The Distribution of Settlement in Southern Pictland

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THE following paper is based on a lecture given by the authors at the Society's annual conference, held at Dundee, in 1973.

SINCE WAINWRIGHT'S clear definition of the Pictish problem nearly twenty years ago, many scholars have added valuable information relating to various aspects of its solution. Recent publications have concentrated largely on careful scrutiny of the literary works of the Picts and their contemporaries as well as on detailed analyses and comparative studies of Pictish art. It is generally accepted that past generations of archaeologists, lacking modern sophisticated dating techniques, failed to differentiate Pictish material from that of a general iron age context; but now this difficulty is being overcome, although archaeologists still have little conception of the social and economic organization of the Pictish peoples as revealed by domestic artifacts. Despite the paucity of archaeological material, the historical geographer can make a significant contribution; first, by analysing spatial relationships, and secondly, through an environmental approach based on the recognition that a fundamental relationship exists between a society and its environment. Both these approaches are employed in this study of Pictish settlement.

Among theories that have been put forward already by various authors are those of Wainwright,[1] who hinted at an indefinite association between the Picts and souterrains, and of Whittington and Soulsby,[2] who were able to draw positive conclusions from a comparison of the distribution of *pit* place names with soils and the agricultural potential of the environment. A relationship between the Picts and timber-laced forts has been demonstrated at Burghead[3] where radio-carbon dates indicated construction in the 4th century A.D.; while the discovery at Craig Phadrig of a clay mould for an escutcheon of a hanging-bowl together with 'E' ware, and radio-carbon dates from the same site indicate the reuse of such forts within the period of the historical Picts[4]; at Cullykhan also the excavator has postulated Pictish reuse of the vitrified fort[5]. Other relationships, hitherto

[1] Wainwright (1955). For shortened references, see List of Sources, p. 65.
[2] Whittington and Soulsby (1968).
[3] Small (1969).
[4] Small and Cottam (1972).
[5] Greig (1972).

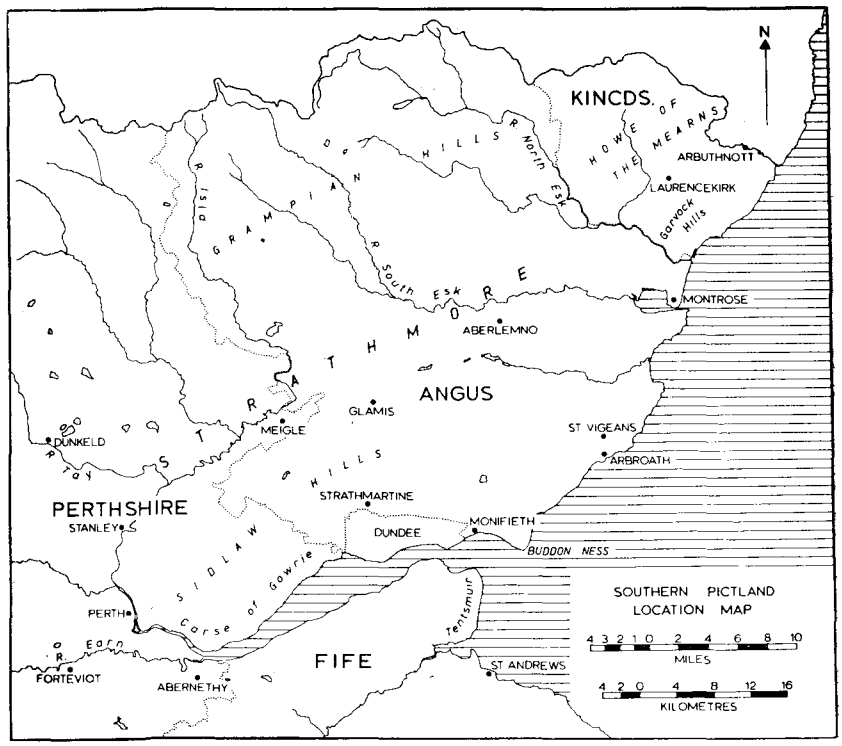

FIG. 4
MAP OF SOUTHERN PICTLAND
as defined in text (p. 45)

undiscovered or unnoticed, may also exist, and it is the purpose of this paper to explore these possibilities.

Geographical analysis tends to begin with a distribution map, a simple visual aid equally familiar to archaeologists and geographers, yet readily susceptible to subjective misinterpretation. Because a distribution map in itself represents only a series of points in space which are difficult to compare or relate to environmental features, more sophisticated statistical techniques have been applied in recent years. The assignment of some sort of spatial value to archaeological material is not an unreasonable approach, as it must be accepted generally that the significance of, for example, a hillfort extends beyond its immediate locality, and that that of a symbol stone is not confined to the very spot upon which it stands. Clearly any monument or artifact represents activity over a wider area and must be regarded as having a spatial component which can be represented in various ways; these include the use of Thiessen polygons, the overlay on a map of a network of squares or hexagons, and the analysis of spheres of influence.

