but the distribution of

sites continues above the valley floor on Beanley Moor. Beanley Plantation[60] with its triple ramparts and its command over the route towards Alnwick and Powburn, is the most dominant of the sites, but Jenny's Lantern[61], Titlington Mount[62], and The Ringses[63], are all heavily defended with two or more ramparts enclosing hut circles and hollow pits, although the enclosed areas are small at half to three-quarters of an acre. Although Bla wearie[64] and Camp Plantation[65] appear to be in valleys, they top steep declivities above the stream beds and have every indication of defensive siting. To the east and south, on isolated outcrops of sandstone, other settlements follow the same general pattern. Honey Hill, South Charlton[66] is on the northern peak of a ridge; Castle Hill, Callaly[67] with a splendid view of the middle tract of the Aln dominates the western end of Callaly Crags, defended by two ramparts on the south and east and three on the west; and Broomwood[68] is "on rising ground, very stony, with a double ditch and a good view southward from Shawdon to Shipley"[69]. The same general picture also applies to sites further west around Rothbury[70]. Lordenshaws[71], Old Rothbury[72], Westhills[73], and Little Mill[74], all have two or more ramparts, and are typical hillforts on hill crests. The broad sweep of sandstone provides excellent aspect for sites capable of defence.

This detailed analysis is necessary to establish that fell

sandstone outcrops offer excellent sites for the defensive type of native settlement. The majority of sites mentioned above place defence of the inhabitants as a prime factor of construction.

Scremerston Coal Measures - In Northumberland, this Group consists of sandstones and shales with some coal measures of wholly estuarine or freshwater character[75]. They outcrop in a narrow belt from the mouth of the Tweed to Alnwick, in Redesdale, in the Tyne valley above Wark, and much of the ground southwards towards the Roman Wall[76]. There appears to be no significant relationship between this Group and native sites, despite the fairly large area which the Group occupies.

Limestone Group - Sandstones and shales still predominate in this Group but limestones occur at intervals of 100 feet or so with thicknesses of 50 to 60 feet, throughout the north-east.[77] The main belt runs along the coast from the Tweed towards the Aln and then south-west towards the South Tyne before turning south to the dales of the Pennines and noteably Redesdale. The limestones yield good soils wherever they outcrop. The cultivation terraces seemingly associated with many native sites in Lower Redesdale and North Tynedale may be a reflection of the qualities of drainage offered by limestone scenery[78]. However, the general distributions of limestone and native sites in Northumberland and Durham[79] do not appear to be associated. North of the Aln where the limestone belt fringes the coast, native settlements

predominate inland. In the Upper Wansbeck region, the settlements spread westwards into Upper North Tynedale with no particular pull towards the limestone parent rock. In the extreme south of Northumberland south of the Roman Wall, the limestone is bare of native settlement, but this may be attributed to economic and social conditions rather than to geology.

The limestone of west Durham appears to attract possible native sites to the central portion of the outcrop. The relative density of sites is probably due to the route characteristics of the Wear valley as a throughway into the Pennine interior and over to the Eden valley, more than attractability of the rock type.

Millstone Grit

In Northumberland and Durham the millstone grit is defined as comprising the measures lying between the lowest coal of the coal measures and the highest limestone[80]. In Durham, three grits are parted by masses of shales and clays, the whole being about 300 feet thick. These outcrop between the Upper Wear and the Derwent and across middle Teesdale. Native settlements tend to avoid the grit areas,[81] but the lack of sites makes any comparison weak.

The grits are arenaceous and carry about 15% of clayey matter, and therefore the landscape is neither sharp and craggy in form, nor a mass of weathered rock debris, but more rolling

and smooth. In Northumberland, the belt of grits runs south-west from the mouth of the Coquet to the Tyne at Stocksfield, and is thickly covered with drift material. Approaching the Derwent, the drift cover is less thick and the grits weather to form poor soils.

Coal Measures

The sequence of coal measures is incomplete in Cumberland, Northumberland and Durham, for some of the upper measures were removed by denudation before the covering of Permian and Triassic Rocks[82]. Only along the western edge of the outcrop are the measures exposed and then the high silica and low alkali content detracts from the fertility of the top soil making the pastures bad grazing lands. The measures were not important as settlement areas. In Durham[83] the majority of possible native sites are upon coal measures, but this is because the series occupies the large central area between the Carboniferous Limestone of the west and the coastal plain of the east.

Igneous Rocks

The intrusive rocks associated with the Carboniferous strata comprise sills and dykes. The most important of the former is the Great Whin Sill which outcrops at intervals across Northumberland and north-east Cumberland along the Pennine escarpment and in Teesdale[84]. In areas free from drift the Sill forms escarpments and is responsible for cliffs and

waterfalls, including High Force in Teesdale. The rock weathers to a rich soil, but the chief characteristic of the formation, the ability to provide a strong defensive position, probably the most determining factor of native siting. The outcrop curving around Budle Bay by Belford in the north, is the final escarpment before the coastal plain, and it is the extremity of the north-south chains of sites stretching from the Aln to Belford. In the south-west, the Whin Sill escarpment provides an excellent base for Hadrian's Wall. The native sites which stretch along this escarpment are probably more associated with the Roman works than with the rock outcrop. Lack of dating evidence excludes a firm opinion upon this possibility.

Permo-Triassic

The Magnesian Limestone east of the Pennines extends from the Durham coastal area between South Shields and Hartlepool inland to Ferryhill and Darlington with a narrow extension southwards to Ripon in Yorkshire. The lower portion of the outcrop is hard, grey limestone and dolomite forming a prominent escarpment. The higher beds, east of a line running south from Sunderland, are soft light-coloured dolomites. All the Permian soils are very porous and offer excellent drainage[85], but much of the outcrops are covered by a thick mantle of drift[86]. The sparsity of sites in County Durham forbids any further correlation between settlement and Magnesian Limestone.

Jurassic

The only remnants of this system in the north are to be found near Carlisle, around Great Orton, where exposure is extremely limited, and in the Cleveland Hills where the Lower Lias are soft shales, Upper Oölite sandstones, and shales with limestones.

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77 Map 6.
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79 Map 6
80 Map 13
81 Map 15 Durham Native Sites and Solid Geology - Millstone Grit, Magnesian Limestone and Bunter Sandstone.
82 Map 6
83 Map 16 Durham Solid Geology - Coal Measures, Carboniferous Limestone and Native Sites.

84 Map 11
85 Map 13
86 Map 8

TABLE 1 GEOLOGICAL HISTORY OF THE NORTH

Periods		Deposits
POST-GLACIAL		Blown Sand, Peat, Alluvium, Raised Beaches, Submerged Forest.
GLACIAL		Boulder Clays, Sands and Gravels.
		Unconformity
MIOCENE		Igneous Dykes.
JURASSIC	GREAT ORTON	Shales and Limestones.
TRIASSIC		Red Shales and Sandstones.
PERMIAN	MAGNESIAN LIMESTONE	Shales, Sandstones and Breccias.
		Unconformity
	IGNEOUS ASSOCIATION WHIN SILL	
	COAL MEASURES	
	MILLSTONE GRIT	
CARBONIFEROUS	LIMESTONE GROUP	Shales, Sandstones, Coals, Limestones, Conglomerates, Basalts.
	SCREMERSTON COAL GROUP	
	FELL SANDSTONE GROUP	
	CEMENTSTONE GROUP	
OLD RED SANDSTONE	GRANITES, LAVAS AND AGGLOMERATES	Granites and other Plutonic Igneous masses; Lavas and Agglomerates.
		Unconformity
SILURIAN	LUDLOW SERIES	
	WENLOCK SERIES	Shales and Sandstones.
	LLANDOVERY SERIES	
ORDOVICIAN	ASHGILL SERIES	Shales overlying
	CONISTON LIMESTONE SERIES	Limestones.
	BORROWDALE VOLCANIC SERIES	Unconformity
	SKIDDAW SLATE SERIES	Lavas and Ashes.
		Shales, Grits and Sandstones.

Adapted from Eastwood, T.,'British Regional Geology. Northern England', (1963), p.3. H.M.S.O.

CHAPTER 2 CLIMATE AND VEGETATION

In 1957, R.J.Braidwood[1] lamented "the almost complete lack of comprehension on the part of archaeologists of (a) the necessity of understanding the enviroment as a functioning entity, before cultural interpretation could proceed, and (b) the full interpretive potential of non-artifactural materials". J.Desmond Clark[2] echoes this idea by stating ". . .it is essential that the enviroment and ecological setting of cultures . . . be established as accurately as possible, for, without this knowledge, we can hardly begin to interpret the cultural evidence. It is necessary to know the nature of faunas, of vegetation and climate, of kinds of forms of raw materials, available to man or so on". Thus, using pollen analysis as a study prerequisite to prehistoric interpretation[3], Pittioni emphasised the value of the geographical/archaeological relationship. Application of this idea to the study of the pre-Roman and Roman Iron Age in the north of England, should give a fuller picture of man in his enviroment.

Climate and vegetation of Iron Age England in the north are inevitably linked, the latter responding to variations in the former. Man, in his enviroment, reacted by adapting his way of life to particular conditions. Modern man is still governed to a great extent by the specific conditions of his

enviroment, although he possesses the technological ability to create his own artificial enviroment. Iron Age man lacked these technological aids and was tied to his surroundings to a greater extent. It is important to try and understand exactly what these surroundings were, to place the natives in their historical context, and to do this we are able to draw upon the researches of botanists, geologists and geographers, and apply the results to our present knowledge of the people of Iron Age north England.

ALTITUDE

The exposed positions and extreme heights above sea-level of some native settlements lead us to question whether there was any significant climatic difference between the Iron Age and the present day. On Rotherhope Heights near Alston in Cumberland, Hutchinson noted semi-circular ramparts at 1858 feet[4]; and on nearby Bellbeaver Rigg at 2000 feet K.Jenkinson noted similar earthworks[5]. Also, at about 2000 feet overlooking the Eden valley on Melmerby Scar, there is an extensive defended site with traces of three ramparts plus hut circles situated on the stone outcrop on top of the ridge. The close proximity of the Roman Maiden Way to the south may provide part of the answer to the foundation of the settlement[6]. The hill-fort at Carrock Fell, five acres in size, is at a height of 2174 feet, and according to R.G.Collingwood belonging to the

early Iron Age series[7], and being probably slighted under Vespasian in the late first century A.D. The height of the hill-fort does not give us any clue as to the conditions of siting. As T.Donald noted in 1794[8], meadows were only 520 feet below the fort. In relationship to the surrounding landscape, the hill-fort is not severely sited. Castle Folds on Great Asby Scar at 1330 feet, is a defended cliff site with one rampart and ten huts built into the wall interior[9]. Richmond suggests Roman influence in the wall construction as at Ewe Close, Yanwath, Hugill and Lanthwaite Green, implying Roman Iron Age foundation.

In Northumberland, only High Knowes, Alnham, at 1225 feet strikes one as being excessively high. G.Jobey found here a double-palisaded homestead[10] of probably pre-Roman Iron Age origin.

This small number of sites may be supplemented by those other sites which are situated around the 1000 foot contour. Noteable groups are the farmstead villages of Crosby Ravensworth, Crosby Garrett and Asby in Westmorland, the hill-forts of West College Burn, and Yeavering Bell in Northumberland. The latter site, 13½ acres in size and showing abundant traces of internal occupation, is 1182 feet high at the summit and on the exposed northern fringe of the Cheviot massif[11]. Sited with an impression of strategy, one is left to consider the

harshness of life at that altitude and exposure.

CLIMATE/VEGETATION RELATIONSHIP

Fluctuations of climate in Britain, present one aspect of relative chronology as they may be observed in geological structure as landform traces of former ice-sheets - meltwater deposits of glacifluvial gravels, sands, clays and other varved sediments; moraines; kames; eskers and aggraded terraces. Examination of these deposits may give some sort of relative chronology - but only for the region in which they are deposited. Other information; traces of rainfall variation, pluvial or interpluvial; changes in relative levels of land and sea; and changes in flora and fauna, used in co-ordination with geological and geomorphological finds, should build up a fairly accurate relative chronology in which to fit Iron Age man.

Tansley[12] gives us a picture of British vegetation from the end of the Palaeolithic to the Historic period[13]. It is worth examining his findings in detail, to give us an idea of the landscape then, compared with that of the present day. The contrast between living conditions of Iron Age and Modern societies will then become apparant. Using the terminology of Blyth and Sernander, Tansley has divided post-glacial history into seven stages from the Subarctic of 9000 B.C. to Recent, A.D. 500 to the present. The climatic fluctuations of the pre-Boreal, Boreal and Atlantic, through cold and dry, warm

and dry, to warm and wet, affected vegetation and consequently man, so closely linked to his enviroment. The birch and pine of the colder climates gave way to hazel, oak, elm and alder of the Mesolithic era. With the onset of the Sub-Boreal phase in about 2000 B.C., our interest is stimulated by the extension of Neolithic upland grassland through human influence at the same time as the disappearance of the lime which marks particularly warm and wet climatic conditions. Other evidence for drier conditions comes from the check upon bog growth during the Bronze Age. With the beginning of the Iron Age, Tansley sees the formation of younger sphagnum peat and the spread of beech, indicative of the onset of the cold and wet Subatlantic period. The influence upon man was met by the increasing destruction of forest and a great increase in agriculture and pasture grazing. In the north we are entitled to assume that the rainfall during the Iron Age was comparable with that of today, although the temperatures were probably lower.

C.E.P.Brooks[14] gives us a picture of British vegetation from the end of the Bronze Age and its relationship with known possible rainfall chronology. The early Iron Age was a period of great peat formation; the peat beds on the Frisian dunes between two layers of blown sand are dated to 100 B.C. At Lonsdale in North Lancashire[15], a study of the peat mosses shows that for this area the Sub-Boreal period was marked by drier

weather conditions facilitating the checking of the growth of bogs in upland areas, and the local increase of pine and yew, and therefore the extension of upland grassland for cattle and sheep grazing. These higher areas probably contrasted strongly with the tree-choked valleys and were therefore settled more extensively. The wetter Sub-Atlantic period brought the spread of sphagnum and peat. This factor was detrimental to the extension of the uplands, and with lowland tree-clearing, led to the discontinuity of occupation of the area[16].

In agreement with this general pattern of post-glacial climatic and vegetational history, is the meteorologist G.Manley[17]. He calculated that the summer temperatures were about 4°F cooler that the Sub-Boreal phase for the early Iron Age, and the winters rather mild due to much wind and cloud. He makes the point that during the Roman occupation, "the evidence favours the view that the climate of southern England was still rather damper than at present; but it is extremely difficult to say how much of this was attributable to the extensive damp uncleared and undrained forest and marsh"[18].

POLLEN ANALYSIS

The next logical step in the investigation should be to examine the detailed evidence for particular areas. Pollen analysis provides us with a clue to the conditions of the micro-region. Pollen analysis may be considered more valuable

to the chronological record by providing the type of flora and fauna in any one area, but it cannot give a detailed picture of the whole area of north England. In 1956 Godwin[19] used pollen analysis to indicate in great detail vegetation changes resulting from climatic variation. In Britain, he found a widespread distribution of spruce, fir and heath during the last interglacial suggesting that the climate then was wet and cold. Post-glacially, he observed the distribution of these plants extended to a lesser extent, and that the beech was being replaced by the hornbeam. When applied to north England, pollen analysis provides an easier interpretation of general climatic conditions for the Iron Age. It does not provide an answer to the problem of deducing climatic phases throughout the whole of the north of England for the duration of the Iron Age.

Particularly in the north Pennines,in 1932, Raistrick and Blackburn produced the first comprehensive study of the area using the results of pollen analysis[20]. They found that most of their records ended in the Sub-Boreal period because many of the upland peats became partially dried, and heather grew freely upon them, and the conditions favouring the preservation of pollen ceased. In the case of Catton Carr, south of Hexham, and possibly Colt Crag, Gunnerton, peat formation continued through the Sub-Boreal period and the pollen indicated an

increase in pine, birch and heather on higher levels of the fells. The return of the wet conditions in the Sub-Atlantic initiated many of the present wet bogs and mosses, based on the older peats, but containing little or no tree pollen. In the lowlands, the increased rain in the Sub-Atlantic times resulted, in many cases, in the final silting up of ponds such as Prestwick Carr and Newbiggin Carr, in upper Blythdale and north of Blyth on the coast, respectively.

1.6 kilometres to the south of Housesteads Roman fort is a bog called Muckle Moss. In 1960, Pearson carried out an extensive pollen analysis of this bog associating his recordings with the known history of man in the area[21]. He concluded that the occurrence of plantago and compositae, was associated with the cultivation of the land within the immediate region. The horizon at which plantago pollen was first recorded corresponded to a date A.D. 100-200. Housesteads to the north was occupied during this period and the cultivation of the ground may have influenced the N.A.P.(Non-Arboreal Pollen) spectra and more recent horizons of the bog profile above 270 cms. Pearson noted cereal pollen in his profile above 150 cms., with some down to 270 cms. He dated the 150 cm. horizon to A.D. 1000 - a date when Sewingshields Castle 3.2 kms. to the north east of Muckle Moss, was a farm of Hexham Abbey. Coupled with this evidence, Pearson noticed that there

was only a slight decrease in tree pollen rain above 255 cms. horizon, and a marked increase in the rate of peat accumulation. Above 250 cms., he found that there were three peaks of sphagnum growth but he attached no significance to this phenomenon until there was proved a more direct correlation between definite stratigraphic evidence and the peaks themselves.

In 1964, Chapman[22] analysed the ecology of Coom Rigg Moss in Northumberland, situated 25 miles north east of Carlisle and 10 miles west of Bellingham, on the watershed between the Irthing and the Chirdon Burn at a height of a thousand feet. He took the VIIb/VIII horizon at 240 cms., to be dated about 500 B.C. and the VIII Mod. horizon at 125 cms. about A.D. 600. Chapman's profile showed that the T.P.F. (Tree Pollen Frequency) decreased from the VIIb/VIII boundary in the Early Iron Age, dropping even lower at 120 cms. in the Sub-Roman period. The graph of the NAP/AP (Non-Arboreal Pollen/Arboreal Pollen) rises at the VIII boundary with VIIb but remains steady until the end of the Iron Age, when it rises sharply. The first appearance of plantago pollen and other herbaceous pollens in any quantity occurs about one third of the way through zone VIIb. This probably relates to the activities of Neolithic people in the west[23], and Bronze Age people to the east[24]. Plantago shows a peak in both of the profiles that Chapman took across the bog, just after the beginning of zone VIII and then drops to only a little more than its earlier values. Fraxinus, a species

probably favoured by forest clearance and increase in light, graminae, cyperaceae and ericaeae, also show peaks at this level. There must be some speculation as to the people responsible for this phase of deforestation, but if zone VIIb/VIII boundary is taken as 500 B.C.[25], it would seem likely that it precedes the Roman occupation in the north of England, possibly due to the Votadini people moving northwards about the time of the Roman Conquest in the south of England.

CORRELATION

An interesting exercise in speculation would be to correlate the known defended native sites in the north of Britain with modern rainfall figures[26] assuming a close similarity between Iron Age and modern rainfall[27]. The highest rainfall belts are to be found in the Cumbrian mountains of the west, and the Cross Fell range of the northern Pennines. The Cheviot massif of Northumberland is surprisingly dry for its height and exposure. Low rainfall belts are found up the Eden valley and east Northumberland and Durham. If defended native sites are plotted against these rainfall belts, the pattern emerges of settlement concentration along the Cheviot fringe, the Cumbrian massif peripheral, and the sides of the Eden valley. A statistical correlation between the distribution of these defended sites and the different rainfall belts, using K.Pearson's Product Moment Coefficient[28], results in

there being no significant relationship between the two factors. This means that the siting of such settlements was neither geared to regions where plenteous rainfall was available, nor was it connected with regions of low rainfall. We must therefore look further afield for siting factors. For the calculation, the number of sites within rainfall belts divided into the area of each belt were plotted against the maximum rainfall figure of each seperate belt. The result,+0.188, shows that the distribution of defended native sites in north England was not related to the rainfall climatic factor. This negative evidence has as much value as a positive result.