The first of these techniques recently has become quite fashionable among archaeologists working on the distribution of hillforts in southern England,[6]

[6] Cunliffe (1971); Hogg (1971).

but the application of the technique has certain disadvantages, in that it is necessary to assume contemporaneity of data, and also moderate homogeneity of landscape. In the S. of England, where relatively more accurate knowledge has been obtained about the hillforts themselves as well as their occupants, the technique may be quite valid and produce useful results. In Scotland many hillforts are located in areas too high for permanent occupation, and there is a greater diversity of landscape because of the wider variety of rocks. Furthermore, a number of forts at least are known to be of several periods, and excavation may prove that many more fall into this category. In view of these difficulties, construction of Thiessen polygons would be unreliable in this instance.

FORTS AND CLASS I SYMBOL STONES

The area studied in this paper comprises part of southern Pictland, stretching from the Grampian watershed in the N. to central Fife in the S., and E. from the coast as far W. inland as Dunkeld (FIG. 4). It has no special significance beyond the fact that it contains a wealth of Pictish symbol stones, and provides a convenient sample area in which to test certain hypotheses.

FIG. 5 illustrates the distribution of forts within the area, with an hexagonal grid superimposed to give a spatial value to each fort. Hexagons are used in this type of geographical analysis, rather than squares or other shapes, because they are the closest approximation to the ideal form, a circle, which utilizes all available space. The size of the hexagons and positioning of the grid ideally should be such that no hexagon would contain more than one fort; but in practice this is not possible, as instances occur where two forts are located very close to one another, and the best compromise has to be affected, such that a reasonably sized territory is assigned to each fort. In this case the territory works out at approximately 20 sq. km.

Within the area regional groupings of forts may be differentiated. The four major concentrations are in the Dunkeld area where the R. Tay debouches into the Vale of Strathmore, at the head of the Tay estuary around Perth, in the central part of the Sidlaw Hills, and at the NE. extremity of these hills. Apart from one or two forts on the highland margin there is no penetration of the highland zone. A more objective assessment of the spacing or grouping of forts can be made using the technique of 'nearest neighbour analysis'; this is a method developed by biologists but subsequently used by geographers to "compare settlement patterns and to estimate the probable amount of environmental influence on settlement".[7] For any given distribution an index value (N.N.I.) can be computed ranging from zero for maximum aggregation, through unity for a random distribution, to a maximum of 2.15 for complete dispersion. The index value for the distribution of forts shown in FIG. 5 was 0.54. This confirms that a considerable amount of clustering or grouping occurs, and that the environment exerts a marked influence over the distribution of the forts.

Carved stone monuments form the most important body of field evidence for

[7] Haggett (1972).

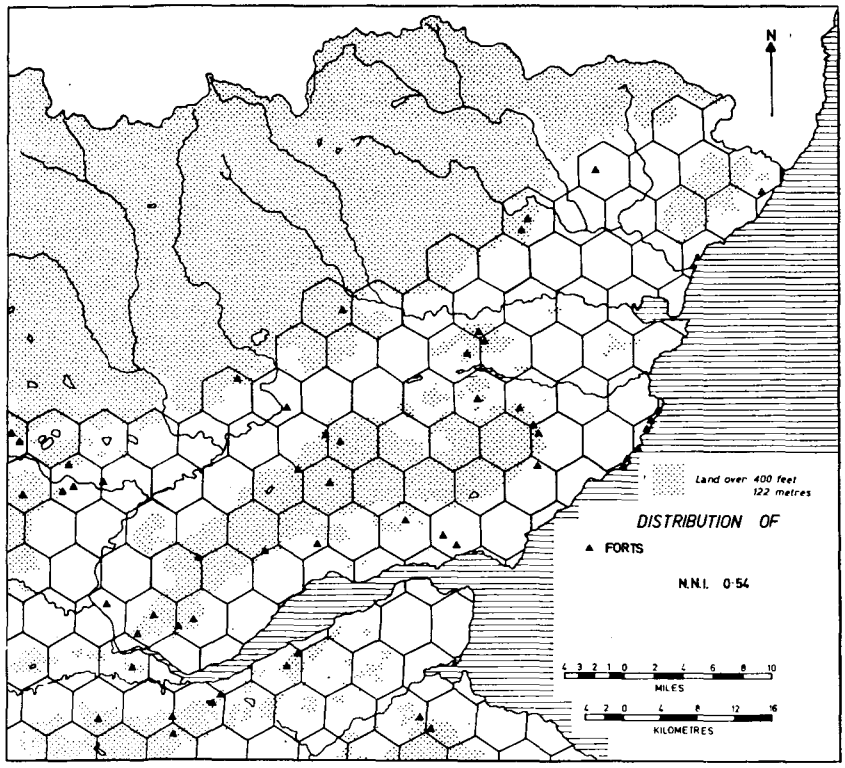

FIG. 5
DISTRIBUTION OF FORTS
in southern Pictland (p. 45)