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13 Table 2 British Post-Glacial History.
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15 Diagram 1 Stratigraphy of Mosses of Peat in Lonsdale, North Lancashire.
16 Diagram 1 Stratigraphy of mosses of peat in Lonsdale,N.Lancs.
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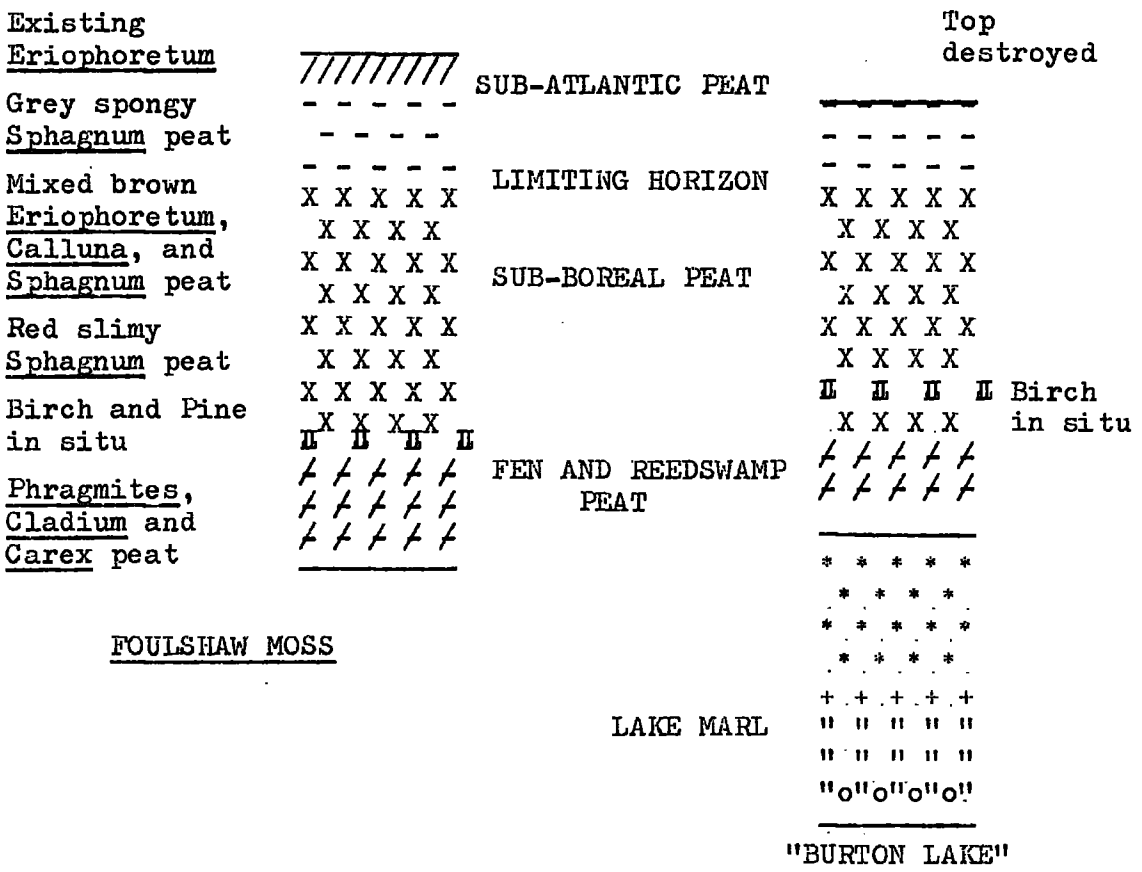
TABLE 2 TABLE OF BRITISH POST-GLACIAL HISTORY

CLIMATIC RECORDS OF PERIODS ACCORDING TO BLYTT AND SERNANDER			FOREST VEGETATION	HUMAN INFLUENCE ON VEGETATION	ARCH. PERIODS
B.C. 9000	SUBARCTIC	Cold and Dry	Dryas Vegetation		End of Palaeolithic
8000	PREBOREAL	Fluctuations of climate	Birch and Pine: some Hazel and Oak and a little Elm and Alder in Eastern England		
7000	BOREAL	Warm and Dry	Birch and then Pine dominant Hazel maximum		
6000			Expansion of Mixed Oak forest Recession of Pine and great increase of Alder		Mesolithic
5000		'Climatic optimum'?			
4000	ATLANTIC	Warm and Wet	Mixed Oak forest dominant(Sphagnum vigourous in wetter climates)		
3000					
2000	SUB-BOREAL	Drier	Local increase of Pine and Yew Disappearance of Lime. Entry of scattered Beech	Extension of upland grassland under human influence: Increase of Agriculture	Neolithic
1000			Bog growth checked		Bronze Age
0	SUBATLANTIC	Cold and Wet	Formation of younger Sphagnum peat? spread of Beech		Iron Age
A.D. 1000	RECENT	?Warmer and Drier		Increasing destruction of forest: great increase of agriculture and pasture: spread of weeds of cultivation	Historical Period

Adapted from Tansley,(1939),p.150.

DIAGRAM 1 STRATIGRAPHY OF MOSSES OF PEAT IN LONSDALE, NORTH LANCASHIRE.



Note:

These raised peat mosses were built up above fens, the basal peat consisting of the remains of fen and reedswamp plants. In Foulshaw Moss, the layer of pine and birch stumps in situ marks the onset of drier conditions permitting the invasion of trees, which were later engulfed in bog-moss. The mixed brown Sub-Boreal peat consists of bog-moss, cotton grass and heather. The upper-most layer of grey spongy Sphagnum peat was formed in the wetter Sub-Atlantic period and continued down to the 19th.century when the moss became drier and was occupied by a surface vegetation of cotton grass.

In the generalised section through the peat of the old "Burton Lake" basin, the shell marl deposited on the lake floor is overlaid by reedswamp and fen peat, and this again by the same types of Sub-Boreal peat with birch stumps, in situ at the base and Sub-Atlantic peat.

Adapted from Pearsall, W.H., Journ.Ecol. 34 (1947),p.137

CHAPTER 3 LAND QUALITY

In 1950 the North East Development Association produced a Land Quality Classification of Northumberland and Durham[1]. They split the land into a basic tripartite division. Category 1 soil series giving rise to good quality land. Category 2 defective in two factors:- (a) Site - too elevated or on steep slopes or bad aspect (b) Soil factors - deficient because of shallowness, inadequate depth for cultivation or imperfect drainage conditions. Category 3 where site conditions deteriorate - where extreme elevation, steep slopes, bad aspect, poor soil conditions due to increased heaviness in texture, and shallowness or very inferior moisture conditions. These major divisions are further divided into sections.

The distribution of native sites may well correlate with the intensity of cultivation of soils, and give a warped picture of their relationship. An example of this is to be seen in the eastern plain of Northumberland where there is a hint that the native population was a great deal more widespread than that envisaged by historians to date. The information comes from air photographs taken in the last few years of the central coastal plains of the east, by J.K.St.Joseph and Dr.N.McCord. The latter has found sites by crop-marks at Mitford (NZ/1784), south West House (NZ/1579), Newsham Farms (NZ/3078), Seghill (NZ/2873), Burradon (NZ/2773), and Hartburn (NZ/0886) which

appear to be a small homestead within a rectilinear enclosure. These are all on the east coastal plain of Northumberland.

The same annihilation of historical evidence probably took place in the Lake District. The most distinct of the farmstead villages in the parishes of Crosby Ravensworth and Crosby Garrett, may have had a much wider distribution lower in the Eden valley itself, although the liklihood of forest filling much of the water course, is great. Modern agriculture, which is highly intensive up to at least 600 feet, makes use of the warm well-drained soils of the valley. These may well have been worked by native and Roman alike, as would have the lateral and terminal moraines of the valley sides and ends, being loose and porous in texture.

DURHAM

It is extremely difficult to attempt to correlate the distribution of known sites in County Durham with land quality because of the low density of settlement. Near Chester-le-Street and in a narrow belt south of Sunderland to the Tees, is a comparatively large area of good quality land[2]. The soils are derived from parent material of a very varied origin from boulder clay to Triassic. Most are fairly well drained medium to heavy loams which may or may not be calcareous. Similarly, between Gainford and Staindrop north of the Tees, the soils are derived from boulder clay of Millstone Grit

origin, and are mixed with a complement of other Carboniferous materials deposited by the Stainmore Ice. This variety of constituents, produces a fine variable soil. The lack of native sites is prominent in the Tees valley.

Medium quality land is widespread throughout the eastern half of the County, and approximately eighteen sites are on it. Poor quality land is confined mainly to the west of Durham, but there is not a correspondingly higher percentage of native sites. This gives us a hint that Iron Age settlement may have been much more widespread in the eastern half of the County than we have evidence for. Northumberland coastal plain we now know to have been far more densely populated than was first thought. The same may well apply to Durham. Air Photography on the same scale as that in Northumberland would ratify this supposition.

NORTHUMBERLAND

In Northumberland, the soil series is complex, and varies significantly from region to region, affecting the quality of the land. Along the Tweed valley the gently undulating landscape has developed Category One soils from boulder clay of Old Red Sandstone origin. The soils are variable in depth and the texture and drainage conditions are satisfactory. It is immediately noticeable that native sites are strung out along the margin with the poorest quality Category Two soils,

a further indication of the probability of more extensive settlement in the better quality land areas. The coastal area between Belford and Craster also has soils derived from boulder clay deposits of the Tweed/Cheviot Ice. They are reddish in colour and of heavy texture. The influence of the Whin Sill upon soils is noticeable, but this influence is not reflected in the settlement distribution. Few sites, except around Belford on the Whin Sill, are to be found along this coastal belt.

The widespread distribution of Category Two land quality in Northumberland, outside of the Cheviot massif, illustrates two points. Below the Coquet, native settlement is extremely sparse; and above the Coquet, native distribution is dispersed but substantial. The reasons for this are most likely that the north-eastern quarter of the County has upstanding outcrops of various rocks which offer good defensive sites, whereas the south-eastern quarter is a great deal flatter and offers fewer defensive sites. The knowledge from air photography that this latter area was occupied by a particular type of homestead with single or double enclosure, probably not for defensive purposes but for enclosing cattle, is important when we consider Northumbria as a whole. We are left with the question, were these settlements essentially part of the pre-Roman Iron Age possibly being timber in construction, or were they contemporary

with the defensive sites of the Cheviot peripheral to the north and west?. The answer to this would probably alter the relationship between the Roman and native in the north as well as between areal groups of native settlements[3]. Excavation of one of these plain sites is a necessity.

A general summing up of the Category Two land quality areas would be that they are of varied geological origin, derived from boulder clay associated with rocks of the area. The main soil-forming materials are Old Red Sandstone, Andesite, Lower Carboniferous and Fell Sandstone boulder clays. The depth, texture and moisture conditions are therefore favourable to land utilisation, but consideration of the topography makes it evident that siting conditions, in particular elevation and aspect, may often be unfavourable, compared with siting conditions further to the west.

Category Three land quality, that where the site conditions deteriorate, is spread throughout west Northumberland from the south Tweed valley to Tynedale and beyond into Durham. The lack of cultivation and improvement of the land has no doubt led to the preservation of great numbers of native sites around the peripheral of the Cheviot. In the interior of the massif, sites may exist but obviously to a far lesser extent despite the untouched state of the ground. The complete answer to this mystery will only become apparant after much more

extensive field work and interpretation of the evidence. This remains one of the greatest problems of the Iron Age in the north. The answer does not completely lie in the forbidding aspect and exposure of landscape of the interior.

The Table below[4] examines the site factors and soil factors of areas throughout Northumberland and Durham, and indicates where the deficiencies lie. (Reference should also be made to the Ordnance Survey Maps, scale 1 inch to the mile, sheets 71, 78, and 85).

LAND USE

It is perhaps relevant to examine a few detailed examples of the effect, if any, of modern land use upon the distribution of native sites.

Fifty per cent of the area of the North Hexham Land Use Map[5] is heath and moorland, and yet 65% of the sites in the area are situated upon it. 23% of the sites are on grassland, 10% in forest land, 1% on arable land and 1% in urban areas. The great percentage of sites above the level of cultivation is one pointer towards the overall importance of strategic siting. The number of grassland sites on the valley floors is not so indicative of the possibility of a substantial number of valley sites because much of the grassland is unimproved and marginal, although ploughing-up during the Napoleonic Wars at the turn of the nineteenth century, spread in many

cases, into the moorlands.

In contrast to this upland area, the environs of Alnwick[6] offer a gentler more rolling landscape, which is reflected in the higher percentage, 26%, of sites upon grassland. 55% of settlements are upon the heath and moorland which occupies a third of the area of the map. The majority of these are in the foothills of the Cheviot around Ingram. The heaths and moorlands closer to Alnwick are much more devoid of settlement.

The Appleby area of the Eden valley is heavily sprinkled with arable land, and possesses a highly defined margin with the heaths and moorlands of the Alston Block to the north-east and the Lake District to the south-west[7]. Half of the thirty sites on the map are on grassland of the valley fringes and the foothills of the Crosby Ravensworth Fells with concentrations at the head of Lyvennet Beck. Twelve sites are on the heath and moorland but it is noticeable that they fringe the 'interior' of the fells.

1 Table 3 Land Categories in Northumberland and Durham.
2 Map 18 Durham Land Quality and native sites.
3 Map 19 Northumberland Land Quality and native sites.
4 Table 4 Site and Soil Factors in Northumberland and Durham.
5 Map 20 North Hexham Land Use, and native sites.
6 Map 21 Alnwick Land Use, and native sites.
7 Map 22 Appleby Land Use, and native sites.

TABLE 3 LAND CATEGORIES IN NORTHUMBERLAND AND DURHAM

LAND CATEGORY	APPROX.ACREAGE IN REGION	APPROX.% OF REGIONAL AGRICULTURE
1a	1948	0.1
1b	14032	0.6
1+2	32404	1.4
2+1	119245	5.0
Tot.Cat.1 land :	167629	7.1
2a	84326	3.5
2b	842254	35.5
2+3	184279	7.8
Tot.Cat.2 land:	1110859	46.8
3+2	255570	10.8
3	836480	35.3
Tot.Cat.3 land:	1092050	46.1

Total agricultural area as shown on Maps 18 and 19
= 2370538 acres.

TABLE 4 SITE AND SOIL FACTORS IN NORTHUMBERLAND AND DURHAM

SITE FACTORS		SOIL FACTORS		
ELEVATION	STEEPNESS	UNFAVOURABLE ASPECT	SHALLOWNESS	DEFICIENT DRAINAGE
Egglestone	Newburn	Egglestone		Egglestone
Newburn		Newburn		
			Haswell	Haswell
		Croxdale		Croxdale
Middleton				Middleton
		Tynedale	Tynedale	Tynedale
	Housesteads		Housesteads	
	Chatton	Chatton	Chatton	
	Tunstall	Tunstall		
		Easington		Easington
	Westerton		Westerton	
			Durham	Durham
Hadrian		Hadrian		
		Gainford		Gainford
		Harbottle	Harbottle	
		Boldon	Boldon	
	Hilton	Hilton		
				Hepple
				Westwoodburn
			Twice Brewed	
			Otterburn	
			Hawthorn	
				Ryhope
		Hart		
			Dalton	
				Foxton
		Whickham	Staindrop	
			Dawdon	
			Butsfield	
				Spennymoor
				Bamburgh
				Eshott
				Powburn
				Cornforth
				Norham
				Ebchester
				Murton
				Sharperton

CHAPTER 4 RELIEF AND DRAINAGE

DRAINAGE

The complex arguments on the development of the drainage pattern of north England do not concern us; we are more concerned about the effect of this drainage pattern upon settlement distribution. It is obvious that present-day streams and rivers radiate from the uplands and converge upon the lowlands conforming to a single dominant direction[1]. It is clear that differential erosion upon the varied rock basis, had already modelled the major features of the present-day landscape before the beginning of the Great Ice Age. Glaciation took place upon a mature landscape, but the present landscape shows a high degree of adjustment to the uniclinal structure, and the alternation of rocks of differing resistance. Cuesta forms are common and must have been so before the spread of glacial drift. Associated, are strike-line valleys along less resistant rocks. An example is the soft Cementstone depression between the igneous of the Cheviots and the Fell Sandstones. The streams from the massif enter this depression and flow northward into the Breamish-Till system. Transverse fracturing through the Fell Sandstones has aided the Aln and the Coquet in breaching and they now flow eastward.

The anticline to the south of Coquetdale forms the uplands in central Northumberland that are the watershed between the

Wansbeck and Pont, and the drainage of Redesdale and North Tynedale. The South Tyne, in a structural trough, follows an ancient line of the drainage pattern. Cross Fell is the focal point of drainage in the north and it corresponds with the area of maximum uplift in the south-west, and the lines of drainage follow the south-eastward direction of the slope.

The radial drainage pattern of the Lake District is well known. The Eden valley receives many of the eastern streams[2]. Much of this drainage formed by the Lowther, Eamont and Calder, collects in a strike vale, and runs in front of the Carboniferous escarpment towards the Eden. The Howgill Fells mark the line of demarcation between north and south flowing drainage. The Lune has captured much of the drainage from the Eden, which in turn has encroached upon the basin of the Tees.

Despite the widespread glaciation of the area, the hydrographic pattern of the area remained little changed. The main effect was the choking of the valleys with drift and the smoothing of the landscape. Exceptions are the Cheviot massif and the Lake District. The Cheviot radiating streams have deeply eroded valleys but even then do not produce craggy features. The Lake District slates and volcanic rocks contrast strongly, and glaciation has emphasised these contrasts. The massive volcanic rocks were plucked by the ice with resulting craggy, rough landscape; the slates were abraded and smoother forms

predominate.

RELIEF

The existence of accordant summits and levels throughout the north is strongly attested by Professor S.E.Hollingworth[3]. He puts the Lake District levels at 2000 feet, 1600 to 1700 feet, 1000 to 1050 feet, 730 to 800 feet, 570 feet and 400 feet, with outstanding levels at 430 feet, 820 feet and 1050 feet. For the Cheviot area Dr.R.Common[4] recognised surfaces from 550 to 750 feet, 1000 to 2000 feet, and 1600 to 1700 feet. The two areas may be generally related. It is interesting to bear these levels in mind when considering Iron Age siting in the northern area.

ACREAGE/HEIGHT RELATIONSHIP OF DEFENDED SITES

An analysis of the number of native sites defended in the north of England[5] yields some interesting problems[6]. The defensive sites are divided according to shape and placed in their height categories. The most significant height group is between 600 and 700 feet with 29(20%) of the total of 147 sites. Between 500 and 700 feet 35% of the sites, between 500 and 800 feet, 48% of the sites, and between 300 and 800 feet, 68% of the sites are found in the north. The number of defensive sites below 200 feet and above 900 feet is minimal, although there is a small concentration between 1000 and 1250 feet[7].

In Westmorland, an analysis of parish height/density relationship[8] shows us that the number of sites in a parish increases with the height above sea-level. We know that the spread of average altitude of sites in Westmorland is considerable, between 250 and 1300 feet; and that the number of sites per parish varies between 1 and 8. Thirteen of the parishes have only one native site in them, but the eighteen other parishes have more. Average height for the whole of the Westmorland sites is about 750 feet. This reflects a concentration of sites along the south side of the Eden valley especially in the parishes of Crosby Ravensworth, Crosby Garrett and Asby, where fell settlement is prolific close to the Lyvannet Beck, Scandal Beck and Hoff Beck, respectively; avoiding both the Eden valley plain, and the bare limestone of the fell tops[9].

The size of a defensive site and its relationship with height above sea level, may give us some clue to the considerations of siting. Before we embark on this analysis we should examine the distribution of native defended sites in the north, with reference to the geomorphology of the area.

R.G.Collingwood[10] imagined the Lake District to be

> 'devoid of fortified hill towns of the early Iron Age, except perhaps for Carrock Dell, which are so common in Southern Scotland and Southern England'.

He failed to appreciate that as Christison pointed out[11],

in West Scotland most of the forts are quite small, and it is to this smaller class that the forts of the Lake District belong.

The Pennines may well have provided an effective barrier to the migration of cultures and to their contact. In the Lake District there is a rather different pattern of forts and defended settlements, with univallate outnumbering multivallate[12]. The majority of the forts are around the central core, along the southern fringe of the mountains, around Ulverston and Cartmel, and along the north and south sides of the Eden valley. The outliers to this distribution lie close to valley routes.

In Northumberland, multivallate considerably outnumber univallate sites, with concentrations around the Cheviot peripheral and down into Upper Wansbeck and Blythdale. The sparsity is especially noticeable between Northumberland and the Lakeland massif. It is reasonably clear that the Bronze Age/Neolithic character of the Cumbrian inhabitants remained undisturbed until the Roman occupation, and even then the disturbance appeared to be minimal. No hasty defences were thrown up around the villages in Westmorland, as they may have been further north in Northumberland. However, this 'cultural backwater' of the Lake District may be very misleading. George Jobey has found evidence for pre-Roman palisaded

enclosures in Northumberland changing to stone-built enclosures in the Roman period[13]. The same continuity may have existed further west.

Hill Forts

The average acreage of hill forts is higher than any other group of sites[14], at more than 4 acres for Northumberland and above 2.6 acres for the other counties. Yeavering Bell[15] in Northumberland, is the largest at 13.5 acres and Clennel Hill[16] is the smallest at 2 acres. Even this size is large compared with other types of native site in the north. In Westmorland, the hill fort of Carrock Fell[17] is 5 acres enclosed. Of the little evidence we have on the other hill forts, the smallest appears to be Dunmallet[18] at 1 acre. Of the 19 hill forts outside Northumberland, only 6 have published acreages. The average for all the hill forts in the north is between 3.42 and 4.15 acres. No doubt this figure average would be lower if the statistics were available for the remaining sites.

The average height above sea-level of the hill fort is again considerably higher than that of other sites, at about 650 feet for the 4 northern counties. The hill forts of Cumberland average the highest between 883 feet and 957 feet. Carrock Fell is excessively high at 2174 feet, but this is counterbalanced by the low elevation of Castlehow[19] at 260 feet. Most of the other hill forts in Cumberland are above

600 feet. In the rest of the north, the highest hill fort is only 742 feet at Windemere on Allen Knott[20]; the lowest is 90 feet at Afterpile Castle[21] in North Lancashire. One is left to speculate whether this phenomenon is a reflection of the different use of hill fort in the different blocks of Cumbria, Cheviot and Alston.

Promontory Forts

The promontory fort is defensive by its very nature. There are only 5 sites classified as such in the whole of the north, and therefore conclusions should only be regarded as general. The average size is about 1 acre and the average height about 320 feet. Both figures are considerably lower than those for hill forts. The largest promontory site is Roughting Linn[22] in Northumberland at 1.75 acres, and the smallest is South Knock Hill[23] at 0.25 acre. The small size is probably due to the deficiency of sites which may fall into this category, because of the particular nature of the ground. Promontories can only exist where a meandering stream is downcutting rapidly enough for the site to be called defensive. These conditions are hard to find even in the north.

The extremes of height for this class of defensive site are 625 feet for the smallest site and 30 feet for Ebbs Nook in Northumberland[24].

Cliff Sites

These sites are defended on at least one side by a cliff, and should really be referred to as cliff-site hill forts. In this category, the cliffs are incorporated into the defensive systems of the settlements. There are 19 such sites in the north the majority being in Northumberland. There, the average size is between 1.27 and 1.33 acres. This tallies with the figure for the sites in Westmorland which average about 1.25 acres. The largest cliff site is Ford Wood[25] in Northumberland, still only 2.5 acres; the smallest are Rayheugh[26], Middle Dean[27], and West Brizlee[28], all 0.5 acres each and all in Northumberland.

The majority of the sites are just over 500 feet in height, but the extremes vary between 1330 feet for Castle Folds[29] on Great Asby Scar in Westmorland and 2000 feet for Cunsfell[30] in Cumberland, to 210 feet for Spindlestone Heugh[31], Ratchwood[32] and West Brizlee.

Ring Sites

The circular defensive sites form the largest single group in the north, with 44 sites. Reliable figures are only available from Northumberland, and this County has an average of between 0.82 and 0.85 acres for the enclosed area. This is much amaller than the size of the previous sites. The largest site is only 2 acres at Paston Hill[33] while many are a quarter

acre or less in size.

The average height, however, is fairly high at nearly 600 feet - perhaps this is a compensatory factor for the difficulty of defending an open site with encircling ramparts. It should have been advantageous to have constructed sites encorporating natural defensive features. The highest site is only 1120 feet, this being the only settlement over 1000 feet. The lowest is Castle Hill[34] in Cumberland which is only 130 feet above sea-level.

Oval Sites

There are 20 such sites in the north and they should be associated with the ring sites above, although only two of them are outside Northumberland. Their average size is almost identical to that of the ring sites, between 0.912 and 0.86 acres. There are three sites of 1.5 acres, and one, Gibbs Hill[35], a quarter of an acre. The average height is again much the same at just under 600 feet. Only one site is above 1000 feet and that is Great Hetha[36] at 1129 feet. The lowest is Crook Hill[37] at 185 feet. Both are in Northumberland.

Irregular Sites

There might be some significance attached to the irregular site as a defensive settlement, because it appears that a site with multiple ditches must be primarily for defence. This irregularity would probably be the result of the incorporation

of the natural contours of the hill or other natural feature which may be turned to the advantage of the defenders. There are 8 such sites in the north and they average between 0.88 and 1.0 acres; the same as the oval and ring-shaped sites. The largest site is 3.25 acres on Sizergh Fell[38] in Westmorland. The smallest are just under 1 acre. The average height above sea-level is a little lower than the two previous categories at just over 500 feet. The extremes are 250 and 750 feet.

Rectangular Sites

The rectangular sites differ significantly from the above. The average size of the site is the smallest of all the defended sites at 0.75 to 0.77 acres. There are 23 settlements of this type of which only three are to be found outside Northumberland. The extremes of size are 1.25 acres and 0.25 acres, which is a limited range. The extremes of height are 1080 feet at Manside Cross[39] and 360 feet for Laverock Law[40]. Influence of the Roman occupation may possibly be indicated by concentration of the rectangular sites in the southern half of Northumberland above the junction of Dere Street and the Devil's Causeway[41].

The acre/height above sea-level relationship of defended sites in the north of England is summed up in Map 25. Hill forts are clearly generally higher than other sites although spread throughout the height range. Cliff sites have the same

height spread but have a lower acreage. Promontory sites are both lower and smaller than the latter. Ring and Oval sites have a very wide spread in height but are all confined to small acreages. Rectangular sites are likewise small but have a higher situation above sea-level.

Extending this relationship further, the density of defended sites varies according to the height above mean sea-level[42]. Height plotted against acreage and density within arbitary 50 foot height/acreage groups, results in a concentration at 600 feet of at least 8 sites one acre in size. Five site density blocks of one acre in size are at 700 and 450 feet. Four site blocks still only one acre average size are at 900 feet, 600 feet, 550 feet and 200 feet. Three site density has a wider range from 950 feet down to 300 feet but still as small as one acre. Two site blocks are within a smaller height range from 200 to 800 feet and go up to 2 acres in size. Areas with a single site density are liberally spread from sea-level to 1200 feet and from below one acre to 7 acres in size. The general pattern is one of a focal point of density at 600 feet spreading higher and lower fairly evenly within the one acre region. Larger sites occur at all heights but there is no concentration of larger defended sites at any one height. The significance is between the concentration of smaller sites around the 600 foot contour and the dispersal of larger

sites away from this contour.

AREAL EXAMPLES IN NORTHUMBERLAND

North Cheviot

A simple map of the spread of native sites in the North Cheviot area[43] indicates the predominance of settlement between 400 and 1000 feet. Plotted on a graph[44] the North Cheviot group of sites[45] are concentrated between 400 and 950 feet. They fall into 6 major groups whose medial values are 420, 508, 616, 728, 863, and 955 feet. These compare favourably with Hollingworth and Common's accordant summit levels for the Lake District and the Cheviot area[46]. These 6 groups have been plotted on a map of the North Cheviot.

The sites within the highest group are close together in the north around Yeavering with an outlier in the south at Threestone Burn. Group 2 sites are in 2 major areas to the west of Yeavering and in the south around Ilderton. Group 3 is arbitarily distributed along the whole line of settlements. Group 5 has a similar distribution except that none are found south of the Kettles. Group 6 are again spread liberally throughout the area, but keeping to the outer fringes of the massif. The most significant Groups are therefore 1 and 2, the highest sites. As further analysis shows, the hill forts on Humbleton Hill[47] and Yeavering Bell in the north appear to be the leading settlements of the whole area, from all aspects.

Map 27 brings out more clearly the remarkable siting picture of native settlement. The great Millfield Plain between the Glen and the Till is virtually bare of sites. In fact, there are only 14 sites below the 500 foot contour, out of the 77 marked on the map. In contrast, 4 sites are above 1000 feet and these fringe the main highland block. Between the College Burn and Wooler Water, the sites are almost entirely along the 500 foot contour; west of the Burn to the Bowmont, they spread liberally over the Kilham and Kirknewton Moors. Their relationship with water source is dealt with in greater detail in a later chapter.

North Tynedale

The area of the North Tyne has a high concentration of sites within a limited area[48]. Areal Groupings show these to be divided into nine major sections, the divisions of the Groups following natural boundaries of watersheds and rivers[49]. This is the main reason for the insignificant site relationship with height above sea-level. There are few sites which appear to cluster together around a certain contour, and the spread is from the valley floors to the plateau tops. Groups that do occur locally are the settlements of the Gunnerton/Barrasford ridge, and the settlements from Redesmouth to Birtley along the fringing eastern scarp of the North Tyne river valley. Elsewhere, the sites appear to slightly favour the higher

areas around Kirkwhelpington Common.

Mid-West Northumberland

In mid-west Northumberland[50], it is immediately obvious that over the whole area, native sites favour valley siting against hill-top sites. The Coquet, North Tyne and Rede all attract chains of sites up to the 1000 foot contour. The exception to the pattern is the area between the Upper Wansbeck and the lower reaches of the North Tyne and the Rede, as shown in Map . Few of the rest of the native sites stray away from the major valleys, and few are higher than 1000 feet.

The cultivation terraces indicated on the map[51], bring up a very controversial point of historical interpretation. Feacham[52] states quite strongly that 'there is no evidence in the form of field systems to show that agriculture as opposed to pastoralism, was practised systematically before the early part of the Christian era'. The suggestion that agriculture predominated over pastoralism has been little voiced; a more likely situation would have been agriculture as an adjunct to pastoralism. Our evidence for dating of field systems or even native sites, is so poor that only excavation can provide some sort of answer. Piggott[53] states that no trace of field systems of Iron Age or Romano-British type can be found in North Britain although he admits that two or three iron ploughshares of Belgic type have been found in south Scotland

in Roman contexts. He continues that the nature of the terrain prohibits much improvement in agricultural technique beyond a primitive level. He gives us no examples of the primitive level of agricultural technique, and he does not take into account the reasonable nature of the terrain in the lowlands of Scotland, nor the evidence of later cultivation within the area. Iron sickles have been found at Traprain Law[54], lynchetted "Celtic" fields below the broch of Torwoodlee near Galashields[55], and 50 querns from the broch of Cin Trolla[56]. 79 terraced areas for cultivation are listed in the Inventory of the Royal Commission report on Roxburghshire[57], and examples are known as far north as Perthshire. Although probably much later than the Iron Age sites in southern Scotland, the practice of agriculture whether of domesticated or wild grasses, during the pre-Roman and Roman Iron Age, seems credible.

By analogy, we find that the same pattern of possible cultivation may have existed in Westmorland. The practice of garden agriculture is formulated for the native communities in the Royal Commission report for the County[58]. Strip agriculture appears in the vicinity of hut groups on Skirsgill Hill, Nateby, Waitby, and Wharton, with widths of the strips varying from 12 feet to 90 feet. Contemporaneity is again difficult to establish. More recently, G.Jobey sees associations of stone-walled settlements with field systems

as being exceptional in Northumberland[59]. He notes long lynchet strips close to the settlements at Knock Hill but is inclined to give them a later date. Westmorland may be rather different in character and development.

1 Smailes, A.E.,'North England', (1960), p.33.
2 Map 23 Cumberland, Westmorland, Durham and Lancashire-North-of-the-Sands and defended sites.
3 Hollingworth, S.E.,'The recognition and correlation of high-level erosion surfaces in Britain: a statistical study', Quart. Journ. Geol. Soc. 94 (1938), 55-84.
4 Common, R.,'The geomorphology of the east Cheviot area', Scot. Geog. Mag. 70 (1954), 124-138.
5 Map 23
6 Diagram 2 North England defended sites, height and acreage.
7 The sites from the diagram have been divided into hill forts, promontory forts, ring, irregular, oval and rectangular forts, with more than one rampart, and cliff sites. This minute division may not be strictly necessary, and a grouping of the ring, oval and irregular forts, 71 sites; hill forts, 29 sites; promontory and cliff forts, 24 sites; and rectangular forts, 23 sites; may be more comprehensive.
8 Diagram 3 Westmorland parish/height comparisons.
9 Map 24 Crosby Ravensworth siting of native settlements.
10 Collingwood, R.G.,'The last years of Roman Cumberland', CW2, XXIV (1924), 247-255.
11 Christison,'Early Fortifications in Scotland', (1898).
12 Map 25 North England Defensive sites.
13 Jobey, G.,'Appendix ii Palisaded Works in Northumberland and Durham', AA4, XL (1962), 31-34.
14 Table 5 Percentage Height Distribution of Defensive sites in the North of England.
15 cf.Ref.11 Chapter 2.
16 NCH,XV (1940) p.62.
Dixon, D.D.,'Upper Coquetdale', ( ), p.111.
Jobey, G.,(1965), p.61.
17 cf.Ref.7 Chapter 2.
18 Taylor, M.W.,'On the vestiges of Celtic occupation near Ullswater', CW1, I 157-161, (1874).

Fair, M.C.,'Roman and Briton. A Theory for future establishment of facts', CW2, XLIII (1943), 82-86.
The average width of ditch is 27 feet and the average depth is 13 feet clear in the west, north and south. The east is steep and loses the ditch. The main entrance is at the south end of the west face where there is an oblique gap.

19 Collingwood, R.G.,'Castle How, Peel Wyke', CW2, XXIV (1924), 78-87. The north and south sides are steep and unapproachable. The summit has been artificially flattened and is 42 by 20 yards with the north-east area raised above the rest. In the innermost west and outer eastern ditches, cobbles have been laid, each 5" to 6" long.

The site must have been primarily for defence. The area enclosed is small and therefore the number of people would have been limited and the fear rather strong. The area between the ditches utilised for either human or animal habitation indicates some degree of overcrowding. The time of construction must have been great. The site would have fallen fairly quickly because of the problem of provision storage; therefore the invaders were probably only marauding bands of passing natives from the west and the north, who came for short periods of time and in small numbers.
Fair, M.C., (1943), 82-86.
CW2, XI 118-121.

20 Lowndes, R.A.C.,'Allen Knott', CW2, LXIV (1964),94-97.
The site is steep to the north and west and gentle to the south and east. In the east the rampart survives to 4 courses with a loose core fill. There are no traces of palisade. Appears to be of Iron Age A type.
RCHMW, (1936), p.247.

21 CW2, 1 p.316.

22 Jobey, G.,(1965), p.60.
NCH, XIV (1935), 34-45.

23 Jobey, G.,(1964), 41-64.
NCH, XIV (1935), 38.

24 MacLauchlan, H.,(1867), p.9.

25 Jobey, G.,(1965), p.60.

26 Jobey, G.,(1964), p.61.

27 Jobey, G.,(1965), p.63.

28 Jobey, G.,(1965), p.42.

29 Fair, M.C.,(1943), 82-86.

30 CW1, VI p.488.

31 NCH, 1 (1893), p.175.
MacLauchlan, H.,(1864), p.39.

32 Jobey, G.,(1965), p.61.

33 Jobey, G.,(1965), p.61.
NCH, XIV (1935).
MacLauchlan, H.,(1867), p.30.

34 Rome Hall, G.,'Ancient Remains in Geltsdale', CW1, VI (1881), p.465.
35 NCH, XIV (1935).
36 Jobey, G.,(1965), p.60.
MacLauchlan, H.,(1867), 37-38.
37 MacLauchlan, H.,(1864), p.40.
Jobey, G.,(1965), p.61.
NCH, I (1893), 175-176.
38 Hughes, T.M.,'Ancient enclosures on Heaves Fell, Levens', CW2, XII (1912), 397-402.
39 Honeyman, H.L.,'Manside Cross and Gunner's Box"Camp"', PSAN4, IV 81-82.
Jobey, G.,(1965), p.62.
40 MacLauchlan, H., (1864), 44-45.
NCH, XIV (1935).
41 CBA, Research Reprt. No.7.,'Rural Settlement in Roman Britain', Ed.Thomas, C.(1966), Chapter 1, 'Homesteads and settlements in the Frontier Area', by Jobey, G. p.6.
42 Diagram 4 North England Defended Sites and Density.
43 Map 26 North Cheviot Relief and Drainage.
44 Diagram 5 North Cheviot Site Height Analysis.
45 Map 26
46 cf. Page
47 Jobey, G.,(1965).
48 Map 28 North Tynedale Relief and Native Sites.
49 Map 29 Northumberland Native Site Groups and Roman Sites.
50 Map 14
51 Map 14
52 Feacham, R.,'The North Britons - the Prehistory of a Border People', (1965), p.143.
53 Piggott, S., in 'Roman and Native in North Britain',(1958), ed. by Richmond, I.A.
54 Childe, V.G.,'The Prehistory of Scotland',(1935), p.224.
55 cf.above.
56 cf.above.
57 RCHM, Roxb. I (1956).
58 RCHMW, (1936).
59 Jobey, G.,(1964),41-64.

TABLE 5 PERCENTAGE HEIGHT DISTRIBUTION OF DEFENSIVE SITES IN THE NORTH OF ENGLAND

All hts. in feet	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000	1000+
HILLFORTS:	5.3%		8.6%	5.3%	10.9%	12%	15%	7.6%	15%		20%
Total number 29.											
PROMONTORY:	20%		20%	20%		20%	20%				
Total number 5.											
RING:		6.9%	4.6%	9.2%	16.1%	13.8%	23%	6.9%	6.9%	9.2%	2.3%
Total number 43.											
IRREGULAR:			25%	12.5%	12.5%	25%		25%			
Total number 8.											
CLIFF:			15.9%	15.9%	5.3%	10.6%	15.9%	5.3%	10.6%	5.3%	15.9%
Total number 19.											
OVAL:		5%	10%	20%		5%	30%	20%	5%		5%
Total number 20.											
RECTANGULAR:				4.3%	8.6%	25.8%	17.2%	25.8%		4.3%	8.6%
Total number 23.											
Total All Sites:											
Percentage:	1.4%	2.7%	8.1%	10.1%	9.5%	14.9%	19.6%	12.8%	7.4%	4.1%	8.9%
Number:	2	4	12	15	14	22	29	19	11	6	13

CHAPTER 5 METHODS OF ANALYSIS

The trilogy of aspect, intervisibility and distance from water source are three major factors which affect the siting of native sites in North England. The importance of aspect in settlement positioning is abundantly clear on examination of most of the sites in the north. A south facing site is warmer than a north or east facing site. This has been a basic consideration since prehistoric times. Deviation from this norm must lead us to search for another dominating factor of siting. Prehistoric man sited his home for a reason, or a number of reasons, and it is our job to unravel the complexity of his thinking, with the information that we have available to us. Intervisibility, or the degree of connection with neighbouring sites, had importance in tribal groups. Is it possible for us to establish loose groupings in settlement areas? A pattern may emerge with deeper investigation. Unfortunately, we are hampered by our lack of knowledge of the time and length of occupation of the visible sites. We must therefore assume maximum occupation and analyse accordingly, as a minimum oocupation would be impossible to estimate. Distance from a water source should also be a siting factor of prime importance, especially with regard to defensive sites. Theoretically, enough food can be stored by the inhabitants of a fort, either in the form of dried meats or cattle, to last the occupants

weeks or even months. A lack of water within the site or close to it, would render the defence breachable.

Three areas have been chosen for comparison of siting factors. The North Cheviot, Bellingham/Kirkwhelpington and Crosby Ravensworth and Asby have been selected because of their different situations in the pattern of native settlement in the north of England, and because each of these areas has a density of sites which makes an analysis worthwhile. We are justified in selecting these three areas, as sampling is a justifiable analytical technique much in use by geographical and economic statisticians. To attempt an analysis of the whole of the sites in the northern area would be a tedious and drawn-out task. Used with caution, random sampling is allowable although the method may be inappropiate for the investigation of spatial variations of some phenomena, since it can lead to a biased sample. We have made a deliberate bias towards these three areas, and therefore our sampling is more straightforward.

An area with few sites would not present a representative picture of siting factor relationships. 41 sites are on the sample map of the North Cheviot[1], 22 sites are on the Crosby Ravensworth map[2], and 35 sites are on the Bellingham/Kirkwhelpington map[3]. The areas of the maps vary between 38 square miles for the North Cheviot, to 50 square miles for Crosby Ravensworth

and Asby, and 72 square miles for Bellingham/Kirkwhelpington. The difference in densities makes no difference to the use of analysing techniques. Each of the areas is examined separately but in an identical manner. The results are then compared and relationships between the three areas are suggested.

ANALYSING TECHNIQUES

Use of Maps and Diagrams

Interpretation of evidence, especially correct interpretation, is a necessary part of all research. There is no technique which may not be used in interpretation, as long as the shortcomings of that technique are recognised. The researcher should constantly look out for new methods of handling his material to obtain different results or different angles on a general theme. The background to the picture may be already known, but it is the details that require the analysis. Through using statistical and cartographic techniques, to evaluate the relative importance of siting factors for different areas, the place of the native in the economy and history of the north of England, may be changed. If it is not changed, then it may become more clearly established. No method which might lead to a fuller understanding of the native, should be ignored. Limitations of time and space forbid the writer to progress too far along this path, but a full analysis using a limited number of techniques has been attempted.

Vector Diagram

This is a form of graph in which the values are plotted as accumulative radii from a point of origin[4]. Our focal point is the approximate centre of each native site. The accumulative vector gives emphasis to the statistical material.

Scatter Graph

This graph has only one value for each of the two variables[5], but this is known for several places. This has the advantage that each example is seperate and distinct. The graph is used to investigate what sort of relationship, if any, exists between two variables which occur over a wide area. The relationship has to be deduced from the patterns which the scatter of dots shows when the values are plotted. A random scatter shows no systematic relationship between the two variables under investigation. Grouping on the graph leads to a further question of reasons for this grouping, and also the reasons behind the few examples which may fall outside the main groups.

The three separate areas have been compared using scatter diagrams with three alternating variables - aspect/distance from water source; aspect/intervisibility; and intervisibility/distance from water source. The three areas show significant spatial characteristics in this relationship.

Triangular Graph

The Triangular graph is a statistical device which can

show three variables instead of the usual two, and is primarily designed for showing varying proportions as part of the whole. Each side of the triangle is 100 units long and each point of the triangle acts as both 100 for one scale and 0 for another. The graph should establish the existence of groups of similar places so that some sort of classification can be produced. The position on the graph of a single point or a group will require some interpretation[6]. Generally, a location close to one of the points of the triangle implies that one component must be very large, whilest location close to a side of the triangle indicates that one component is quite small.