the Picts recognized at the present time; these are usually divided into three classes. The earliest, Class I, is characterized by symbols, of uncertain significance, incised on usually undressed boulders. Class II has relief carving on a prepared slab and incorporates the Christian cross as well as Pictish symbols. Class III, the last in chronological sequence, has no symbols. This third class is somewhat unsatisfactory for it covers a long period of time and a variety of artistic forms. The urgent need for a full reappraisal of this group, however, does not preclude its use in this paper, nor in any way affect the conclusions derived from its distribution. A large number of the Pictish monuments, particularly of Classes II and III, was destroyed at the time of the Reformation and it is somewhat difficult to assign existing fragments to either class. Furthermore, the mutilation which took place in the wake of the Reformation was uneven in its distribution in Pictland. In some cases stones were said to have been pulverized, whereas in other parts the monuments appear to have suffered no damage whatsoever. In statistical terms these factors do not appear to invalidate the arguments which follow.

The distribution of Class I symbol stones (FIG. 6) does not show the same tendency to cluster as in the case of the forts; the nearest neighbour index of

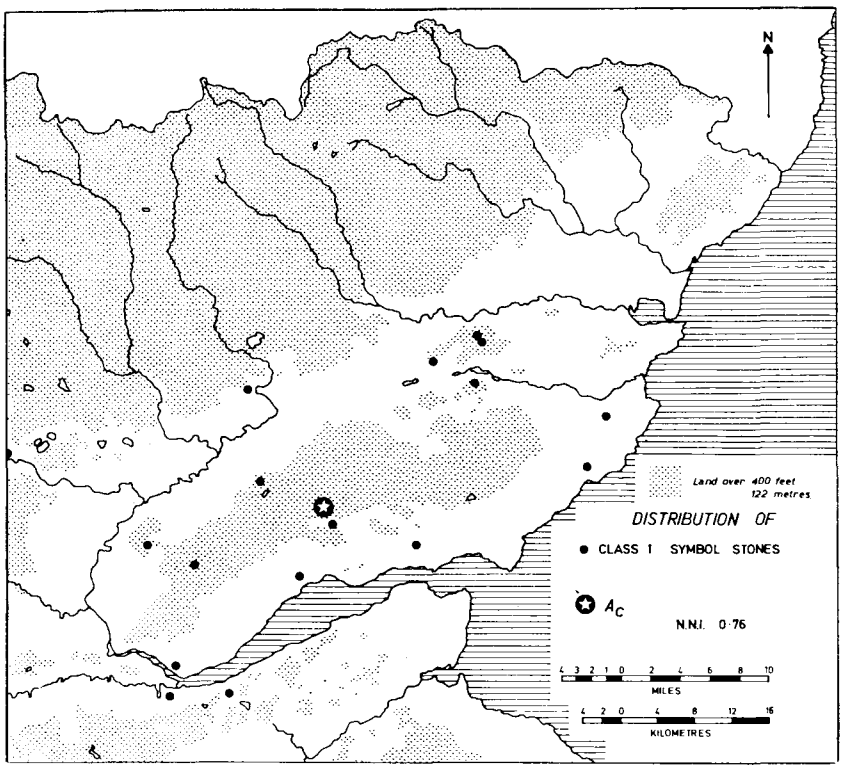

FIG. 6
DISTRIBUTION OF CLASS I SYMBOL STONES
in southern Pictland (p. 46 f.)

0.76 verges towards the random part of the scale. It would seem, therefore, that the environment does not exert as much control over the distribution of Class I stones as of forts. The arithmetic mean centre (AC) of the distribution also was computed and plotted. This is one of the most sensitive measures of average position, affected by every item in the distribution, and is invaluable in assessing shifts in total distributions over periods of time.[8] It will be used to compare the distribution of all classes of symbol stones.

Comparison between FIGS. 5 and 6 indicates a degree of conformity in the two distributions. To elucidate this, a more generalized map of fort groupings and territories was drawn (FIG. 7) and Class I symbol stones were plotted on it. It can be seen that only in a few instances does a symbol stone lie beyond the territorial compass of a fort, and then not significantly so. All the areas which appear negative as far as the distribution of forts is concerned are also negative with respect to the distribution of Class I symbol stones. Thus at face value a positive association between the two distributions is indicated. An objective

[8] Neft (1966).

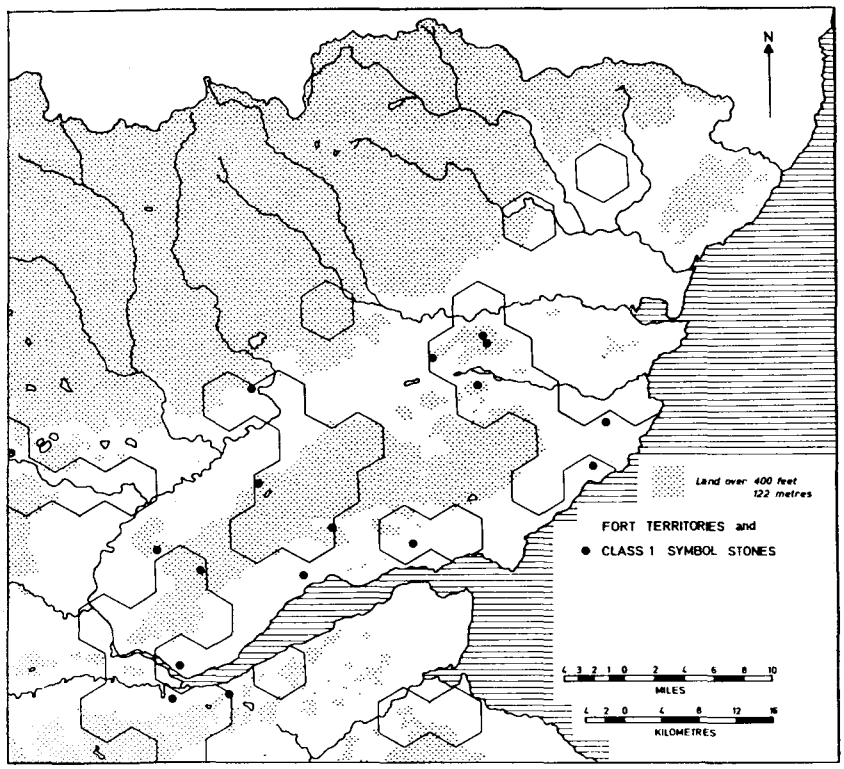

FIG. 7
FORT TERRITORIES AND CLASS I SYMBOL STONES
in southern Pictland (p. 47 f.)

assessment of the degree of association can be made employing Spearman's rank correlation technique[9]. The use of a 10-km. grid, based on the National Grid, gave a correlation coefficient of 0.83 which is highly significant at the 1 per cent. level. This result, however, must be treated with some caution as it is extremely dependent upon the size and positioning of the grid and is also affected by the high proportion of blank squares. As a check on its validity the same technique was applied to assessing the relationship between forts and cup-marked stones, standing stone monuments, and urned cists, none of which has any postulated association with Pictish symbol stones. These tests gave correlation coefficients of 0.66, 0.52 and 0.56 respectively, all of which are significant at the 1 per cent. level. A positive relationship thus was established between forts and distributions which would appear totally unconnected. Such a result almost certainly reflects the continuous use of particular environments over long periods of time, and the nearly total rejection of unfavourable areas. The correlation between forts and Class I symbol stones (0.83) is significantly different from that between forts and cup-marked stones (0.66), but the validity of the method is rendered dubious in absolute terms.

[9] Gregory (1963).

It is safe to conclude only that there is a higher correlation between the distribution of forts and Class I symbol stones than any of the other tested distributions. A further association between souterrains and Class I symbol stones (correlation coefficient 0.75) was also established, thus lending tentative support to Wainwright's belief that the Picts had some connexion with these souterrains. Souterrains are known to range over more than a millennium, and until more is known of their purpose there would seem to be little advantage in the pursuance of this problem.

The drawing of any firm conclusions from the above analysis would be unwise, but a tentative relationship between the Picts and forts was postulated as a basis for further investigation. This was attempted by means of a stochastic model incorporating a probability matrix,[10] whereby a grid is constructed over an area and probabilities assigned to each square in the matrix, and then a theoretical distribution is built up by drawing numbers from a random numbers table. This method was performed initially on a purely environmental basis. FIG. 8 illustrates how the area was divided into three zones. Zone 1 is land over 250 m. above sea-level which on modern empirical evidence may be regarded as unsuitable for permanent occupation. Zone 2 represents the remainder of the land surface which may be considered unsuitable for occupation because of steep slopes, poor drainage and other factors. Zone 3 is land considered suitable for occupation. It is inferred that Pictish symbol stones are indicative of settlement areas. This is based on the premise that irrespective of the nature or function of these symbol stones, none has yet been found in zones described here as unsuitable for occupation (one exception does occur among Class III symbol stones but is probably a freak location), and it is unlikely, therefore, that they were divorced from settlement areas. Matrix squares in zone 1 were assigned a probability value of 1 in 100 based on the extreme unlikelihood of this area being used for settlement; zone 2 received a value of 1 in 10 based on the results of Whittington and Soulsby's survey; zone 3 was given a value of 1 in 1. The same number of theoretical sites as actual (17) was chosen by random numbers. FIG. 9 illustrates the result of the application of this method. Some similarities can be seen to exist between the theoretical and actual distributions; the respective nearest neighbour indices are 0.66 and 0.76. (The former indicates a considerable degree of environmental control, but this is to be expected since such an hypothesis was built into the model.) But, on the whole, the theoretical distribution does not compare well with the actual distribution, although it is confined almost exclusively to areas favourable to settlement. This suggests that some additional factor influenced the location of symbol stones, and that the control was not purely environmental.