The significance of position in different parts of the triangle is translated by Diagram 5 . The centre smallest triangle is the area where the factors of siting are evenly mixed where none of the factors is over 40% or under 20% in value. The areas around points of the triangle show that two of the factors are very small at under 20% whilest one is very large, over 60%. The areas along the sides of the triangle between the points are where one factor is very small, under 20%. The three triangles formed between the central points of the sides and the corners, have one dominant factor over 50%. Points along the lines bisecting the sides and leading to the corners, are all equal in value. In more detail, the specific areas within the triangular graph emphasise the

dominance of one factor over the other two. The degree of dominance depends upon location with regard to distance from the points, centre and sides of the triangle.

The siting factors must be weighted to 100 before they can be plotted on the triangular graph. The maximum distance from the water source is taken as 100; intervening distances as percentages of the maximum. The degree of aspect over one mile in extent from 0 degrees to 360 degrees is weighted to 100; and the degree of intervisibility in number of sites visible from a site is weighted taking the maximum as 100. A complication arises with the plotting of the sites within the triangle, as the three factors, their values not originally adding up to 100%, usually plot to three points on the graph. This is compensated by the medial point of the resulting triangle being taken as the mean of the three values. Diagrams 9, 12 and 13 indicate these medial points plotted from the three values, with interconnecting lines. Diagrams 10, 11 and 14 show the sites divided into groups within the triangular graph; and whether they are the result of a straight plot where the three factor values are synchronised, or whether they are medially plotted. Occasionally sites are plotted outside the triangle. Where percentage statistics are used, this cannot occur; where weighted statistics are used, this indicates an overwhelming deficiency in one factor, or an overwhelming dominance of

one or more factors.

Use of Statistics

"Geographical thought involves measurement"[7], and statistical analysis of quantitative data can greatly assist the interpretation of such information.

Correlation

A more precise method is needed to present the association between variables on a quantitative basis. One of the simplest methods of measuring the relationship between the variables is the use of K.Pearson's Product Moment Correlation Coefficient. The value of this ranges from -1 to +1. With a correlation of +1, one variable increases or decreases at the same time as the other increases or decreases. -1 shows an inverse relationship between the two variables. 0.0 indicates no relationship between the two variables. It is important to understand, however, that the degree of relationship is not proportional to the size of the coefficient[8]. A coefficient of +0.6 does not mean that the relationship is exactly twice as strong as one indicated by a coefficient of +0.3. The correct interpretation depends on the particular pattern being investigated and the purpose for which the coefficient is being calculated. Generally, the following is a rough but useful guide to the degree of relationship indicated by the size of the coefficients:-

0.9 - 1.0 Very high correlation; very strong relationship.
0.7 - 0.9 High correlation; marked relationship.
0.4 - 0.7 Moderate correlation; substantial relationship.
0.2 - 0.4 Low correlation; a definite relationship but a small one.
Less than 0.2 A slight correlation; relationship so small as to be negligible.

Reliability of Correlation Coefficients

The statement of the value of a correlation coefficient is not sufficient evidence of relationship between two variables. The coefficients are subject to sampling errors, and therefore it is necessary to test reliability by comparing their values with their standard errors.

The standard error of r is given by the formula:

$$\sigma r = \frac{(1 - r^2)}{(N - 1)}$$

where N= number of sites in each area, and r= Correlation Coefficient.

Applying this formula to Appendices 2 to 10, the odds are 2 to 1 that our values do not deviate by more than σr.

Appendix	Correlation Coefficient			
2	+0.504	±	+0.61	or +0.4
3	-0.43	±	-0.56	or -0.3
4	+0.347	±	+0.48	or +0.22
5	+0.13	±	+0.29	or -0.03
6	+0.21	±	+0.36	or +0.06
7	-0.051	±	-0.21	or +0.11
8	-0.118	±	-0.33	or +0.1
9	+0.513	±	+0.67	or +0.35
10	-0.517	±	-0.68	or -0.36

It must also be pointed out that sampling distributions

of correlation coefficients, are not symmetrical ones. The shape of the particular sampling distribution, depends on both the size of the correlation coefficient, and the size of the sample. The former affects the sampling distribution symmetry. When the r-value approaches +1 or -1, the sampling distribution becomes more and more skewed. In practice, there is no real need to worry about the effect of this skewness for correlation coefficients that range from +0.8 to -0.8, provided the sample is a large one, as standard error is applicable only to small r-values and large N-values.

The three sample areas have all been examined from the point of view of the three siting factors, using this statistical method. The results in some cases indicate a significant relationship, and in others indicate a significant negative relationship between the variables. In statistical analysis, a negative answer may be as meaningful as a positive one.

The Chi-Squared Test

This Test provides another measure of association between sets of data. It tests the null hypothesis that the observed results do not differ significantly from those which are to be expected by chance. Applied to the investigation of siting factors, Chi Squared Test shows that the sampling of the three site areas are related only to a very small degree, using the factors of distance from water source, degree of aspect and degree of

intervisibility.

1 Map 30 North Cheviot Aspect and Intervisibility of native sites.
2 Map 31 Crosby Ravensworth and Asby Aspect and Intervisibility and native sites.
3 Map 32 Bellingham/Kirkwhelpington Aspect and Intervisibility of native sites.
4 Monkhouse, F.J., and Wilkinson, H.R.,'Maps and Diagrams', (1964), p.30.
5 Dickinson, G.C.,'Statistical Mapping and the Presentation of Statistics', (1964), p.26.
6 Diagram 5 Significance in different parts of the Triangle.
7 Bowman, I.,'Geography in relation to the social sciences', Part V of the Report of the Committee on the Social Studies to the American Historical Association,(1934), p.1.
8 Connolly, T.G., and Sluckin, W,'Statistics for the Social Sciences', (1962).

CHAPTER 6 SITING FACTORS

DEGREE OF ASPECT

Consideration of siting factors involves attempting to put oneself into the mind of the Iron Age native in an effort to rationalise the particular choice of a site. The degree of visibility might be an important factor of siting if the native is concerned about his position with regard to an accepted route through the valleys, or about the possibility of raiding parties. He will site his home accordingly. In some cases he will settle on a minor valley floor where he will hope to pass unnoticed, or he may settle on a hill top for defence or for a good strategic view of the surrounding countryside. There are three significant divisions of aspect, and the relative proportions of these, govern the importance which the settler attaches to siting. First there is the view up hill from the camp which will strategically be 'dead ground'. This will be limited in most cases and most rarely will it be over 50 per cent of the total view. That situation would indicate extreme caution in siting. Visibility up to one mile is the second division of aspect. This quadrant will again indicate caution in siting as well as strategic 'foolishness'. One mile is little distance in which to have warning of attack, but it does put water source within sight of camp and allow for a reasonable field of vision. The number of cases of sites having aspect

in these first two divisions, is extremely small. They usually have some degree of the third division which is visibility over one mile. This vision is very important as totality indicates a hill-top site. On the Maps 30, 31 and 32, the site circular symbols are divided according to the three latter divisions.

North Cheviot

The 41 sites grouped around the periphery of the massif illustrate a variety of aspect patterns[1]. The immediate impression is one of the high number of sites with visibility over one mile in extent, and the small number of sites with visibility only up to one mile. Site number 40, at a considerable distance from the majority of the sites, consists of a loose collection of huts[2] in the valley of the Harthope Burn. Visibility from this site is very limited. A similar condition applies to site 41 by Threestone Burn[3] where huts were noted by MacLauchlan[4]. Only down valley is visibility extended beyond one mile. All the other sites on the map have a considerable range of visibility. The Accumulative Aspect Graph[5] demonstrates the major facing quadrant of the sites in the north Cheviot. The most significant degree of visibility is that over one mile in extent, and it is this factor which governs most of the sites in this area. The north-east quadrant has the greatest degree of aspect, contrary to usual

siting proceedure, and this may reflect danger of some type from that direction rather than a preference for north-facing slopes. Two sites are completely hill top sites and have aspects of 360 degrees. Humbleton Hill[6] is a large nine acre site with outer systems of stone walls, and an inner enclosure of walls 12 feet thick. Eleven hut platforms are visible within the perimeter and three in the adjoining eastern enclosure. The site appears to be of importance especially compared with the other sites in the North Cheviot region. We shall see that in other siting aspects too, Humbleton Hill dominates. Yeavering Bell[7] is the second hill top site, of 13 acres with over 130 circular or oval scoops and 'ring-groove' marks of timber huts. The site is the easternmost of four oppida on the south side of the Tweed inhabited by the Votadini. There is a hint of second century and later occupation with finds of samian ware and two Late Roman 'minims', a glass armlet and a Romano-British fibula. The importance of the site between the second and the fourth centuries A.D. is again reflected in the factors of siting. Yeavering Bell is the highest site in the region at 1182 feet and physically dominates all the other sites.

Bellingham/Kirkwhelpington

The sites at the junction of the Rede and the North Tyne and some miles to the east, are of a very diverse character[8]. The Accumulative Aspect Graph[9] shows the prevailing direction

of siting to be from north-east to south. There is a great variety in direction of facing especially with visibility in excess of one mile. Site 8 on Map 32 at Black Buteland[10] overlooks the river junction, and High Shields(Nightfolds) site 11[11] is on the west-facing escarpment near Birtley. Some of the remaining sites are split in their ability to sight over one mile. Site 3, Garrett Hott[12], on a knoll of ground close to the Rede/North Tyne confluence, sights up Redesdale, up and down the North Tyne. In between, the visible ground is 'dead' with sighting under one mile. A similar site is 2 at Stirks Cleugh[13] with only intermittent views of any substantial distance. Site 30 on Whitehill[14] has a limited view to the east and the west but good to the north and the south. All the remaining sites except five, prefer to site with a sight towards the south-east. The exceptions are those settlements which have no visibility above one mile in extent. They are mainly clustered to the east of Dere Street in the midst of Kirkwhelpington Common sites. Sites 31 and 32, Herpath[15] and Ray Cottage[16], are both on rises of ground in the valley of Ray Burn but have a very limited visibility. Sites 15, 16 and 18, Hetchester[17], Quarry House[18], and Crookdene[19] are on the flattish moors above Bavington and also have a limiting field of vision. One of the most commanding positions of the countryside west of Kirkwhelpington is occupied by site 14

on Great Wanney Crag[20]. Visibility is excellent from the 1000 foot position except in a small south-south-west quadrant. Excavation should determine the importance of the site relative to the other sites in the area. An interesting observation with regard to the mass of sites is that apart from the hill top sites, most of the quadrants of visibility over one mile are facing downstream of the closest water course. Crosby Ravensworth and Asby

The 22 sites in this area show a distribution around the upper reaches of the Lyvennet Beck and Scale Beck[21]. The Accumulative Aspect Graph[22] shows the major direction of visibility as northward overlooking the Eden valley. Sites 5 to 15 inclusive show clearly a limited siting with few settlements having an aspect further than one mile any greater than a few degrees. Sites 6, 13 and 14, W.S.W.Ewe Locks[23], Ravens Gill East[24] and West[25] sides, are irregular-shaped village settlements with little sign of defensive features. None of them have an aspect over one mile, or are,sighted in prominent positions, and they seem to be satellites of adjacant larger sites. Site 21, Holborn Hill[26], despite its name, can only see any distance distance downstream. Again this site is an enclosed village of small size along a slight scarp above the stream. Sites 1, 2, and 3 in the north-west corner of Map 31 are prominent for their depth of visibility. Scar Plantation[27],

Wickerslack Moor[28], and Harberwain[29] are also village sites, which look out over the foothills of the Eden valley. They are not primarily defensive sites and they avoid the hill summits of the north-east sloping plateau. Positionally, site 17, Castle Folds on Great Asby Scar[30] is the most strategically placed and dominant site in the area at a height of 1330 feet, but its view is limited on the south by the Knott at 1353 feet, and on the north by the Great Asby Common. However, the Pennines and the Appleby area of the Eden valley are visible to the north-east. The settlement is defended by a rampart of orthostatic construction and there are traces of ten huts along the interior of the wall. The bare nature of the surrounding countryside and the remoteness of siting suggest a retreat in time of raiding from one of the villages in Crosby Ravensworth. Nicolson and Burn[31] noted this inaccessability of the site which was

> 'strongly walled about and contained an area of about an acre and a half; and at the highest corner there hath been a fort about seven yards square within, by way of shelter for the keepers and as a kind of citadel to retire to'.

(This is the hut at the south-west angle).

DEGREE OF INTERVISIBILITY

An important factor of siting should be the amount of relationship between settlements in an area. For reasons of

defence, strategy and economy, it would seem necessary that some sort of communication be available to inhabitants. A large number of sites in close proximity as in our three sample areas, suggests tribal groups, or at least some alliance between the settlements. The defensive nature of many of the sites indicates to a certain extent their unsure position and fear of attack. Communication would therefore be of prime importance in defence. Visual communication would be the quickest and easiest. An examination of the degree of inter-visibility between sites would therefore measure the extent of the importance of this factor in siting of the settlements. Degree of intervisibility might also rise with the importance of that site within the community. The analysis below attempts to look at this position.

North Cheviot

Generally, this area shows a high degree of intervisibility between sites. An average of 4.5 sites are visible from each site[32]. The extremes are no other sites visible from sites 40 and 41, New Burn[33] and Threestone Burn[34], to Yeavering Bell[35] with 16 sites visible. The latter site completely dominates the area in this respect. Twice as many other sites are visible from Yeavering Bell as from any other site in the area. On Map 30 the inscribed circles have a radius proportionate to the number of sites visible. After Yeavering Bell, Humbleton

Hill[36] stands out as a site of some importance with 7 visible sites. Only one site on the northern rim of the massif is alienated from its neighbours. Site 22 on Coldberry Hill[37] has only one other site within its visual range, and consists of two conjoined enclosures of different construction date. The earlier northern enclosure shows traces of a scoop and traces of stone foundations for a circular house 18 feet diameter. Such sites were usually due to the adaption to a particular topography where habitation sites were limited to steep hill slopes. Jobey suggests[38] that the scooped enclosure is a fore-runner of the Romano-British type of homestead and settlement, as found overlying some hill forts. This would place the site out of context with most of the other sites in the North Cheviot. Among the other sites further to the south-east, Ringles[39] of South Middleton, site 34, dominates with 8 sites visible from the interior. This does not necessarily mean that Ringles is significantly important in the area, but rather that the very close proximity of a number of sites leads to a high degree of intervisibility. The site is double-ramparted, circular, and an acre in size. Traces of internal settlement are not published. The site might be considered for further investigation.

Bellingham/Kirkwhelpington

There is a greater dichotomy between the sites within the

region of Map 32 than there is in the North Cheviot. Immediately noticeable is Great Wanney by the nature of its height above the Berry Hills to the east. Many sites in the Upper Wansbeck are visible from this prominence. Sites 24 and 25, Ferneyrigg[40] and Ray Burn[41], also stand out as well sited settlements. The former is an elevated rectangular site of about 1.75 acres noted by Ball to have only one ditch, but two entrances. The latter is likewise rectangular but much smaller at 0.25 acre. Visibility appears to have little significance upon the importance of these two sites as local tribal centres. In the west, sites 3 and 4, Garrett Hott[42], and Rede Bridge[43], have close visual relationship with Birtley sites, but don't themselves seem to be important. Isolated sites with only one site visible, are common in the region with seven, even where adjacant settlements are numerous within a mile. Site 37 at Birky Burn in the north[44] is a collection of small low concentric rings that appear to be hut circles, and has no apparant connection with any other site on the fells.

Crosby Ravensworth and Asby

Sites 7 and 6, Ewe Locks[45] and Ewe Close[46], dominate the area[47] insomuch as between them nine sites are visible. Both are villages with irregular and rectilinear enclosures and stone walls of orthostatic construction. About 18 hut circles in Ewe Close and 8 in Ewe Locks and the general sophistication

of the settlements, speak of peaceable farming communities between the 800 and 1000 foot contours, close to water supplies, their shape being a natural product of the lie of the land. Parallels to this form of hut village are found in southern England on the Downs at Rotherley and Woodcuts, for example, and they indicate native cultures of the Early Iron Age and Roman periods. Rectangular buildings are evident at both sites suggesting later reoccupation, even perhaps, near continuity of occupation through to the medieval period. The degree of intervisibility is fairly constant around the upper reaches of Lyvennet Beck where there is an obvious connection between the communities. The Scale Beck area sites are limited to intervisibility of one, except site 18 at Muddy Gill[48] high up the valley, another village but with defensive ramparts, containing 6 to 10 huts.

DISTANCE FROM WATER SOURCE

Distance from source of water should be a prime factor of siting of any settlement in any region. Fortunately, the north of England is well endowed with seasonal rainfall few regions receiving less than 30 inches of rain per year, and many receiving considerably more. Numerous native sites in the north are in hill country dissected by perrenial streams and are rarely sited further than a few hundred yards from water. With a few exceptions, sites avoid areas with infrequent streams.

Crosby Ravensworth and Asby

The bare limestone plateaux of Crosby Ravensworth Fell and Great Asby Scar are bare of native sites and of streams[49]: Settlement is restricted to below the spring line except for the 'retreat' at Castle Folds[50]. The 'clint' scenery of bare rock so widespread in the area is completely avoided even when defensive positions are offered along cliff tops as at Orton Scar above Crosby Ravensworth. The greatest distance from a stream is a third of a mile from Gilts House 2[51] east of the Lyvennet Beck. The distribution of springs is coincidental with breaks in the limestone strata. Spring distribution is strange in the Crosby area. Only three springs are recorded west of a north/south line from the Knott. To the east of this line, many streams rise from springs on the edge of the limestone plateau. The drainage is more intermittent and altogether more typical of limestone.

North Cheviot

Map 30 clearly shows the extensive drainage pattern with few sites far from water. The two exceptions are Yeavering Bell[52] and Humbleton Hill[53], hill top sites with the nearest stream a third of a mile from the summits. 23 of the sites out of 41 may be described as valley sites; of the remainder, all but two are on hillsides or less prominent rises of ground close to small streams. Springs are non-existent, except close to the Cheviot

at the junction of the granites with the lavas and agglomerates.

Bellingham/Kirkwhelpington

There are ten sites not directly sited in a valley or close to a stream, but none of them are more than half a mile from a water source[54]. The cliff site on Great Wanney Crag[55] even, has streams along the base of the cliff and down the lee-side of the escarpment. The distribution of springs is fairly even throughout the region, but only site 5 Lee Orchard[56] in Birtley appears to rely upon a supply of spring water.

1 Map 30
2 NCH, XIV (1935).
3 MacLauchlan, H.,(1867), p.47.
4 NCH, XIV (1935).
5 Diagram 7 North Cheviot Accumulative Aspect Graph.
6 Jobey, G.,(1965), p.62.
BNC, XI (1885-6), 158-159.
Mackenzie, I p.383.
MacLauchlan, H.,(1867), p.20.
7 Cf. Chapter 2 Ref.11.
8 Map 32
9 Diagram 8 Bellingham/Kirkwhelpington Accumulative Aspect Graph.
10 Rome Hall, G.,'On ancient British remains near Birtley and Barassford, North Tyne', AA2, VII (1876), p.3.
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NCH, XV (1940).
11 NCH, IV (1897), 351-353.
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O.S. (1922), 25".
12 NCH, IV (1897), 351-353.
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13 NCH, XV (1940).

14 Hodgson, I 2 p.192.
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Hodgson, I 2 p.191n.
16 NCH, XV (1940).
17 NCH, XV (1940), p.56.
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18 AA2, XII 'Notes on a Pre-Historic Camp and Avenue of Stones on Throckington Quarry House Farm', (1887), p.155-158.
Air Photograph A484.
19 Hogg, A.H.A.,'Northumbrian Forts and Farms', Arch. News Letter No.8,8 - 14.(1948).
20 Jobey, G.,(1965), p.63.
Hodgson, II 1 p.198n.
21 Map 31
22 Diagram 9 Crosby Ravensworth and Asby Accumulative Aspect Graph.
23 RCHMW, (1936), p.89.
24 RCHMW, (1936), p.86.
25 RCHMW, (1936), p.88.
26 RCHMW, (1936), p.18.
27 RCHMW, (1936), p.89.
28 RCHMW, (1936), p.88.
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29 RCHMW, (1936), p.88.
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30 Richmond, I.A.,'Castle Folds by Great Asby', CW2, XXXIII (1933), 233-237.
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31 Nicolson and Burn,'History of Westmorland',1(1777), p.491.
32 Map 30
33 NCH, XIV (1935).
BNC, VI (1868-72), p.368.
34 MacLauchlan, H.,(1867), p.47.
35 Cf.Ref.7.
36 Cf.Ref.6.
37 Jobey, G.,(1962), 47-58.
38 Jobey, G.,(1962), p.58.
39 Jobey, G., (1965), p.61.
MacLauchlan, H.,(1867), p.43.
40 Ball, T.,'Some Rectilinear Earthworks in Northumberland', PSAN4, 1 (1923-24), 230-231.
41 O.S. (1926), 25".

42 Cf.12.
43 O.S. (1925), 25".
44 Hogg, A.H.A.,'Gwynedd and the Votadini', Ant. XIX (1945), p.80ff.
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RCHMW, (1936), p.83.
47 Map 31
48 RCHMW, (1936), p.18.
Air Photographs St.Joseph, J.K., A821, ChT., CAPC BF11.
49 Map 31
50 Cf.Ref.30.
51 Cf.Chapter 2 Ref.11.
52 Cf.Chapter 2 Ref.11.
53 Cf.6.Ref.
54 Map 32
55 Cf.Ref.20.
56 MacLauchlan, H.,(1867), p.73.

CHAPTER 7 COMPARATIVE RELATIONSHIPS

A full analysis using statistical and cartographical methods, of the calculated information on the siting factors of native sites in the north of England, results in a pattern of 'pull' dominance for the three seperate areas of North Cheviot, Bellingham/Kirkwhelpington and Crosby Ravensworth and Asby. The aim of the study is to establish the areal importance of the siting factors, and to see how one factor may affect the other two. Expression of the same material in different analytical forms is carried out in order to obtain the maximum value from the evidence available.

COMPARISONS BETWEEN SITING FACTORS

Triple Comparison

The Triangular Graph[1] is the only diagrammatic method which may be used to examine three variables areally.

North Cheviot - Diagram 9 indicates the sources from which the North Cheviot sites are plotted. We note that few of the sites have remote sources for their plottings except site 37, West Southmiddleton Dean[2], which has a low degree of intervisibility and aspect but is very close to a water source. Medially plotted, the site is near the exact centre of the triangle. Site 25, Whinney Hill[3] has an average aspect and degree of intervisibility but is an excessive distance from the nearest water source, with the result that one of the plots is outside

of the triangle.

The major Groupings on the Triangular Graph[4] stand out fairly clearly. The sites which have been plotted straight without resorting to calculation of a medial plot are 16 in number, and some of them are very significant. Group III, sites 40 and 41 are especially significant with regard to their siting factors. Their factors of intervisibility are negative and only Threestone Burn[5] has a small quarter with an aspect over one mile. Both are very close to water sources. Site 41 has its degree of aspect in exact inverse relationship to its distance from the water source. Both sites are in the region where two factors are overwhelmed by one factor - this being the water source. Group II contains 8 sites which are straight plotted. Reference to Map 33 which shows the location of the major Groups within the triangle, indicates that Group II sites are liberally spread around the periphery of the massif and appear to be typical of the majority of the sites. The lower half of the Group are in the region which has one of the siting factors very small. In this case it is the distance from the water source. The upper half of the Group approaches the region where the factors are evenly mixed. The straight plotting is therefore, what one would expect from sites which have an average degree of aspect and inter-visibility, and close proximity to water. Group IIa may be

divided generally into sites which have a smaller degree of intervisibility and one factor dominant over 50%, and sites which have the degree of aspect greater than the degree of intervisibility and the distance from the water put together. Group Ia sites are dominated by their excessive distance from water. Group I sites, close to the triangle centre, display average siting factors, but with a slight leaning towards excessive distance from water. Sites 1, 2, 15 and 37 have a limited degree of aspect. Site 37 has an exact inverse relationship of water distance to degree of intervisibility. The absence of sites 6 and 19 from the map is conspicuous. The dominance of these sites in respect of aspect and intervisibility and their distance from water, places them in a theoretical Group 4 on Map Ia.

The sum of all the above plotting is expressed in Appendices 2 to 4.The correlation between the degree of aspect over one mile in extent and the degree of intervisibility[6] is moderately significant at +0.504 with a substantial relationship. As one would expect, where there is an increase in aspect over one mile, there is an increase comparable in the degree of intervisibility. The result of a correlation between distance from water source and degree of aspect is negative to the extent of -0.43[7]. This indicates that there is again a moderate relationship between the increase in aspect and decrease in

distance from water. There is a definite relationship, although only a small one, between the degree of intervisibility and distance from water[8], as the value is +0.347.

Bellingham/Kirkwhelpington - In contrast to Diagram 9, the plots of the three variables for Bellingham/Kirkwhelpington[9], show considerable difference between sources. Only one site, number 12, is straight plotted. Two sites, numbers 21 and 29 are plotted outside the triangle because of the value of their extreme distance from water source. Sites 14, 36, and 37 are not able to be plotted at all because of their variability of siting factors. Site 14, Great Wanney[10] is fairly close to water but has a high degree of both aspect and intervisibility. Sites 36 and 37, Birky Burn[11] and Coppingburn Crag[12], are close to water, but have small degrees of aspect and intervisibility. When Diagram 5 is applied to Diagram 11, a pattern emerges. There are no sites in the area with two factors very small and one very large, and there are nine sites with the factors of siting evenly mixed - sites 1, 9, 18, 20, 23, 24, 26, 31, and 35. Most of these are in the Upper Wansbeck basin. Seven other sites are not dominated by one particular factor, but sites 19, 24 and 35 have their distance from water in exact inverse relationship to their degree of aspect. The spread of sites within areas of the triangle which denote the smallness of one siting factor greater than 20%, is very

even. Three are in the area of the degree of intervisibility, seven where the distance from water is small, and five where the degree of aspect is small. The nearness of water, it must be remembered, is a favourable siting factor.The two major Groups of sites[13] show a distribution relevant to the even relationship between the siting factors. Group 1 sites which stray from the average siting factor are limited to the Upper Wansbeck except for site 13 close to Dere Street in the south. This site at Tone Inn[14] suggests a hint of Roman influence in the rectangular shape, proximity to Roman constructions, and divergence from normal siting factors. Group 2 are spread throughout the region.

The three correlations between the three variables for Bellingham/Kirkwhelpington, indicate insignificant relationship between them, with values of +0.13 for Appendix 5, +0.21 for Appendix 6, and -0.051 for Appendix 7. The most significant value is +0.21 for the correlation between aspect and water source, which indicates a small but definite relationship between the two variables: as aspect increases, the distance from the nearest water source decreases. This result is different from the value for the North Cheviot, as one value is positive and one negative. This serves as an indication that water distance as an important factor in consideration of siting of native settlement, should not be considered.

Appendices 5 and 7 show a slight correlation between the variables, but the relationship is so small as to be negligible.

Crosby Ravensworth and Asby - Diagram 13 shows the extreme variability of plotting the sites according to the pull of the three variables. Two sites are plotted off the triangle, sites 1 and 5. Site 1 at Scar Plantation[15] is remarkable for its excessive distance from water and its wide degree of aspect. The latter factor overwhelms other siting considerations. Site 5 at Ewe Close[16], is remarkable for its low degree of aspect for such an obviously important site, and its high degree of intervisibility. Most of the three sources for the sites are wide apart indicating extremes among most of the sites, of siting factors. Diagram 5 applied to Diagram 14 shows a distinctive quintuple grouping. Four sites in Group 2, 18, 20, 21, and 22 are in the area within the triangle where the siting factors are evenly mixed, These sites are all in the Asby area, indicative of regionalism of siting characteristics. Sites 3, 14, and 15 are similarly sited but with a leaning towards limited degree of aspect. Group 1 sites, numbers 6, 8, and 9, 10, 11, and 12, situated in a crescent around the Upper Lyvennet Beck[17], are in an area where one of the siting factors is greater than 50%. This is the degree of intervisibility, expected where close siting of settlements is common. The two sites in Group 3, 7 and 13, have a very small, less than 20%, degree of aspect, but

are similar in other respects to the adjacant sites. Sites 4, 16 and 19 are all outliers to the general distribution of settlement, and they display prominent siting characteristics. Site 4 is an excessive distance from water, but site 16 is at an even greater distance and has no sight of any other settlement. Site 19 has likewise a great distance between itself and water source, somewhat over half a mile. Group 5, sites 2 and 17, are situated on Map 35 away from the concentrations of settlement, and they display a wide degree of aspect, the latter site also a marked distance from water.

The correlation between degrees of aspect and intervisibility has virtually no significance with r = -0.118[18]. Between degree of aspect and distance from water, and between degree of intervisibility and distance from water, there is a substantial relationship. The valuse for the two are +0.513 and -0.517 respectively. As the degree of aspect increases, the distance from water increases in the positive result; as the degree of intervisibility decreases the distance from water increases in the negative result. The former result is expected with favourable aspect for sites taking them to the higher regions further from stream beds. The latter result proves that a high degree of aspect does not necessarily result in a high degree of intervisibility: more sites are not viewable because of this aspect. The correlation between aspect and intervisibility

at -0.118 is clear, and serves to illustrate the relationship.

Scatter Diagram

Diagrams 15, 16 and 17 examine the relationship between the three areas North Cheviot, Bellingham/Kirkwhelpington, and Crosby Ravensworth and Asby, for each pair of variables.

Diagram 15, shows the degree of intervisibility against the distance from water source. There is considerable distance between the areas. North Cheviot sites are never far from water and have a high average degree of intervisibility. The Bellingham/Kirkwhelpington area has a greater extreme of water distance, and most of its sites are concentrated in a graph area where degrees of intervisibility are small and distance from water is fairly short. The Crosby Ravensworth and Asby area has much less degree of intervisibility but many of the sites are far from water source. This implies that siting considerations neither rely upon closeness to water nor upon visible connection between the settlements.

The aspect-intervisibility relationship is much closer. Diagram 16 shows that in the North Cheviot area both the variables have high values, because of the close correlation between the two and the abrupt nature of the ground. The Bellingham/Kirkwhelpington sites are more closely confined, but the relationship is still clear between the variables. The Crosby Ravensworth and Asby area follows virtually the same

pattern. This is probably a reflection of the extreme landscape in these two latter areas tending towards giving the sites less vantage points and hence a smaller degree of intervisibility.

The water-aspect relationship on Diagram 17 is vastly different between the three areas. As we have already observed, the North Cheviot sites are all close to water and most of them have aspect over 100 degrees. The Bellingham/Kirkwhelpington sites are similarly confined, but in Crosby Ravensworth and Asby they spread from 0 to 1400 feet from water and from 0 to 270 degrees of aspect.

CORRELATIONS BETWEEN HEIGHT ABOVE MEAN SEA LEVEL AND SOME VARIABLES

In Westmorland, an expected correlation would be between the average height above sea level for the sites within a parish, and the number of sites within that parish. Appendix 11 shows the reverse taking place. The value of +0.072 indicates negligible relationship. The interpretation of this would be that areal distribution is not a product of the close connection between siting on high ground and inter-site relationship. We have already noted the very small relationship between the three siting factors, and this points towards some other reason for the siting of the undefended villages of the Eden valley. The historical development of the area explains the sites as being at the cultural extremity of the Lake District but

the complex village structures and relatively advanced appearance of the settlements belies this theory.

A comparable examination of the relationship between height above sea level and the degree of intervisibility for the Bellingham/Kirkwhelpington group of sites, reveals again an insignificant relationship between the two[19]. Plotted on Diagram 18, the distribution is between 450 feet and 900 feet with no specific concentration within a small height range. The degree of intervisibility is similarly evenly spread from one to five. +0.059 indicates a negligible relationship. For the area, the aspect/intervisibility relationship is also negligible, and therefore a particular height value has no effect upon the siting of a settlement.

CONCLUSION

Relative Pulls

A condensation of all the evidence for siting using Diagram 5, shows the relative pulls of different factors in the three areas[20].Specific areas within the triangle mean specific values for the relationships between the three variables. Throughout the triangular analysis, A represents the distance from water source, B the degree of aspect, and C the degree of intervisibility. The most dominant siting area within the graph with 48.5, 50, and 30 per cent of the sites in the three regions, is within a triangular area between lines joining the central

points of the three sides. This is where the sites take into account the various factors of siting to a moderate degree. Outside of this area, the dominance of one or more variables is more felt.

Only in Crosby Ravensworth are there any sites which have the pull away from water greater than the pull of the other two variables put together. Also at Crosby Ravensworth, 15% of the sites have a greater value of water distance than of degree of aspect. Bellingham/Kirkwhelpington sites have 8.5% of their number with this value; no North Cheviot sites have dominance of distance from water over aspect. The same pattern occurs with water-intervisibility relationship, except that 9.2% of the North Cheviot sites are sited where the value of distance from water is greater than the degree of intervisibility. The values for the three areas where sites are exactly equal in their siting factors, are 8.5% for Bellingham/Kirkwhelpington, 10% for Crosby Ravensworth and Asby, and 2.3% for North Cheviot, where the pull of water is the same as the pull of aspect. Where the pull of water is equal to the pull of intervisibility, the percentages are nearly the same.

The power of the pull of aspect as a siting factor is evidently fairly small in the three regions. Less than 5% of the sites in Crosby Ravensworth and 2.3% of the sites in the North Cheviot have the value of aspect greater than the value of

intervisibility. In contrast, 11.5% of the sites in the North Cheviot are sites with the value of aspect greater than the other two values put together. No sites in Crosby Ravensworth are so influenced, nor are they in the same area where aspect is greater than the water pull. No sites in Bellingham/Kirkwhelpington and only 2.3% of sites in the North Cheviot have the pulls of aspect and intervisibility exactly the same, whereas 5% of Crosby Ravensworth sites show this pheonomenon, indicating some degree of connection between the two factors in the area. The dominance of the degree of intervisibility is also limited. Under 5% of all sites in the three areas are sited where intervisibility is greater than aspect; but surprisingly, where intervisibility is greater than distance from water and aspect put together, there are about 5% of sites. Only in the North Cheviot are there any sites at all which have intervisibility greater than the pull of water.

The amount of dominance of the three factors of siting divides fairly evenly between the three sample areas.[21] North Cheviot has a greater percentage of its sites at 5.5% with two of the factors less than 20% and one factor greater than 60%. The small percentage would be expected as no one factor should have that amount of domination over the other two. Crosby Ravensworth and Asby has 60% of its sites with one of

the factors averaging less than 20%, indicative of the relatively high value in siting of the otherctwo variables. High value percentages also oocur for the other two areas, Bellingham/ Kirkwhelpington has 26% (considerably more than the other two areas), of its sites with no factors of a lesser value than 40% or greater than 20%.

The pull dominance is summed up in Appendix 14 where the siting factors and three sample areas are related. The general picture is one of domination of one siting factor in only a few cases. With distance from water source, Crosby Ravensworth stands out with 33.6% of its sites not taking the nearness of a water source into account. In the North Cheviot, because of the proximity of water to all sites, only 12.5% are sited far from water. The degree of aspect is especially relevant to North Cheviot with 20% of sites taking it into account - only 8.4% and 5.6% of the sites do this in Crosby Ravensworth and Bellingham/Kirkwhelpington. The degree of intervisibility for the three areas is fairly comparable varying from 11.2% to 16.8% of the total number of sites. The majority of the sites, 42%, in Bellingham/Kirkwhelpington, 29.4% in Crosby Ravensworth, and 35% in North Cheviot, are not dominated by excessive siting pulls; but a small number of sites, 14%, 12.6%, and 20% respectively, have one of the siting factors weak, and therefore influenced more by a combination of the

other two.

MEASURE OF THE ASSOCIATION BETWEEN THE THREE SAMPLE REGIONS USING THE χ^2 TEST

The divergence between an expected distribution of a variable and one actually obtained may be expressed in terms of a quantity called chi-squared. From this and reference to the table of degrees of freedom[22], we may tell what is the probability that the difference between the observed and the theoretical results is due to chance sampling fluctuations.

The formula by which to compute chi-squared is

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

where O is the observed frequency of the variable, and E is the expected frequency. $\sum$ is 'the sum of'. To decide whether a value of χ^2 is indicative of a significant divergence of the observation from expectation, we must also take into account the number of degrees of freedom on which the particular computation of the χ^2 is based.

The expected and observed frequencies of sites in different parts of the triangle are applied to the χ^2 formula with the result that $\chi^2 = 28.476$. The number of degrees of freedom is the number of rows minus one multiplied by the number of columns minus one, which is 12 x 2 = 24. Reference to a table for the χ^2 distribution between the districts shows that for $\chi^2 = 28.476$ with 24 degrees of freedom, the difference between

the areas is significant at the 0.2% probability level. Hence, the three districts are related to the degree of 0.2% using the siting factors of distance from water source, degree of aspect and degree of intervisibility. The method tests the null hypothesis that the observed results do not differ significantly from those which are expected by chance. This tells us that our three areas and three siting factors have little chance of being related by anything other than coincidence.

1 Diagram 6
2 Hardy, J.,'On Urns and other Antiquities found round the southern skirts of the Cheviot Hills', BNC, XI (1885-6),p.276.
3 NCH, XIV (1935), 34-45.
4 Diagram 10 North Cheviot Native Sites and Major Groupings.
5 MacLauchlan, H., (1867), p.47.
6 Appendix 2 Correlation between Degree of Aspect and Degree of Intervisibility for Native Sites in the North Cheviot.
7 Appendix 3 Correlation between Distance from Water source
8 and Degree of Aspect for Native Sites in the North Cheviot.
8 Appendix 4 Correlation between Degree of Intervisibility and Distance from Water source for Native Sites in the North Cheviot.
9 Diagram 13 Bellingham/Kirkwhelpington Plotting Three Variables by Weighting.
10 Jobey, G.,(1965), p.63.
Hodgson, 2 I p.198n.
11 Hogg, A.H.A., (1945), p.81.
12 Hodgson, 1 II p.191.
13 Map 34 Bellingham/Kirkwhelpington Groups from Triangular Graph.
14 NCH, IV (1897), p.301.
MacLauchlan, H.,'Survey Memoir of Watling Street from Tees to Scotch Border, in years 1850 and 1851', (1852), p.26
15 RCHMW, (1936), p.89.
16 Cf. Chapter 6 Ref.46.

17 Map 35 Crosby Ravensworth and Asby Groups from Triangular Graph.
18 Appendix 8 Crosby Ravensworth and Asby Correlation between Degree of Aspect and Degree of Intervisibility.
19 Appendix 12 Correlation between Degree of Intervisibility and Height above Mean Sea Level for Native Sites in Bellingham/Kirkwhelpington.
20 Appendix 13 Analysis of Triangular Graph for Three Sample Areas showing Relative Siting Pulls of Distance from Water source, Degree of Aspect, and Degree of Intervisibility.
21 Appendix 13
22 Fisher, 'Statistical Methods for Research Workers',(1954).

CHAPTER 8 ROMAN/NATIVE RELATIONSHIP

The difficulty of establishing the relationship between the indigenous peoples of the north of England and the Roman 'infiltrators' stems from the lack of material evidence indicative of Romanisation from the native sites, and from lack of literary evidence relative to this question from the military sites. The combined paucity of evidence lends us tentatively to construct the possible relationships between the two cultures, using evidence by analogy, and the siting and layout factors which predominate. There are several methods, however, by which the general pattern of siting relationships may be established. A maxim which we might adopt could be that native settlement close to an occupied Roman site could have a greater degree of Romanisation than settlement further away. The unsatisfactory aspect of this idea is the ignoring of the physiography of the landscape which may render sites at a great distance from Roman centres easily influenced by means of valley routeways or river crossings. In rough country, as in the Lake District, a site close to a Roman fort might be relatively untouched by Roman influence.

There is also the consideration of the deliberate policy of Rome to develop lands within the Roman pale by effective Romanisation and even transportation of natives from one area to another. I.A.Richmond tells us in '<u>Romans in Redesdale</u>'[1] that

the Roman policy forwarded by Agricola[2] was to use a network of inland roads not only for revictualling and reinforcing troops, but for segregating subject folk in groups suitable for police supervision and tax-collecting. The rectilinear native settlements which predominate south of the Roman road between High Rochester and Low Learchild, from the Simonside Hills to Hadrian's Wall, date from the second century A.D. (although the evidence for this is very slight due to lack of excavation), perhaps the result of Imperial policy of frontier hinterland settlement. G.Jobey tentatively points out that the Antonine advance in c.140 A.D. may have stimulated the development of the area by transference of population. The rectangular form of the settlements plus their regular spacing from each other strongly suggests Roman influence[3]. As G.Jobey rightly suggests, we can see a degree of Romanisation in the rectangular form of the possible late Roman farm buildings at Old Brampton[4], Risehow, Maryport[5], and Wolsty Hall[6]. We must, however, draw the distinction between the villa site, as at Old Durham[7], probably run by a fully Romanised 'native' of many generations, and the native farmstead situated within the sphere of Roman influence but retaining indigenous characteristics, and only slight Roman connections.

The resemblence of the south Northumberland sites to the '<u>viereckschanzen</u>' of the Upper Rhine and its tributaries in

an area including Rhaetia, was noted in 1943[8]. The suggestion of a population transfer between 140 and 150 A.D. associated with reorganisation of the frontier under Lollius Urbicus, is a theory lacking in positive evidence[9]. To suggest that this move also led to the introduction of the rectangular form for native homestead, would be to place undue emphasis upon shape being a response to Roman rule in an area. Indeed, we find rectangular enclosures of Bronze Age date in Wessex[10], and of Late Celtic date in Bavaria[11]. These latter have a clearly marked area of distribution in southern Germany. In plan, they are straight sided ramparts of unequal length, with external v-shaped ditch and sharp corner angles. At Deisenhofen, south of Munich, the Roman road from Salzburg(Juvavum) to Augsburg(Augusta Vindelicum) cuts through the enclosure proving a pre-Roman context. Most of the dateable finds from these rectangular camps and from those at Gennoch in Swabia, and Sallach in Lower Bavaria, occur in the corners and date from the last century before Christ, and are assignable to Late La Tène.