Distribution of forts has been shown already to bear some correlation to the distribution of Class I symbol stones; a weighting system was devised therefore within the stochastic model to favour fort areas. Zones 1 and 2 were assigned the same probability values as previously; zone 3 was modified so that only squares in the matrix housing a fort and adjacent squares were given a 1 in 1 chance of selection; other squares in zone 3 were assigned a 1 in 3 chance. FIG. 10 illustrates

[10] Everson and Fitzgerald (1969).

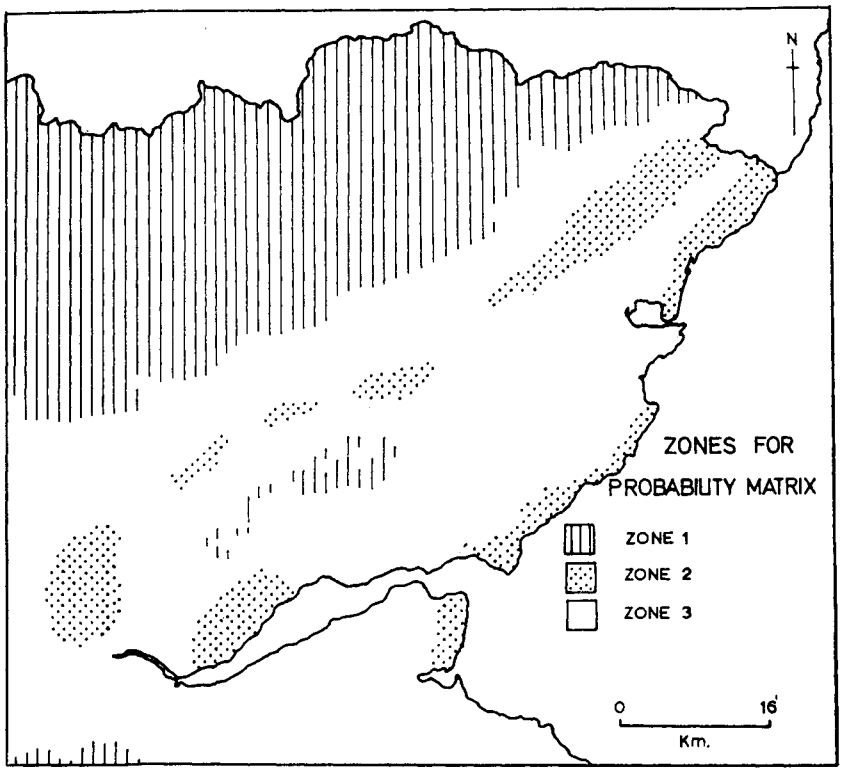

FIG. 8
ZONES FOR PROBABILITY MATRIX
in southern Pictland (p. 49)

the similarity to the actual distribution. The new theoretical distribution has a nearest neighbour index of 0.78. It would seem possible on these grounds to suggest with some certainty that two of the prime factors accounting for the distribution of Class I symbol stones were the availability of suitable land for settlement and the distribution of forts. Until more is known of the forts themselves, it is not possible to qualify the nature of this relationship any further.

Forts are known to span over a thousand years, though it is by no means likely that they were occupied continuously. To a warlike people such as the Picts forts would offer a suitable refuge in times of strife; some ruined and disused forts were probably refurbished for temporary or, perhaps, semi-permanent use, while others such as Burghead[11] were actually built at this time. All forts are likely to have been used in this intermittent way, but only the evidence from Craig Phadrig[12] and Cullykhan[13] makes it reasonable to assert that at least some forts were utilized in this manner.

[11] Small (1969).
[12] Small and Cottam (1972).
[13] Greig (1972).