The stone-built huts of the Tyne-Forth area appear to be closely associated with the pax Romana[12], dating from the second to fourth centuries A.D. The sequence seems to be the abandonment of the hill forts followed by the initial establishment of stone-built settlements stretching from the North

Cheviot hills down to the line of Hadrian's Wall. It is debateable whether the finds of Roman artifacts in these settlements implies the same sort of relationship as existed at Traprain Law, but the Roman occupation would have accelerated the unifying processes of the Lowland tribes[13] and therefore the purchase of Roman goods through trade need not directly imply Roman suzereignty.

There are three further methods which might help in assessing the relationship between thr Roman and native in the north of England. Correlations using the Product Moment Correlation Coefficient, the population potential isoline map, and the use of the scatter diagram, all add weight to our present evidence of the distribution of second to fourth century stone-built settlements in Northumberland, and to defended native sites of possible Roman period occupation, in the Lake District.

In 1943, M.C.Fair[14] cited a number of examples of defended native sites in the Lake District overlooking ancient tracks that might have been deliberately set up by the Roman administrative authorities, in order to establish a network of look-out posts and signal stations. She noted that Castle Crag in Borrowdale[15] with Scarfell and Caermote visible, had yielded Roman remains at excavation. Castle How on Peel Wyke at the foot of Bassenthwaite overlooked the junction of the Papcastle and Old Carlisle road with a possible branch road south from

Caermote to Keswick[16]. R.G.Collingwood partly excavated the site in 1924 and found in the innermost western and outermost eastern ditches, laid cobbles, and also some chiselled sandstone in which he states to be the Roman style[17]. However, he disagrees with Fair by placing the hill-top settlements post 383 A.D. constructed as a temporary refuge after the Romans had left. Fair also suggests that Reecastle in Watendlath stands above a routeway from Keswick to Ambleside[18]. Similarly, Buckcastle in Shoulthwaite Gill[19], Dunmallet above Kirkstone Pass[20], and The Helme near Kendal above the fort[21], dominate routes. Collectively, this evidence is still weak, because of the lack of knowledge about the details of the Roman road system in the Lake District, and because of the lack of dating and occupation evidence from most of these sites. Taking the defended non-Roman sites in the Lake District as a whole, and relating them to the possible road pattern, still does not provide us with a clue to the relationship[22].

A continuation of the coastal system of forts south of Ravenglass is a possibility with a route connecting with the north-south Roman roads further inland to the east. The majority of the hill forts which are clustered in the Furness area, are pre-Roman in origin, although some of them indicate Romano-British occupation. Stone Walls, Urswick[23], possesses a square annex of later construction; Skelmore Heads, Ulverston[24],

a sub-rectangular enclosure; and Stone Walls, Seathwaite[25], a square chamber withrounded angles. The possibility of Roman influence in these constructions is no more than tenuous.

Further to the north, the defended sites are primarily related to the physiognomy of the landscape, sites in the hills and mountains of the massif and on the Pennine side of the Eden valley. Deliberate siting either close to, or away from Roman roads of native sites, or deliberate siting of Roman roads to connect the major native centres of population, is difficult to prove, especially as so few of the Lake District native sites have been excavated to provide dating evidence and a picture of the continuity of occupation.

POPULATION POTENTIAL

The influence of any concentration of population from one part of an area to another may be expressed as the number of people in that concentration multiplied by its distance to the spot at which its potential is being assessed[26]. This potential has great significance with the regard to the relationship between Roman and native, assuming that distance of the sites from Roman establishments, and degree of concentration of the possible native population within their populated areas, are effective criteria of this relationship. The method is best shown mapped by means of isopleths with an interval expressed in terms of number of settlements per mile. In the

case of the north of England, the points for interpolation may be located in the centre of the local groups of population. This arbitary assessment takes into account conformation of the landscape and ease of interconnection between sites within the same area. The potential of each of the points has then been calculated by the formula:

$$nd = P$$

where n is the number of settlements in a local group, d is the distance and P is the potential.

The population potential at each centre of native population will be the sum of the influence of all other centres upon it, plus its own influence upon itself. The method reveals the great concentrations of potential in some areas, strongly illustrating the effect of distance of numbers of native sites from their nearest Roman sites, and how rapidly potential increases with distance, especially if the number of settlements is high.

Westmorland

In Westmorland, the relationship between the distribution of Roman and that of the native, is fairly marked[27]. Despite the relatively small value of the average distance of each group of native sites from the nearest Roman fort,(the highest value is only 8.6 miles for the Haweswater area); the potential values are quite high for much of the County[28]. The Roman

system of roads neatly bisects the County, and the distribution of Roman forts is related to the major route through the Eden valley, and the southern route over Shap. The densest area of native settlement is clearly between the Eden valley and the fort of Low Burrow Bridge. Map 37 emphasises this fact, but the thousand foot contour shows how cut off are the north and south areas. The Crosby Ravensworth, Crosby Garrett, Asby and Shap Fells provide a very effective barrier to southward penetration of Roman and native alike, and it is clear that the majority of native sites on the map must have had greater contact with the Roman forts in the Eden valley than the forts further to the south. (This assumes occupation during the Roman period). The highest concentrations of populations occur in the latter areas, and the lowest in the Eden valley itself, and the lowlands south of the Fells. The Isoline Map[29], illustrates further the dichotomy between Roman and native in Westmorland. The ridge of high potential follows the line of the south Eden valley hills where a high number of sites are sited at the furthest possible points from the Roman forts, within the limits of physiographic and climatic suitability. The deliberation of this phenomenon is a point to wonder at. Are the majority of the native sites Romano-British in origin with settlement deliberately out of reach of Roman jurisdiction? Or are they the result of the driving back of the indigenous

peoples by the penetrating Romans from the south? A third possibility is that our concept of the area is distorted by the intensive cultivation of the valley floor throughout the centuries. The air survey of east Northumberland by Dr.N.McCord illustrates this possibility.

Lake District

For the Lake District as a whole, the pattern of relationship is quite clear. The central Cumbrian block, as we would expect, is a zone of high isolation, and this is continued in the east in the Yorkshire Pennines. The third major zone of isolation is in the Furness peninsula. The pre-Roman origin of the hill forts in this area is discussed above, and caution should be observed therefore, when we talk of settlement isolation in the south. The zones of low potential stand out in the north of the Lake District, due to the influence of Hadrian's Wall and its curtain of forts, and also in the Eden valley, a major routeway across the Pennines. The low zone in the south below the central block is caused by the chain of forts from Brougham, through Ambleside and Hardknot to Ravenglass on the coast, and south from Brougham through Low Burrow Bridge to Watercrook and Overborough. In the north-west, the corridor from Carlisle south-westward through Old Carlisle and Papcastle to Moresby and Maryport, stands out as a zone of low potential. The general affect of the isoline map is

the seeming avoidance of Roman populated areas by the native population. The cause and effect of this phenomena are different matters altogether.

Northumberland

The complex nature of native settlement in Northumberland demands a base-map to show the distribution of settlement. Map 29 does not attempt to distinguish those sites which are known to be occupied during the Roman period, nor does it attempt to illustrate the number of sites within a particular area. A scatter diagram[30] plots the number of sites with the arbitarily defined groups against the average distance of those sites from Roman forts. As one might expect most of the Roman forts are situated within reasonable distance from centres of native population. The unknown quantities may be summed up as follows:

a. The evidence that native sites are of Roman date;
b. That Roman forts were strategically sited with a consideration of native settlement;
c. That the native population settled with a consideration of Roman sites.

The extent of native settlement in Northumberland during the Roman period is an unknown quantity. It is probable that the majority were occupied at some time during the hundreds of years of Roman occupation of the north. Lack of material

evidence is no indication of lack of existence. The delimitation of the 52 groups of sites is entirely arbitary and based upon close study of the landscape. The number of sites within the Groups varies from 1 to 67, and the average distance in miles from the theoretical focal point of each of the areas to the nearest Roman fort varies from 1 to the extreme of 25[31]. The relationship between the number of settlements within the Groups and the average distance of the sites within that Group from the nearest Roman fort, produces the isoline map of population potential[32]. The map brings out the differences between the areas with a high density of native population, close to, and at some distance from, Roman forts.

The north Cheviot sites stand out as the highest zone of population potential, with a significant density of settlements in the fringing hills of the Cheviot proper between the Roman forts of Cappuck, Chew Green, and Learchild. The zone stretching across to the coast continues the high potential, with Learchild as the focal point of all the sites in the north Northumberland coastal plain as well as the Cheviot. The importance of the area will be discussed later in the chapter. The second high zone is situated in the triangle of Learchild, High Rochester and the Roman Wall at Portgate, in the valley of the Upper Pont. The density of native settlement is so marked in this area, that the question of Roman influence is again brought to the

surface. The distribution of rectangular sites between the Simonside hills and the Wall is closely related to the network of Roman roads and the distribution of Roman forts. This is aptly illustrated on the population potential isoline map[33].

The extremely low potential of the southern part of Northumberland, indicates basically a lack of native settlement. The area of sparse settlement around Chew Green extending southwards along the route through High Rochester and Risingham, may be geared to a subconscious (or conscious) encirclement of either an area of resettlement or of a Romanized native population. Deliberation in road and fort siting is extremely difficult to establish, but the triangle of Roman roads does suggest planning with some aim in mind; noteably, the development of the area within. (Development in the loosest sense - economically, socially, politically or strategically). The eastern coastal plain of the County shows low potential of population, especially in the valley of the Aln towards Learchild. The potentials of the area are discussed in chapter 7.

CORRELATION

The north Cheviot area provides us with an interesting case-study of the relationship between the line of a probable Roman road north from Low Learchild to the mouth of the Tweed, and the native settlements on the fringe of the north Cheviot

hills. One mile zones were established parallel to the road on the west side, and the settlements counted within these zones.[34] The only settlements used for this examination were stone-built settlements of George Jobeys' for this area.[35] He noted their distribution on convenient slopes or limited gravel flats above the spate level of burns in three main areas of the Breamish Gorge, Brands Hill, and Happy valley, and the feeders of the Bowmont and the Glen. Most importantly, he concluded from the dateable evidence that occupation was generally from the second to the fourth century A.D. with possible continuity of occupation into the post-Roman period, for the stone-built hut. Link with the Roman road in the area might therefore be substantial.

Using the Product Moment Correlation Coefficient of Pearson[36], the correlation between the average distance of those stone-built native settlements from the Roman road is significant to the degree of +0.64[37]. This indicates a substantial relationship between distance and number. Settlement is dense both near and far from the road. For three miles west of the road, the number of sites is only four. Between four and five miles from the road there are twenty-nine sites. Twenty sites are scattered between five and nine miles, and then a cluster of twenty-two sites occurs between nine and eleven miles. The positive correlation value tells us that there was

a probability of a connection between sites in the west and the road, and the fairly high value of +0.64 tells us that there may have been some deliberation in siting a good distance from the Roman line. The Bowmont and Glen are isolated valleys outside immediate Roman jurisdiction. The high density of settlement gives the impression of a desire for isolation. One can only assume that this was from a particular group; in other words, the Romans. Inhospitality of the landscape and difficulty of communication lend extra weight to the suggestion of a deliberate siting policy in a remote area. The choice of a harsher enviroment to live in than that of adjacant areas, must have had a foundation in the relationship with the Roman invaders. The lack of evidence of first century occupation indicates a minimum of contact during that time. The stone-built nature of the Romano-British settlements probably comes from trade contacts and not from deliberate Roman policy: This,in addition to the probable deforestation of the landscape. However, it is dangerous to say that the native population may have been subjected to a close control by the Roman military. In all probability, the native was left to his own devices, except when the question of tax or recruitment arose; then, the Roman machine would act. The correlatory evidence of settlement and routeway, does show a hesitation of siting especially in the region within a few miles of the Roman road.

A more comprehensive method of examination of the relationship between Roman and native, would be to examine this in respect of Roman forts and stone-built settlements.[38] The forts of Cappuck, Chew Green, High Rochester and Low Learchild were used as focal points for communication. The number of settlements and their distance from the nearest Roman fort were correlated, and the result came out as significant to the degree of +0.899, indicating a very high correlation and strong relationship between the two variables. Generally speaking, except at extreme distances from Roman forts, the further away from a fort, the greater the density of native settlement.[39] Up to a distance of six miles from any fort, the number of native stone-built sites totals only nine, but between seven and ten miles there are fourty-two sites, and between ten and eleven miles there are twenty-six sites. The inference of deliberation is hard to ignore in this remote situation. A graph showing this number of sites/distance relationship[40], clearly illustrates the trend towards increase in settlement density with increase in distance from Roman forts. The significance of this is the same as that of the previous correlation.

1 Richmond, I.A.,'Romans in Redesdale',(1940), p.67.
2 Tacitus, 'Agricola', p.20.

3 Jobey, G.,'Homesteads and Settlements of the Frontier Area', in C.B.A.Research Report No.7.,'Rural Settlement in Roman Britain', (1966), 1-14.

4 Blake, B.,'Excavations of Native(Iron Age) sites in Cumberland, 1956-8', CW2, LIX (1959), 1-14.

5 Blake, B, (1959), 1-14.

6 Blake, B.,(1959), 1-14.

7 Richmond, I.A., and Romans, T., and Wright, R.P.,'A civilian bath-house of the Roman period at Old Durham', AA4, XXII (1944), p.15.

8 Ant.,'Native Settlements in Northumberland', XVII (1943), 136-147.

9 a.Brooches suggest Votadinian area. Arch., LXXX (1930),37-58.
b.Epigraphic evidence for presence of Rhaetian pikemen - Raeti gaesati, c.A.D.160 at Aesica.(E.E.1191, AA3, V (1909), p.158; Risingham, early 3rd.century; and Jedburgh, NCH, XV (1940), pp.96 and 135.
Both a. and b. are tenuous evidence of population transfer from Rhaetia as a deliberate act calculated to influence the shape of native homesteads.

10 PPS, VIII (1942), 148-161.

11 Wagner, F.,'Prehistoric Fortifications in Bavaria', Antiq., (1928), II, 43-55.

12 Jobey, G., (1966),p.1.

13 Steer, K.,'John Horsley and the Antonine Wall', in the 5th., Horsley Memorial Lecture, (1963).

14 Fair, M.C.,'Roman and Britain.A theory for future establishment of facts', CW2, XLIII (1943), 82-86.

15 Collingwood, R.G.,'Castle How, Peel Wyke', CW2, XXIV (1924), p.83.

16 Collingwood, R.G., (1924), 78-87.
Curwen, F., CW2, XI (1911), 118-121.

17 Collingwood, R.G., (1924), 78-87.

18 CW2, XXIII (1923), p.252.

19 Ward, J.C.,'Notes on Archaeological Remains in the Lake District', CW1, III (1878), p.247.
Collingwood, R.G., (1924), p.82.

20 Taylor, M.W.,'On the vestiges of Celtic occupation near Ullswater', CW1, I (1874), 157-161. Taylor notes that Dunmallet as well as Maiden Castle, Soulby Fell Ullswater, to be out of line with known Roman roads of the district.
Ward, J.C., (1878), p.248.

21 Collingwood, W.G.,'Castlesteads, Natland', CW2, VIII (1908), 108-112.

22 Map 23

23 Collingwood, R.G.,'The last years of Roman Cumberland', CW2, XXIV (1924), 247-255.

Collingwood, W.G., (1925).
Swainson-Cooper, H.,'The Ancient Settlements, Cemeteries and Earthworks of Furness', Arch., LIII (1889), 389-426.
Jopling, C.M.,'A letter to George Godwin on the subjects of remains ascribed to the era of the Druids in Furness, north of Lancs.', Arch., XXXI (1846), 448-453.
Dobson, J.,'Stone Close, Urswick', CW2, XII (1912), 277-284.
Collingwood, R.G., (1933), 163-200.

24 Powell, T.G.E.,'Excavations at Skelmore Heads near Ulverston', CW2, LXIII (1962), 1-30.
25 Swainson-Cooper, H.,(1889), 389-426.
26 Monkhouse, F.J., and Wilkinson, H.R., (1964), p.303.
27 Map 36 Westmorland Roman and Native.
28 Appendix 16 Westmorland Population Potential based on the number of Native Sites in areal groups and the average distance of these groups from Roman forts.
29 Map 38 Westmorland Population Potential Isoline Map.
30 Diagram 19 Northumberland Roman Native Relationship.
31 Appendix 17 Northumberland Population Potential based upon the number of sites within a region and the average distance of that region from the nearest Roman fort.
32 Map 39 Northumberland Population Potential Isoline Map.
33 Map 39
34 Map 40 North Northumberland Roman Native Relationships.
35 Jobey, G., (1964), 41-64.
36 Monkhouse, F.J., and Wilkinson, H.R.,(1964), p.303.
37 Appendix 18 Correlation between the number of stone-built settlements in regional zones and the average distance of those settlements from the Roman road on the east, north of Low Learchild fort.
38 Map 41 North Northumberland Stone-Built settlements and Roman forts.
39 Appendix 19 Correlation between the number of stone-built native settlements and their distance from the nearest Roman fort in north Northumberland.
40 Diagram 20 North Northumberland Stone-Built settlements and Roman forts.

CONCLUSION

An investigation into historical/geographical relationships is the response of a number of basic questions: how, where, why, in what manner, which and when. Applied to siting factors, or possible reasons for siting, and settlement layout, the search for a reasonable answer has been the major aim of this thesis. It is well known that questions begat questions; in this sense the thesis has been successfullin attaining its goal. The answer to the questions is a matter for further research.

The physical background has been dealt with in some detail but in one sense, unless the complexity of geology and soils, climate and vegetation, land quality, relief and drainage, is applied to each individual native site, where we are certain of its Iron Age occupation, then a thorough analysis cannot be said to have taken place. Here arises another problem. The pattern of settlement examined in this thesis is hypothetical to a great extent, merely because of the lack of information aquired through systematic excavation. Surmise must therefore take the place of fact in many cases. If we back this surmise with good evidence we justify our application.

One of the real gaps in knowledge is evident in the urgent need for comprehensive soil maps of northern England together with the accurate mapping of moraine deposits. This especially

applied to the Lake District where there was probably a small margin of survival between the flooded and wooded valleys and the exposed mountain tops. To plot this margin against known sites with perhaps an isoline construction of percentage deviation from the margin which is the norm, might throw some additional light upon occupation of mountain areas during the pre-Roman and Roman Iron Age.

The extent of the settlement at Catcote in County Durham on the glacial deposits, points to the possibility of a much greater spread of settlement than we have evidence for. Town development, agriculture and coal mining have all taken their toll of the landscape. The high peninsula of Durham City may well have been occupied during the period under examination. This introduces the problem of the relationship of topography to geology - whether native sites were more influenced by one or the other. We can produce evidence that many native sites, especially the defensive types in north Northumberland were situated almost entirely according to the lie of the land. Then we may observe the lowland sites of east Northumberland and note the favouring of low, flat, irrigible land, presumeably for some type of agriculture. Evidence for or against this must be established as soon as possible.

We have touched upon the evolution of climate and vegetation and noted the harsh climatic conditions that could have existed.

However, the matter is entirely relative; very much worse climatic conditions existed in Central and Eastern Europe and Scandinavia and yet noth these areas produced their native cultures. Sub-arctic conditions may have existed in the Scottish highlands or even the northern Pennines during winter, but migration to lower, warmer regions may have answered this problem. The question of migration is especially interesting as it may yet prove an answer to the problems of some settlements found at extreme altitudes. These may have been merely summer high pasturing headquarters.

The application of a great deal more pollen analysis, preferably to the whole extent of the north of England, would be wholly desireable. Unfortunately we must make do with bog areas which are limited in extent, and more importantly, in age. However, there is still much evidence to be gathered from this quarter, particularly close to known native occupied sites. The method could establish the extent of cereal cultivation in a context of time and relative importance in the economy. The quality of the land would have been critical, whether the economy was agriculturally or pastorally based. A pastoral/agricultural ratio for different areas and a constructed isoline map might be a possibility.

How much of a barrier were the Pennines? We appear to have a great cultural difference between the sites of the south side of the Eden valley and those to the east of the Pennines. The

Romans straddled the hills with Hadrian's Wall and the Stainmore gap series of forts, but the indigenous population had already evolved in its own particular manner reflecting local physiography and cultural contacts, probably from the south. East-west contact lacks positive evidence. The native sites in the hill country of the north are found mainly upon and around the six hundred foot contour. On map 27, of the 77 sites, 63 are above 500 feet and 59 below 1000 feet. In north Tynedale, the height of siting is probably more a reflection of communications and siting by major routeways of the stream and river valleys, than any particular choice of height. In north-east Northumberland, sandstone cuestas attract defensive conditions of siting in contrast to the south Northumberland farmsteads sited on the flat coastal plain.

The method of analysis involved the selection of three major factors of siting and applying these to three different arbitarily chosen areas. Several questions immediately arise out of the examination. How important were south-facing slopes? What was the time and length of occupation of visible sites? Were the settlements sited on a family, tribal or nation basis? Is the choice of three areas for examination justifiable; and is the density of settlement in an area important when selecting a sample area? The explanation of these questions was attempted, along with possible answers, in Chapter 5.

The techniques of analysing were limited to a few, but they gave some indication of their potential when applied to historical

problems. All techniques are justifiable in research in the hope that a new angle instead of a repetition of all the old ones, might be arrived at. The use of a triangular graph is fairly common where three groups of data are to be compared. The data used in this case has all been weighted to values between one and a hundred as is conventional. The resultant groupings of sites according to the three factors may then be interpreted according to their particular position in the triangle, and the comparative relationship assessed. Apart from these techniques of mapping, the use of statistics in testing association between data, adds new depth to the investigation. Quantitative analysis has long been missing in the study of historical evidence, especially where this evidence may be digitised.

The choice siting factors is limited to those which may be put into numerical form. The three major factors chosen for particular study illustrate a number of points which might otherwise have been unexposed. The dominance of the north-east quadrant of aspect for the North Cheviot sites is especially noticeable. Does this reflect potential danger from that quarter, coincidence, or geological structure of the area? The wide extent of the rolling foothills of the Cheviots precludes the natives from finding it obligatory to site on the outside of the massif. Many south facing slopes offer the same if not better siting conditions. We must therefore look for some other cause.

Interest in the north is the likeliest explanation. The reason for this interest is a subject for further research. It would be interesting to examine the direction of facing of the Iron Age sites to the north of the Tweed and see if a comparable pattern emerges. The domination of Yeavering Bell, and to a lesser extent Humbleton Hill, pushes the mind to a logical sequence of thought; that the former site was the 'provincial capital' of this zone of Iron Age occupation.

The Bellingham/Kirkwhelpington area illustrates valley siting in preference to hilltop sites, implying generally more peaceful living conditions. The dominance of the site on Great Wanney Crag must be noted. The Crosby Ravensworth and Asby area of Westmorland presents one of the most fascinating problems to the archaeologist. The low average degree of aspect indicates a nucleation of development as shown by the local character of structure of the farmstead communities which have no apparant parallels elsewhere in the north.

The degree of intercommunication between settlement, presuming co-existent occupation, may be reflected in the study of the degree of intervisibility between sites. The pattern of distribution is similar to that of the degree of aspect, one increasing with the other. The anomolies to this are closely studied and make one realise that some other factor of siting probably enters in. The search for these factors is not entirely within the scope

of this thesis but deserves closer consideration.

The distance of sites from water is usually small in the north of England because of the complexity of the drainage pattern. However, it is noticeable that occupation avoids limestone areas with its infrequent streams and rivers, and occurs below the springline.

In detail, the study of comparative relationships is more valuable as it places types of native sites in their correct contrasting context. In the north Cheviot area there is a substantial relationship between aspect and intervisibility but a negative one between distance from water and aspect. This is an expected pattern because of the abruptness of the landscape. In contrast Bellingham/Kirkwhelpington native sites do not consider water as a major factor in siting, and generally the three factors are relatively small in importance. Crosby Ravensworth parish has extreme variability in the values of the three selected variables, illustrating the diversity of regional siting. Substantial correlations were noted between water distance and aspect and intervisibility and aspect.

In the west, there proved to be a negligible relationship between the average height above sea-level of native sites within parishes and the number of sites within the parishes; therefore the areal distribution was not a product of a close connection between siting on high ground and inter-site relationship.

We must look for some other reason for siting along the Eden valley. The village sites were advanced in structural development with more than a hint of sophistication. Did the evolution of the villages take place locally, or was migration to the Eden valley responsible for the appearance of this culture or sub-culture as we may term it?

The Chi-Squared Test was used to measure the association between the three sample regions using the three variable factors of siting. The result of the Test proved that only to the extent of 0.2% was there any chance of the areas being related by anything other than conicidence. The value of this Test is considerable as it shows quantitatively that choice of region was arbitary.

The final chapter is concerned with the relationship between Roman and native in the north of England. Romanisation, and all that it implies, and the degree of Romanisation of the native element, are both non-quantitative in their full meanings, but specific aspects may be dealt with in numerical form. There is much to be said for the assumption that as distance between Roman and native increases the degree of Romanisation decreases. This assumes an inverse relationship being constant. This may have been true generally but local conditions of landform structure, coincident occupation, and the importance of the surrounding landscape in providing food for the Roman militia

would have influenced the relationship.

The application of the idea of population potential assumes the inverse relationship between Romanisation and distance from the nearest Roman site. The native settlements are fairly easily areally grouped and the estimated focal point assessed. In Westmorland, the highest zones of potential follow the south side of the Eden valley as one might expect, and pose four basic questions already referred to:

i) Are the majority of native sites Romano-British in origin?

ii) Are they sites deliberately far from Roman routes and forts?

iii) Is the siting a result of driving back of the indigenous peoples by the penetrating Romans from the south?

iv) Have we missed many native sites on the floor of the Eden valley and adjacant valleys?

Central Cumbria is a zone of high isolation which is continued into the Yorkshire Pennines and Furness. Did native population avoid Roman centres deliberately? In Northumberland, in one sense, we know even less abouththe Roman/native relationship. Are native sites of Roman date or a product of continuity? We have seen that this probably varies with the region and the shape of known settlement. Were the Roman forts strategically sited with a consideration of existing native settlement? Did the

native population settle in various areas because of the Roman sites? The answers to these questions are of prime importance and could fundamentally alter our present notion of motives behind Roman movement in the north throughout the period of occupation. However, one point that must never be forgotten is that lack of material evidence for occupation is no indication of lack of existence.

Two statistical correlations were attempted using two relationships, native stone-built settlements against a Roman road and against Roman forts in the north Cheviot area. The former relationship came out at +0.64 and the latter +0.899; both high correlations, and a guide towards a desire for isolation of the native element in the valleys of the Bowmont and the Glen. The inference is hard to ignore.

Future research in this field must be concerned with attempting to answer the questions put forward in this summing-up. There is no conclusion as such, as this implies an answer. In history there is no such thing as an answer, but rather a plateau of ideas formulated from known evidence. Additional knowledge changes the shape of this plateau, either lowering or heightening it, but it never remains static. That is the reason why the study of history can be so exciting.

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APPENDIX 1

CORRELATION BETWEEN RAINFALL AND DEFENDED NATIVE SITES IN NORTH ENGLAND

RAINFALL BELT IN INCHES X	NUMBER OF SITES ÷ AREA OF BELT Y	X^2	Y^2	XY
Under 25"	1.83	625	3.35	45.75
25-30"	1.09	900	1.19	32.7
30-35"	0.71	1225	0.55	24.85
35-40"	1.22	1600	1.49	48.8
40-45"	1.9	2025	3.61	85.5
45-50"	2.4	2500	5.76	120
50-55"	1.58	3025	2.5	86.9
55-60"	10.0	3600	100	600
60-65"	1.55	4225	2.4	100.75
65-70"	1.45	4900	2.1	101.5
70-75"	2.8	5625	7.84	210
75-80"	2.7	6400	7.29	216
80-100"	1.3	10000	1.69	130
ΣX 730	ΣY 30.53	ΣX^2 46650	ΣY^2 139.77	ΣXY 1802.75

USING FORMULA WHERE $$r = \frac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}}$$

Then $$r = \frac{(13 \times 1803) - (730 \times 30)}{\sqrt{(13 \times 46650) - (730)^2)(13 \times 140) - (30)^2)}}$$

$$\therefore r = \frac{23439 - 21900}{\sqrt{(606450 - 532900)(2820 - 900)}} \qquad \therefore r = \frac{1539}{\sqrt{73550 \times 920}}$$

$$\therefore r = \frac{1539}{\sqrt{67666000}} \qquad \therefore r = \frac{1539}{81652} \qquad \therefore \underline{\underline{r = +0.188}}$$

APPENDIX 2

CORRELATION BETWEEN DEGREE OF ASPECT OVER ONE MILE AND DEGREE OF INTERVISIBILITY FOR NATIVE SITES IN THE NORTH CHEVIOT

SITE NUMBER	DEGREE OF INTERVISIBILITY X	DEGREE OF ASPECT Y	X^2	Y^2	XY
1	5	35	25	1225	175
2	3	55	9	3025	165
3	5	320	25	102400	1600
4	3	220	9	48400	660
5	4	210	16	44100	840
6	16	360	256	129600	5760
7	5	155	25	24025	775
8	6	180	36	32400	1080
9	4	160	16	25600	640
10	5	165	25	27225	825
11	5	220	25	48400	1100
12	5	325	25	105630	1625
13	4	210	16	44100	840
14	3	125	9	15625	375
15	5	40	25	1600	200
16	3	105	9	11025	315
17	4	210	16	44100	840
18	5	150	25	22500	750
19	7	360	49	129600	2520
20	3	140	9	19600	420
21	5	155	25	24025	775
22	1	150	1	22500	150
23	5	125	25	15625	625
24	5	100	25	10000	500
25	5	145	25	21025	725
26	3	180	9	32400	540
27	4	220	16	48400	880
28	3	170	9	28900	510
29	6	170	36	28900	1020
30	6	185	36	34225	1110
31	7	180	49	32400	1260
32	6	220	36	48400	1320
33	5	190	25	36100	950
34	8	180	64	32400	1440
35	6	130	36	16900	780
36	3	190	9	36100	570
37	2	30	4	900	60
38	2	270	4	72900	540
39	3	220	9	48400	660
40	0	0	0	0	0
41	0	40	0	1600	0
	$\leq X$ 185	$\leq Y$ 6995	$\leq X^2$ 1095	$\leq Y^2$ 1482280	$\leq XY$ 35920

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2)}}$

APPENDIX 3

CORRELATION BETWEEN DISTANCE FROM WATER SOURCE AND ASPECT FOR NATIVE SITES IN THE NORTH CHEVIOT

SITE NUMBER	DISTANCE FROM WATER SOURCE X Yds.	DEGREE OF ASPECT Y	X^2	Y^2	XY
1	270	35	72900	1225	9450
2	190	55	36100	3025	10450
3	300	320	90000	102400	96000
4	160	220	25000	48400	45200
5	240	210	57600	44100	50400
6	310	360	96100	129600	111600
7	30	155	900	24025	4650
8	90	180	8100	32400	16200
9	40	160	1600	25600	6400
10	120	165	14400	27225	19800
11	210	220	44100	48400	46200
12	350	325	122500	105630	113750
13	310	210	96100	44100	65100
14	230	125	52900	15625	28750
15	160	40	25600	1600	6400
16	180	105	32400	11025	18900
17	460	210	211600	44100	96600
18	410	150	168100	22500	61500
19	390	360	152100	129600	140400
20	450	140	202500	19600	63000
21	150	155	22500	24025	23250
22	160	150	25600	22500	24000
23	15	125	225	15625	975
24	420	100	176400	10000	42000
25	600	145	360000	21025	87000
26	500	180	250000	32400	90000
27	320	220	102400	48400	70400
28	260	170	67600	28900	44200
29	15	170	225	28900	2550
30	45	185	2025	34225	8325
31	30	180	900	32400	5400
32	50	220	2500	48400	11000
33	40	190	1600	36100	7600
34	45	180	2025	32400	8100
35	50	130	2500	16900	6500
36	320	190	102400	36100	60800
37	70	30	4900	900	2100
38	50	270	22500	72900	40500
39	120	220	14400	48400	26400
40	30	0	900	0	0
41	70	40	4900	1600	2800
	ΣX 8360	ΣY 6995	ΣX^2 3277700	ΣY^2 1482280	ΣXY 575650

USING FORMULA WHERE $r = \dfrac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{(n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}}$

Then $r = (41 \times 575650) - (8360 \times 6995)$

APPENDIX 4

CORRELATION BETWEEN DEGREE OF INTERVISIBILITY AND DISTANCE FROM WATER SOURCE FOR NATIVE SITES IN THE NORTH CHEVIOT

SITE NUMBER	DEGREE OF INTERVISIBILITY X	DISTANCE FROM WATER SOURCE Y Yds.	X^2	Y^2	XY
1	5	273	25	74529	1365
2	3	193	9	37249	579
3	5	306	25	93636	1530
4	3	166	9	27556	498
5	4	243	16	59049	972
6	16	316	256	99856	5056
7	5	33	25	1089	165
8	6	96	36	9216	576
9	4	43	16	1849	172
10	5	123	25	15129	615
11	5	213	25	45369	1065
12	5	350	25	122500	1750
13	4	313	16	97969	1252
14	3	230	9	52900	690
15	5	166	25	27556	830
16	3	183	9	33489	549
17	4	466	16	217160	1864
18	5	410	25	168100	2050
19	7	396	49	156820	2772
20	3	450	9	202500	1350
21	5	150	25	22500	750
22	1	166	1	27556	166
23	5	16	25	256	80
24	5	426	25	181480	2130
25	5	600	25	360000	3000
26	3	503	9	253010	1509
27	4	323	16	104330	1292
28	3	263	9	69169	789
29	6	16	36	256	96
30	6	46	36	2116	276
31	7	33	49	1089	231
32	6	50	36	2500	300
33	5	43	25	1849	215
34	8	46	64	2116	368
35	6	53	36	2809	318
36	3	323	9	104330	969
37	2	73	4	5329	146
38	2	153	4	23409	306
39	3	120	9	14400	330
40	0	33	0	1089	0
41	0	70	0	4900	0
	$\leq X$ 185	$\leq Y$ 8475	$\leq X^2$ 1093	$\leq Y^2$ 2728024	$\leq XY$ 39471

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2)}}$

Then $r = (41 \times 39471) - (185 \times 8475)$

APPENDIX 5

CORRELATION BETWEEN DEGREE OF ASPECT OVER ONE MILE AND DEGREE OF INTERVISIBILITY IN BELLINGHAM/KIRKWHELPINGTON

SITE NUMBER	DEGREE OF INTERVISIBILITY X	DEGREE OF ASPECT Y	X^2	Y^2	XY
1	1	70	1	4900	70
2	3	45	9	2025	135
3	5	75	25	5625	375
4	5	25	25	625	125
5	3	40	9	1600	120
6	1	30	1	900	30
7	3	145	9	21025	435
8	2	240	4	57600	480
9	3	100	9	10000	300
10	2	10	4	100	20
11	2	165	4	27225	330
12	2	220	4	48400	440
13	1	185	1	34200	185
14	8	250	64	62500	2000
15	3	0	9	0	0
16	2	0	4	0	0
17	2	50	4	2500	100
18	1	0	1	0	0
19	2	20	4	400	40
20	2	140	4	1960	280
21	1	200	1	40000	200
22	2	200	4	40000	400
23	3	90	9	8100	270
24	4	150	16	22500	600
25	5	100	25	10000	500
26	3	130	9	16900	390
27	3	180	9	32400	540
28	2	210	4	44100	420
29	2	80	4	6400	160
30	3	120	9	14400	360
31	1	0	1	0	0
32	3	0	9	0	0
33	3	200	9	40000	600
34	1	200	1	40000	200
35	1	90	1	8100	90
36	3	200	9	40000	600
37	0	110	0	12100	0
	$\leq X$ 93	$\leq Y$ 4070	$\leq X^2$ 315	$\leq Y^2$ 656610	$\leq XY$ 10795

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2}}$

Then $r = \dfrac{(37 \times 10795) - (93 \times 4070)}{\sqrt{((37 \times 315) - (93)^2)((37 \times 656610) - (4070)^2)}}$

$r = \dfrac{(399115) - (378510)}{\sqrt{(378510)}}$

APPENDIX 6

CORRELATION BETWEEN DISTANCE FROM WATER SOURCE AND DEGREE OF ASPECT FOR NATIVE SITES IN BELLINGHAM/KIRKWHELPINGTON

SITE NUMBER	DISTANCE FROM WATER SOURCE X Yds.	DEGREE OF ASPECT Y	X^2	Y^2	XY
1	200	70	40000	4900	14000
2	50	45	2500	2025	2250
3	350	75	122500	5625	26250
4	250	25	62500	625	6250
5	350	40	122500	1600	14000
6	200	30	40000	900	6000
7	50	145	2500	21025	7250
8	400	240	160000	57600	96000
9	250	100	62500	10000	25000
10	150	10	22500	100	1500
11	150	165	22500	27225	24750
12	100	220	10000	48400	22000
13	300	185	90000	34225	55500
14	150	250	22500	62500	37500
15	50	0	2500	0	0
16	300	0	90000	0	0
17	50	50	2500	2500	2500
18	50	0	2500	0	0
19	50	20	2500	400	1000
20	250	140	62500	1960	35000
21	800	200	640000	40000	160000
22	200	200	40000	40000	40000
23	250	90	62500	8100	22500
24	300	150	90000	22500	31500
25	50	100	2500	10000	5000
26	150	130	22500	16900	19500
27	150	180	22500	32400	18900
28	300	210	122500	44100	73500
29	650	80	422500	6400	52000
30	650	120	422500	14400	78000
31	100	0	10000	0	0
32	100	0	10000	0	0
33	200	200	40000	40000	40000
34	100	200	10000	40000	20000
35	200	90	40000	8100	18000
36	200	200	40000	40000	40000
37	100	110	10000	0	11000
	$\leq X$ 8250	$\leq Y$ 4070	$\leq X^2$ 2952500	$\leq Y^2$ 644510	$\leq XY$ 1006650

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2}}$

Then $r = \dfrac{(37 \times 1006650) - (8250 \times 4070)}{\sqrt{((37 \times 2952500) - (8250)^2)((37 \times 644510) - (4070)^2}}$

APPENDIX 7

CORRELATION BETWEEN DEGREE OF INTERVISIBILITY AND DISTANCE FROM WATER SOURCE FOR NATIVE SITES IN BELLINGHAM/KIRKWHELPINGTON

SITE NUMBER	DEGREE OF INTERVISIBILITY X	DISTANCE FROM WATER SOURCE Y Yds.	X^2	Y^2	XY
1	1	200	1	40000	200
2	3	50	9	2500	150
3	5	350	25	122500	1750
4	5	250	25	62500	1250
5	3	350	9	122500	1050
6	1	200	1	40000	200
7	3	50	9	2500	150
8	2	400	4	160000	800
9	3	250	9	62500	750
10	2	150	4	22500	300
11	2	150	4	22500	300
12	2	100	4	10000	200
13	1	300	1	90000	300
14	8	150	64	22500	1200
15	3	50	9	2500	150
16	2	300	4	90000	600
17	2	50	4	2500	100
18	1	50	1	2500	50
19	2	50	4	2500	100
20	2	250	4	62500	500
21	1	800	1	640000	800
22	2	200	4	40000	400
23	3	250	3	62500	750
24	4	300	16	90000	1200
25	5	50	25	2500	250
26	3	150	9	22500	450
27	3	150	9	22500	450
28	2	350	4	122500	700
29	2	650	4	422500	1300
30	3	650	9	422500	1950
31	1	100	1	10000	100
32	3	100	9	10000	300
33	3	200	9	40000	600
34	1	100	1	10000	100
35	1	200	1	40000	200
36	3	200	9	40000	600
37	0	100	0	10000	0
	$\leq X$ 93	$\leq Y$ 8250	$\leq X^2$ 315	$\leq Y^2$ 2952500	$\leq XY$ 20250

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2)}}$

Then $r = \dfrac{(37 \times 20250) - (93 \times 8250)}{\sqrt{((37 \times 315) - (93)^2)(37 \times 2952500 - (8250)^2)}}$

$r = 749250 - 767250$

APPENDIX 8

CORRELATION BETWEEN ASPECT AND DEGREE OF INTERVISIBILITY AT CROSBY RAVENSWORTH AND ASBY

SITE NUMBER	DEGREE OF ASPECT X	DEGREE OF INTERVISIBILITY Y	X^2	Y^2	XY
1	280	1	78400	1	280
2	230	2	52900	4	460
3	190	2	36100	4	380
4	120	2	14400	4	240
5	80	4	6400	16	320
6	0	2	0	4	0
7	95	5	9025	25	475
8	70	3	4900	9	210
9	20	3	400	9	60
10	50	3	2500	9	150
11	60	2	3600	4	120
12	60	2	3600	4	120
13	0	2	0	4	0
14	0	1	0	1	0
15	70	2	4900	4	140
16	115	0	13225	0	0
17	220	1	48400	1	220
18	180	3	32400	9	540
19	110	1	12100	1	110
20	90	1	8100	1	90
21	10	1	100	1	10
22	75	1	5625	1	75
	ΣX 2125	ΣY 44	ΣX^2 337075	ΣY^2 116	ΣXY 4000

USING FORMULA WHERE $r = \dfrac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}}$

Then $r = \dfrac{(22 \times 4000) - (2125 \times 44)}{\sqrt{(22 \times 337075) - (2125)^2)(22 \times 116) - (44)^2)}}$

$r = \dfrac{88000 - 93500}{\sqrt{(7415650 - 4515625)(2552 - 1936)}}$

$r = \dfrac{-5000}{\sqrt{2900025 \times 616}}$ $\therefore r = \dfrac{-5000}{\sqrt{1786415400}}$ $\therefore r = \dfrac{-5000}{42262}$