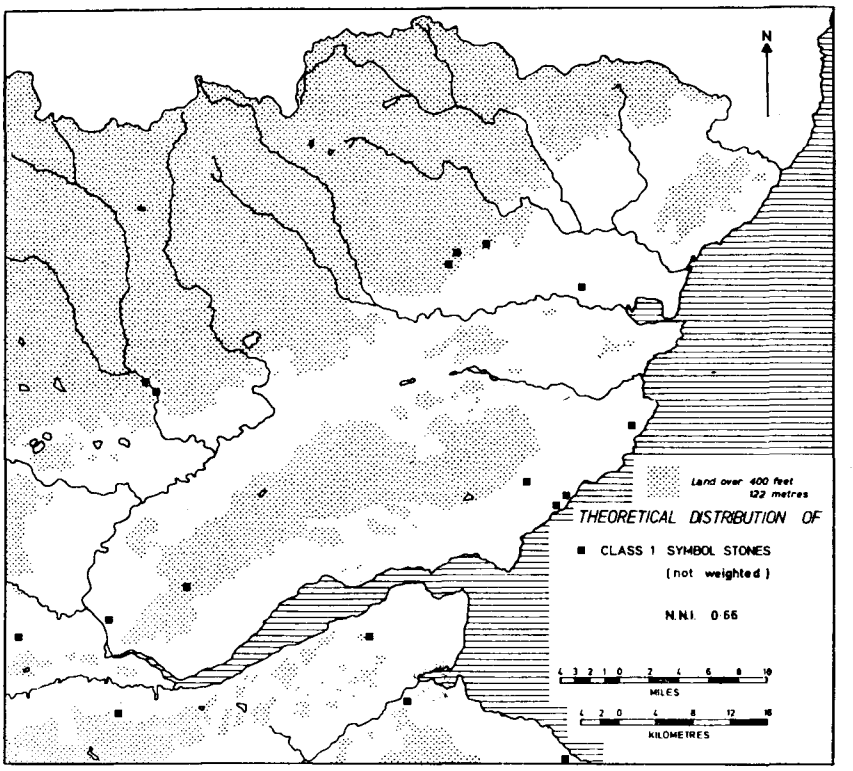

FIG. 9
THEORETICAL DISTRIBUTION OF CLASS I SYMBOL STONES
in southern Pictland; not weighted (p. 49)

CLASS II SYMBOL STONES AND CHANGES IN SETTLEMENT PATTERN

Examination of the distribution of Class II symbol stones (FIG. 11) reveals a changing pattern. Greater independence from the forts is reflected in the lowering of the correlation coefficient from 0.83 for Class I symbol stones to 0.70 for Class II. Furthermore, the nature of the distribution itself changes, one of the most obvious features being the clustering of stones, which results in a lowering of the nearest neighbour index from 0.76 to 0.41. Such a dramatic drop shows that if the influence of the forts was waning, then environmental controls over settlement were becoming more rigid. In some instances the clusters of Class II symbol stones are in places already occupied by Class I stones, as at Aberlemno, Strathmartine and Dunkeld, while other groups appear elsewhere, e.g. Meigle, St. Vigeans, Glamis and Monifieth. These new clusters generally reflect a shift to lower ground, although to some extent this is compensated for by a slight penetration of the highland zone between the R. South Esk and the R. Isla. Whereas the distribution of Class I symbol stones is spread fairly uniformly over the area S. of the highland zone and the R. South Esk, the distribution of Class II symbol stones is

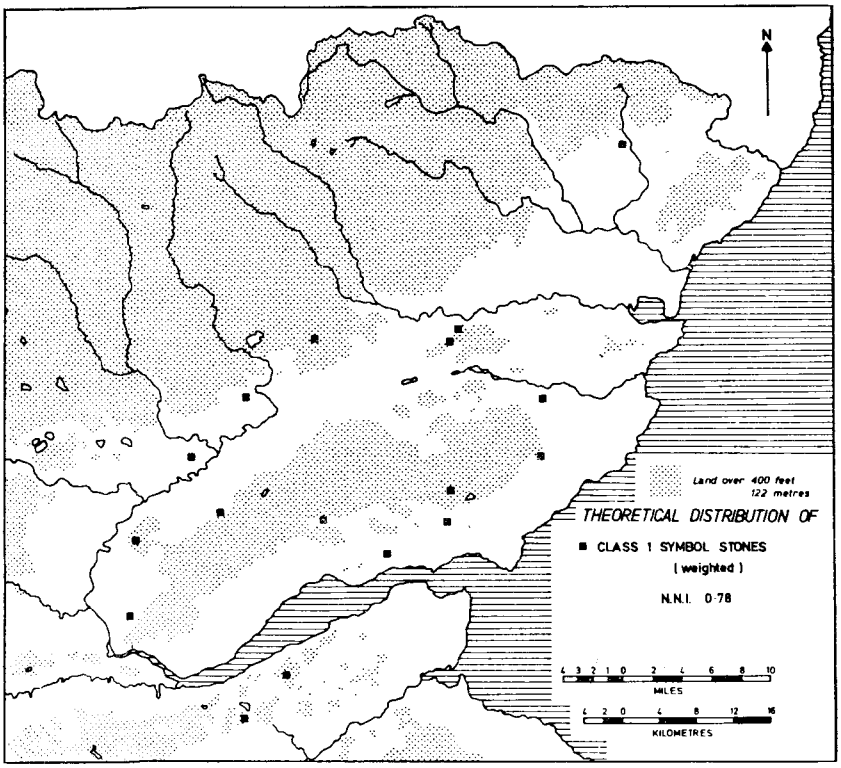

FIG. 10
THEORETICAL DISTRIBUTION OF CLASS I SYMBOL STONES
in southern Pictland; weighted (p. 49 f.)

almost entirely N. of an imaginary line from Dunkeld to Monifieth, and this shift in the overall distribution is demonstrated by the northward migration of the arithmetic mean centre from S. of the Sidlaw Hills to N. of them. The appearance of clusters of symbol stones points to a nucleation of settlement at about this time.

Changes from dispersed to nucleated settlement and *vice versa* are usually precipitated and accompanied by socio-economic or political changes. In this instance the instigating factor would appear to be political; a socio-economic cause would not result in a northward withdrawal of settlement from places already occupied and environmentally suitable, as is indicated by the shift of the arithmetic mean centre. The absence of Class II symbol stones within the study area S. of the R. Tay provides an interesting source for speculation, for this phenomenon may be equated with political pressure exerted on Pictland from the S.; but with controversy still raging over the precise dating of both Class I and Class II stones it is impossible to speculate on the nature of such pressure. That the absence of Class II symbol stones S. of the R. Tay is not environmentally controlled is amply vouched for by the presence of Class I symbol stones, and the subsequent proliferation of Class III symbol stones in N. Fife and E. Perthshire.

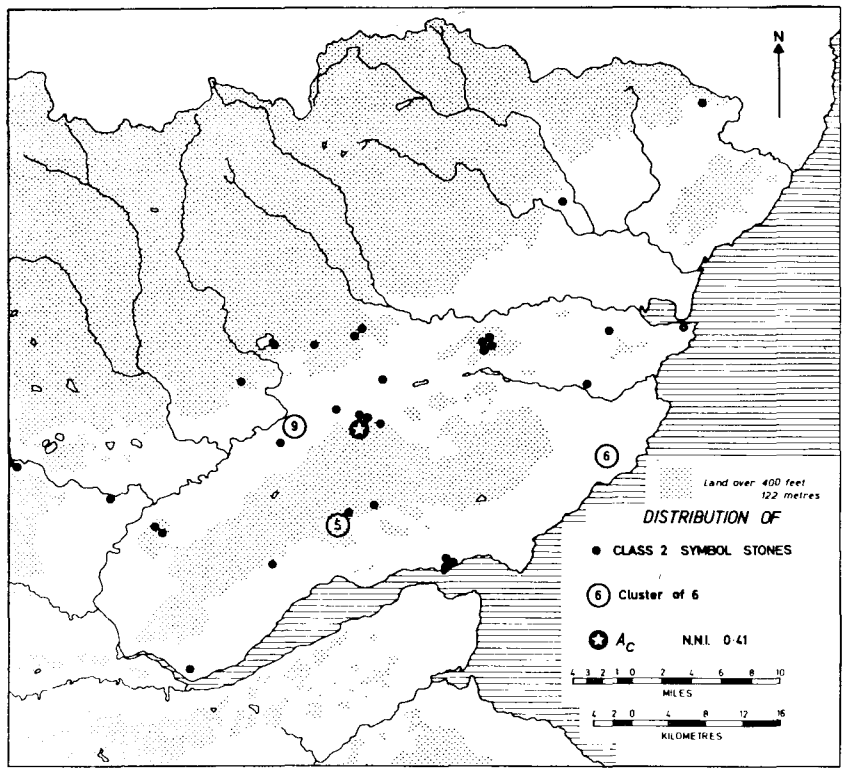

FIG. 11
DISTRIBUTION OF CLASS II SYMBOL STONES
in southern Pictland (pp. 51 ff.)

Other explanations are of course possible, related either to the separate development of the kingdom of Fife, or to the diffusion of relief-sculpturing techniques from the N., but the authors are fully aware of the difficulties of attempting to correlate archaeological evidence and historical events.

FIG. 12 illustrates a theoretical distribution of Class II stones as yielded by the probability matrix. A weighting system was designed to produce a nucleating effect. Zones 1 and 2 on FIG. 8 were given the same probability values as previously. The area S. of the R. Tay was given no chance at all of selection. Of zone 3, squares in the matrix containing a Class I symbol stone were given a 1 in 1 chance of selection and the remainder a 1 in 3 chance. When a new matrix unit received a Class II symbol stone it also had a 1 in 1 chance of further selection. Thereafter, any unit receiving two Class II symbol stones was given 10 additional chances of receiving more, and this value was doubled for each subsequent addition. In this way nucleations were built up as shown. The nearest neighbour index of the theoretical Class II distribution is 0.40, almost identical with that of the actual distribution. The theoretical distribution pattern, however, does not conform very closely to the actual. In the former, the spread of sites is greater than is