$\therefore r = -0.118$

APPENDIX 9

CORRELATION BETWEEN DEGREE OF ASPECT AND DISTANCE FROM WATER SOURCE OF NATIVE SITES AT CROSBY RAVENSWORTH AND ASBY

SITE NUMBER	DEGREE OF ASPECT X	DISTANCE FROM WATER SOURCE Y	X^2	Y^2	XY
1	280	1050	78400	1102500	294000
2	230	500	52900	250000	115000
3	190	550	36100	302500	104500
4	120	950	14400	902500	96900
5	80	350	6400	22500	28000
6	0	100	0	10000	0
7	95	350	9025	122500	33250
8	70	300	4900	90000	21000
9	20	150	400	22500	3000
10	50	250	2500	62500	12500
11	60	200	3600	40000	12000
12	60	200	3600	40000	12000
13	0	700	0	490000	0
14	0	350	0	122500	0
15	70	550	4900	302500	38500
16	115	1400	13225	1960000	161000
17	220	1350	48400	1822500	297000
18	180	200	32400	40000	36000
19	110	850	12100	722500	93500
20	90	400	8100	160000	36000
21	10	300	100	90000	3000
22	75	300	5625	90000	22500
	ΣX 2125	ΣY 11350	ΣX^2 337075	ΣY^2 8867500	ΣXY 1419650

USING FORMULA WHERE $r = \dfrac{n\Sigma XY - \Sigma X\Sigma Y}{\sqrt{(n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}}$

Then $r = \dfrac{(22 \times 1419650) - (2125 \times 11350)}{\sqrt{((22 \times 337075)-(2125)^2)((22 \times 8867500) - (11350)^2)}}$

$r = \dfrac{(31232300 - 24118750)}{\sqrt{(7415650 - 4515625)(195085000 - 128822500)}}$

$r = \dfrac{7113550}{\sqrt{2900025 \times 66262500}}$ $\quad \therefore r = \dfrac{7113550}{\sqrt{192162906562500}}$

$\therefore r = \dfrac{7113550}{13856000}$ $\quad \therefore r = +0.513$

APPENDIX 10

CORRELATION BETWEEN THE DEGREE OF INTERVISIBILITY OF NATIVE SITES AND THEIR DISTANCE FROM WATER SOURCE AT CROSBY RAVENSWORTH AND ASBY

SITE NUMBER	DEGREE OF INTERVISIBILITY X	DISTANCE FROM WATER SOURCE Y	X^2	Y^2	XY
1	1	1050	1	1102500	1050
2	2	500	4	250000	1000
3	2	550	4	302500	1100
4	2	950	4	902500	1900
5	4	350	16	122500	1400
6	2	100	4	10000	200
7	5	350	25	122500	1750
8	3	300	9	90000	900
9	3	150	9	22500	450
10	3	250	9	62500	750
11	2	200	4	40000	400
12	2	200	4	40000	400
13	2	700	4	490000	1400
14	1	350	1	122500	350
15	2	550	4	302500	1100
16	0	1400	0	1960000	0
17	1	1350	1	1822500	1350
18	3	200	9	40000	600
19	1	850	1	722500	850
20	1	400	1	160000	400
21	1	300	1	90000	300
22	1	300	1	90000	300
	$\leq X$ 44	$\leq Y$ 11350	$\leq X^2$ 116	$\leq Y^2$ 8867500	$\leq XY$ 17950

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2)}}$

Then $r = \dfrac{(22 \times 17950) - (44 \times 11350)}{\sqrt{((22 \times 116)-(44)^2)((22 \times 8867500)-(11350)^2)}}$

$r = \dfrac{(394900 - 499400)}{\sqrt{(2552 - 1936)(195085000 - 128822500)}}$

$r = \dfrac{-104500}{\sqrt{616 \times 66262500}}$ $\quad \therefore r = \dfrac{-104500}{\sqrt{40817700000}}$

$\therefore r = \underline{\underline{-104500}}$ $\quad \therefore \underline{\underline{r = -0.517}}$

APPENDIX 11

CORRELATION BETWEEN THE AVERAGE HEIGHT ABOVE SEA LEVEL OF NATIVE SITES IN WESTMORLAND PARISHES AND THE NUMBER OF SITES WITHIN THOSE PARISHES

PARISHES	AVERAGE HEIGHT X Feet	NUMBER OF SITES Y	X^2	Y^2	XY
ASBY	888	6	777444	36	5328
ASKHAM	905	4	819025	16	3620
BAMPTON	1085	4	1177225	16	4340
BARTON	890	2	792100	4	1780
CROSBY RAVENSWORTH	998	11	806404	121	9878
CROSBY GARRETT	1000	3	1000000	9	3000
DUFTON	920	1	846400	1	920
HUGILL	790	1	634100	1	790
KENTMERE	635	1	403225	1	635
KIRKBY LONSDALE	430	2	184900	4	860
KIRKBY STEPHEN	725	1	525625	1	725
LEVENS	240	2	57600	4	480
LOWTHER	725	1	525625	1	725
MALLERSTANG	710	1	504100	1	710
MARTINDALE	910	1	828100	1	910
MARTON LONG	589	1	346921	1	589
LUNE VALLEY	463	5	214369	25	2315
MURTON	550	1	302500	1	550
NATEBY	760	1	577600	1	760
NATLAND	608	1	369664	1	608
NEWBIGGIN	584	2	342056	4	1168
PATTERDALE	590	4	348100	16	2360
SHAP	833	3	693889	9	2499
WAITBY	822	6	675684	36	4932
WARCOP	630	4	396900	16	2520
WHARTON	740	3	547600	9	2220
WINDEMERE	896	1	802816	1	896
YANWORTH AND EAMONT BRIDGE	536	3	287296	9	1608
BARBON	280	1	78400	1	280
STAINMORE	1600	2	2560000	4	3200
	ΣX 22932	ΣY 79	ΣX^2 18425668	ΣY^2 351	ΣXY 61206

USING FORMULA WHERE $r = \dfrac{n\Sigma XY - \Sigma X\Sigma Y}{\sqrt{(n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}}$

Then $r = \dfrac{(30 \times 61206) - (22932 \times 79)}{\sqrt{((30 \times 18425668) - (22932)^2)((30 \times 351) - (79)^2)}}$

$r = \dfrac{1836180 - 1811628}{\sqrt{(552770040 - 525876624)(10530 - 6241)}}$

APPENDIX 12

CORRELATION BETWEEN DEGREE OF INTERVISIBILITY AND HEIGHT ABOVE MEAN SEA LEVEL FOR NATIVE SITES IN BELLINGHAM/KIRKWHELPINGTON

SITE NUMBER	DEGREE OF INTERVISIBILITY X	HEIGHT ABOVE MEAN SEA LEVEL Y Feet	X^2	Y^2	XY
1	1	460	1	211600	460
2	3	525	9	275630	1575
3	5	560	25	313600	2800
4	5	520	25	270400	2600
5	3	600	9	360000	1800
6	1	550	1	302500	550
7	3	675	9	455630	2025
8	2	725	4	525630	1450
9	3	660	9	435600	1980
10	2	475	4	225630	950
11	2	830	4	688900	1660
12	2	755	4	570030	1510
13	1	825	1	680630	825
14	8	1025	64	1050900	8200
15	3	720	9	518400	2160
16	2	725	4	525630	1450
17	2	745	4	555030	1490
18	1	690	1	476100	690
19	2	775	4	600630	1550
20	2	810	4	656100	1620
21	1	825	1	680630	825
22	2	730	4	532900	1460
23	3	760	9	577600	2280
24	4	780	16	608400	3120
25	5	810	25	656100	4050
26	3	860	9	739600	2580
27	3	840	9	705600	2520
28	2	730	4	532900	1460
29	2	690	4	476100	1380
30	3	790	9	624100	2370
31	1	700	1	490000	700
32	3	670	9	448900	2010
33	3	800	9	640000	2400
34	1	800	1	640000	800
35	1	790	1	624100	790
36	3	910	9	828100	2730
37	0	775	0	600630	0
	$\leq X$ 93	$\leq Y$ 26910	$\leq X^2$ 314	$\leq Y^2$ 20104230	$\leq XY$ 68830

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2)}}$

Then $r = \dfrac{(37 \times 68830) - (93 \times 26910)}{\sqrt{((37 \times 314) - (93)^2)((37 \times 20104230) - (26910)^2)}}$

$r = \dfrac{2546710 - 2502630}{\sqrt{(11618 - 8649)(743856510 - 724292100)}}$

APPENDIX 13

ANALYSIS OF TRIANGULAR GRAPH FOR THREE SAMPLE AREAS SHOWING RELATIVE SITING PULLS OF DISTANCE FROM WATER SOURCE, DEGREE OF ASPECT AND DEGREE OF INTERVISIBILITY

SITING PULLS	BELLINGHAM KIRKWHELPINGTON	CROSBY RAVENSWORTH AND ASBY	NORTH CHEVIOT
	(All Figures are percentages of total sites within area)		
A>B+C	0	5	0
C>B	2.8	5	2.3
B>C	0	5	2.3
A>B	8.5	15	0
A>C	8.5	10	9.2
C>A+B	5.6	5	2.3
B>A+C	2.8	0	11.5
B>A	2.8	0	2.3
C>A	0	0	6.9
B = C	0	5	2.3
A = B	8.5	10	2.3
C = A	5.6	10	2.3
INSIDE LARGE CENTRAL TRIANGLE	48.5	30	50
OUTSIDE LARGE CENTRAL TRIANGLE	5.6	0	4.6

PULLS ACCORDING TO SHADED AREAS WITHIN TRIANGLE	BELLINGHAM KIRKWHELPINGTON	CROSBY RAVENSWORTH AND ASBY	NORTH CHEVIOT
2 factors <20% & 1 factor >60%	0	5	5.5
1 factor <20%	42	60	53

APPENDIX 14

ANALYSIS OF PULL DOMINANCE FOR THREE SAMPLE AREAS IN NORTH ENGLAND

All Figures expressed are percentages of the total number of sites analysed in that region.

		BELL./KIRK.	CROS.RAV.	N.CHEV.
DISTANCE FROM WATER SOURCE	A > B+C	0	4.2	0
	A > B	8.4	12.6	0
	A > C	8.4	8.4	10
	A = B	8.4	8.4	2.5
DEGREE OF ASPECT	B > A+C	2.8	0	12.5
	B > A	2.8	0	2.5
	B > C	0	4.2	2.5
	B = C	0	4.2	2.5
DEGREE OF INTERVISIBILITY	C > A+B	5.6	4.2	2.5
	C > B	2.8	4.2	2.5
	C > A	0	0	7.5
	C = A	2.8	8.4	2.5
CENTRAL MAJOR LARGE TRIANGLE				
2 factors <20% & 1 factor >60%		0	0	0
1 factor <20%		14	12.6	20
No factors >40% & <20%		19.6	12.6	5.0
Blank Area		22.4	16.8	30

APPENDIX 15

MEASURE OF THE ASSOCIATION BETWEEN BELLINGHAM/KIRKWHELPINGTON, CROSBY RAVENSWORTH AND ASBY, AND THE NORTH CHEVIOT.

USING THE χ^2 TEST WHERE: $\chi^2 = \sum \frac{(O - E)^2}{E}$

WHERE O IS THE OBSERVED FREQUENCY AND
E IS THE EXPECTED OR THEORETICAL FREQUENCY

	BELL./KIRK.	CROS.RAV.	N.CHEVIOT.	TOTAL
A>B+C	0	1	0	1
C>B	1	1	1	3
B>C	0	1	1	2
A>B	3	3	0	6
A>C	3	2	4	9
C>A+B	2	1	1	4
B>A+C	1	0	5	6
B>A	1	0	1	2
C>A	0	0	3	3
B = C	0	1	1	2
A = B	3	2	1	6
C = A	2	2	1	5
Inside △	17	6	21	44
Outside △	2	0	2	4
	35	20	42	97

EXPECTED FREQUENCIES:

BELL./KIRK.	CROS.RAV.	N.CHEVIOT.
0.36	0.2	0.43
1.0	0.61	1.29
0.72	0.41	0.86
2.1	1.2	2.5
3.2	1.8	3.8
1.4	0.82	1.7
2.1	1.2	2.5
0.72	0.41	0.86
1.0	0.61	1.29
0.72	0.41	0.86

USING THE χ^2 FORMULA:

$$\chi^2 = \frac{0.36^2}{0.36} + \frac{0.8^2}{0.2} + \frac{0.43^2}{0.43} + \frac{0^2}{1} + \frac{0.39^2}{0.61} + \frac{0.29^2}{1.29} + \frac{0.72^2}{0.72} +$$

$$\frac{0.59^2}{0.41} + \frac{0.14^2}{0.86} + \frac{0.9^2}{2.1} + \frac{1.8^2}{1.2} + \frac{2.5^2}{2.5} + \frac{0.2^2}{3.2} + \frac{0.2^2}{1.8} +$$

$$\frac{0.2^2}{3.8} + \frac{0.6^2}{1.4} + \frac{0.18^2}{0.82} + \frac{0.7^2}{1.7} + \frac{1.1^2}{2.1} + \frac{1.2^2}{1.2} + \frac{2.5^2}{2.5} +$$

$$\frac{0.28^2}{0.72} + \frac{0.41^2}{0.41} + \frac{0.14^2}{0.86} + \frac{1^2}{1} + \frac{0.61^2}{0.61} + \frac{1.71^2}{1.29} + \frac{0.72^2}{0.72} +$$

$$\frac{0.59^2}{0.41} + \frac{0.14^2}{0.86} + \frac{0.9^2}{2.1} + \frac{0.8^2}{1.2} + \frac{1.5^2}{2.5} + \frac{0.2^2}{1.8} + \frac{1^2}{1} + \frac{1.1^2}{2.1} +$$

$$\frac{1.2^2}{15.8} + \frac{3^2}{9} + \frac{2^2}{19} + \frac{0.6^2}{1.4} + \frac{0.82^2}{0.82} + \frac{0.3^2}{1.7}$$

$$\therefore \chi^2 = 28.476$$

THE NUMBER OF DEGREES OF FREEDOM IS (NUMBER OF ROWS - 1)x(NUMBER OF COLUMNS -1), WHICH IS 12x2 = 24. REFERENCE TO A TABLE FOR THE χ^2 DISTRIBUTION SHOWS THAT FOR $\chi 2$ = 28.476 WITH 24 DEGREES OF FREEDOM, THE DIFFERENCE BETWEEN THE DISTRICTS IS SIGNIFICANT AT THE 0.2 % PROBABILITY LEVEL.

HENCE,THE THREE DISTRICTS ARE RELATED TO THE DEGREE OF ABOUT 0.2 % USING THE SITING FACTORS OF DISTANCE FROM WATER SOURCE, DEGREE OF ASPECT AND DEGREE OF INTERVISIBILITY.

THE METHOD TESTS THE NULL HYPOTHESIS THAT THE OBSERVED RESULTS DO NOT DIFFER SIGNIFICANTLY FROM THOSE WHICH ARE EXPECTED BY CHANCE.

APPENDIX 16

WESTMORLAND - POPULATION POTENTIAL BASED ON NUMBER OF NATIVE SITES IN AREAL GROUPS AND AVERAGE DISTANCE OF THESE GROUPS FROM ROMAN FORTS

GROUP NAME	NUMBER OF SITES	AVERAGE DISTANCE IN MILES	POPULATION POTENTIAL
1 Eden Valley	8	6 + 8 + 9	23
2 Newbiggin	2	2.25	4.5
3 Lowther Valley	6	3.75	22.5
4 Askham	3	5.3	15.9
5 Ullswater	2	6.75	13.5
6 Patterdale	5	6.8	34
7 Haweswater	5	8.6	43
8 Hugill	3	4.2	12.6
9 Gilpindale, Levens	3	2.8	8.4
10 Upper Lune Valley	2	3.75	7.5
11 Kirkby Lonsdale	2	3.25	6.5
12 Lower Lune Valley	4	5.125	20.5
13 Shap	7	7.625	53.375
14 Crosby Ravensworth	11	7.8	85.8
15 Asby Fells	6	7.6	45.6
16 Kirkby Stephen	15	5.43	81.5
17 Maiden Castle	1	0	0

APPENDIX 17

NORTHUMBERLAND - POPULATION POTENTIAL BASED UPON THE NUMBER OF SITES WITHIN A REGION AND THE AVERAGE DISTANCE OF THAT REGION FROM THE NEAREST ROMAN FORT

REGION NUMBER	NUMBER OF SITES	AVERAGE DISTANCE IN MILES	POPULATION POTENTIAL
I	9	25	225
II	7	18	126
III	3	16	48
IV	8	17	136
V	11	20	220
VI	5	11	55
VII	67	18	1206
VIII	14	15	210
IX	14	14	196
X	3	12	36
XI	16	9	144
XII	20	9	180
XIII	6	10	60
XIV	13	8	104
XV	1	12	12
XVI	33	7	221
XVII	16	3	48
XVIII	7	3	21
XIX	2	8	16
XX	4	8	32
XXI	1	5	5
XXII	4	3	12
XXIII	3	8	24
XXIV	10	7	70
XXV	4	10	40
XXVI	7	7	49
XXVII	17	9	153
XXVIII	2	4	8
XXIX	4	13	52
XXX	6	13	78
XXXI	3	13	39
XXXII	11	2	22
XXXIII	15	16	240
XXXIV	3	6	18
XXXV	7	7	49
XXXVI	51	8	408
XXXVII	9	7	63
XXXVIII	22	5	110
XXXIX	11	8	88
XL	4	11	44
XLI	11	5	55
XLII	14	4	56
XLIII	7	6	42
XLIV	4	5	20
XLV	1	2	2
XLVI	5	2	10
XLVII	4	1	4

APPENDIX 18

CORRELATION BETWEEN THE NUMBER OF STONE BUILT SETTLEMENTS IN REGIONAL ZONES AND THE AVERAGE DISTANCE OF THOSE SETTLEMENTS FROM THE ROMAN ROAD ON THE EAST, NORTH OF LOW LEARCHILD FORT

REGIONS	NUMBER OF SETTLEMENTS X	AVERAGE DISTANCE FROM ROMAN ROAD Y Miles	X^2	Y^2	XY
1	2	0.5	4	25	10
2	1	1.5	1	225	15
3	1	2.8	1	784	28
4	29	3.5	841	1225	1015
5	3	4.6	9	2116	138
6	12	5.5	144	3025	660
7	3	6.3	9	3969	189
8	2	7.4	4	5476	148
9	1	8.2	1	6724	82
10	13	9.5	169	9025	1235
11	9	10.4	81	10816	936
	$\leq X$ 76	$\leq Y$ 60.2	$\leq X^2$ 1264	$\leq Y^2$ 53410	$\leq XY$ 4456

USING FORMULA WHERE $r = \dfrac{n\leq XY - \leq X \leq Y}{\sqrt{(n\leq X^2 - (\leq X)^2)(n\leq Y^2 - (\leq Y)^2)}}$

Then $r = \dfrac{(11 \times 4456) - (76 \times 60.2)}{\sqrt{((11 \times 1264) - (76)^2((11 \times 53410) - (60.2)^2)}}$

$r = \dfrac{49016 - 4575.2}{\sqrt{((13904 - 5776)(587510 - 3624))}}$

$r = \dfrac{44440.8}{\sqrt{8138 \times 583886}}$ $\quad \therefore r = \dfrac{44440.8}{\sqrt{4751663268}}$

$\therefore r = \dfrac{44440.8}{68935}$ $\quad \therefore \underline{\underline{r = +0.64}}$

APPENDIX 19

CORRELATION BETWEEN THE NUMBER OF STONE BUILT NATIVE SETTLEMENTS AND THEIR DISTANCE FROM THE NEAREST ROMAN FORT IN NORTH NORTHUMBERLAND

MILES FROM ROMAN FORT X	NUMBER OF SITES Y	X^2	Y^2	XY
UP TO 1 MILE	0	1	0	0
1-2 MILES	2	4	4	4
2-3 "	1	9	1	3
3-4 "	2	16	4	8
4-5 "	3	25	9	15
5-6 "	1	36	1	6
6-7 "	11	49	121	77
7-8 "	14	64	196	112
8-9 "	7	81	49	63
9-10 "	11	100	121	110
10-11 "	26	121	676	286
11-12 "	3	144	9	36
12-13 "	4	169	16	52
13-14 "	5	196	25	70
14-15 "	4	225	16	60
X TO TOTAL OF 15 MILES FROM FORTS IS 15	ΣY 94	ΣX^2 1240	ΣY^2 1248	ΣXY 902

USING FORMULA WHERE $r = \dfrac{n\Sigma XY - \Sigma X \Sigma Y}{\sqrt{(n\Sigma X^2 - (\Sigma X)^2)(n\Sigma Y^2 - (\Sigma Y)^2)}}$

Then $r = \dfrac{(15 \times 902) - (15 \times 94)}{\sqrt{((15 \times 1240) - (15)^2)((15 \times 1248) - (94)^2)}}$

$r = \dfrac{13530 - 1410}{\sqrt{(18600 - 225)(18720 - 8836)}}$ $\therefore r = \dfrac{12120}{\sqrt{18375 \times 9884}}$

$\therefore r = \dfrac{12120}{\sqrt{181618500}}$ $\therefore r = \dfrac{12120}{13476}$ $\therefore \underline{\underline{r = +0.899}}$