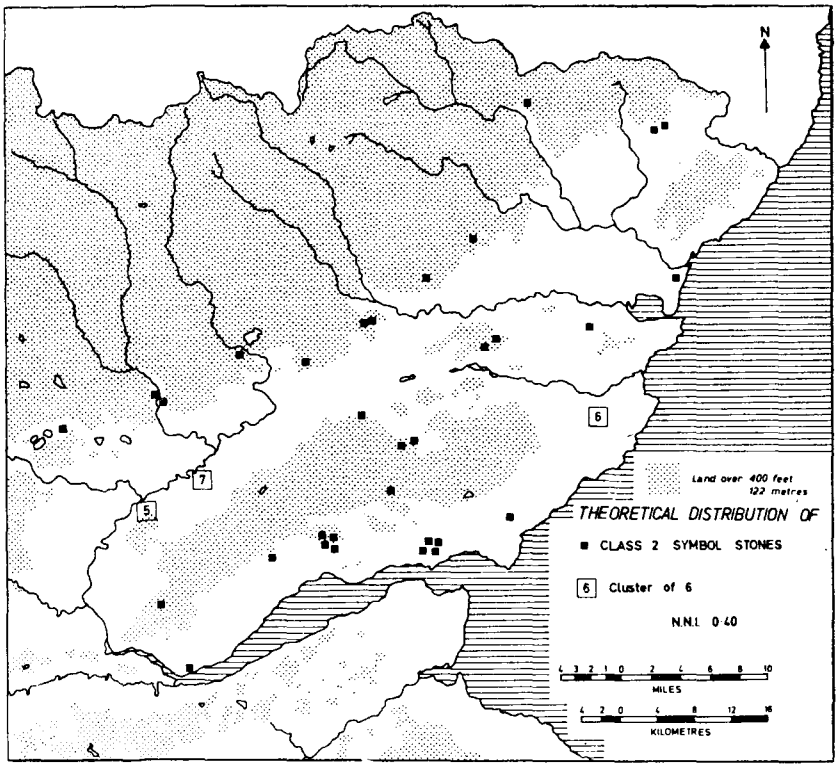

FIG. 12

THEORETICAL DISTRIBUTION OF CLASS II SYMBOL STONES
in southern Pictland; weighted (p. 53 f.)

actually the case—perhaps inevitably, as no weighting was applied to restrict the dispersion of sites within the area between the R. Tay and the line from Dunkeld to Monifieth. This does of course demonstrate that the paucity of sites in this area is unlikely to be a chance occurrence. The purpose of the exercise, however, is not to reproduce faithfully an identical spatial pattern, but simply to test the hypothesis that nucleating factors, in addition to normal environmental controls, were operating. The degree of clustering on the theoretical distribution conforms closely to that of the actual distribution, as shown in TABLE I:

TABLE I

CLASS II SYMBOL STONE CLUSTERS

	Actual	Theoretical
Cluster of more than 5 Class II symbol stones	3	3
Cluster of 3 or 4 Class II symbol stones	2	2
Group of 2 Class II symbol stones	5	6
Individual sites of Class II symbol stones	14	14

From this it would be reasonable to deduce that forces producing nucleation were operative at the time.

The phenomenon of nucleation must be examined in more detail. Already it has been suggested that the instigating factor may have been political: if it were solely political, however, a reversion to the original pattern may be expected to have taken place after the threat had passed; but the distribution of Class III symbol stones disproves unequivocally this point, as the clustering at this period becomes greatly intensified. In this context it is also interesting to note that the association between symbol stones and forts has declined with the appearance of Class II stones. At first sight this may appear surprising as it would seem advantageous to have strong defensive sites to withstand political pressure. The nature of military activities, however, was probably changing. Increasing central political control or invading forces may have dictated the change but, in any event, the role of the fort was probably diminishing as local raiding and reiving gave way to organized warfare. Support for this theory can be cited from two sources: first, events at Nechtanesmere in 685 indicate that both the Picts and the Northumbrian Angles were prepared for organized battle from which a decisive result was possible; and secondly, no radio-carbon dates have yet been obtained for the occupation of forts in Pictland beyond the 5th century—though admittedly the total number of radio-carbon dates obtained is small.

While political considerations may well have precipitated the actual change in settlement pattern, the social structure and economic organization of the Picts must inevitably have been in a state of transition already to permit the change to become permanent. Various hypotheses can be put forward by way of explanations but no specific factor can be singled out. Probably a combination of influences was responsible, but two important events could have influenced the social structure and economic organization of the Picts, acting either independently of or in conjunction with one another: the first is Christianity. Little is known of the type of religion that prevailed in Pictland before the advent of Christianity or of the extent to which it permeated and influenced Pictish life; its effect may have been minimal, perhaps confined mostly to forms of animistic worship and burial ritual. Religions with a strong grain of animism need not provide a strong nucleating influence on society; the spirits of the sky, the rivers, the woods, the fields, are all around people in their environment, and can be invoked, appeased, or worshipped in their natural contexts. Christianity, on the other hand, contains a strong nucleating component in that people must be brought together for worship on consecrated ground, and through the medium of the chapel or church it may have contributed to the reorganization of Pictish society. An indication of the importance of church sites comes from a brief analysis of the association of symbol stones with them. Of course, a number of stones may have been moved prior to their rediscovery in their present locations but, nevertheless, TABLE II may be taken as an indication of the growing importance of church sites.

The second factor possibly determining radical changes in Pictish life is concerned simply with the diffusion of ideas. The Anglo-Saxon invaders to the S. of Pictland brought about a complete reorganization of the settlement structure of

TABLE II

STONES RELATED TO RELIGIOUS SITES

	Total no. of stones	No. discovered associated with churches or chapels	% of total
Class I	17	2	12
Class II	52	46	88
Class III	141	131	93

much of eastern and southern England; the main settlement unit became the village with the church frequently forming the nucleus. The reasons for the organization of society on a village basis, however, were perhaps more economic than social; the agricultural system of the Anglo-Saxons was an innovation in England and demanded a pooling of labour and resources which precluded a pattern of dispersed settlement. A reorganization of the Pictish economic structure could have taken place at about this time as a result of the diffusion northwards of Anglo-Saxon agricultural methods; alternatively, it could have evolved

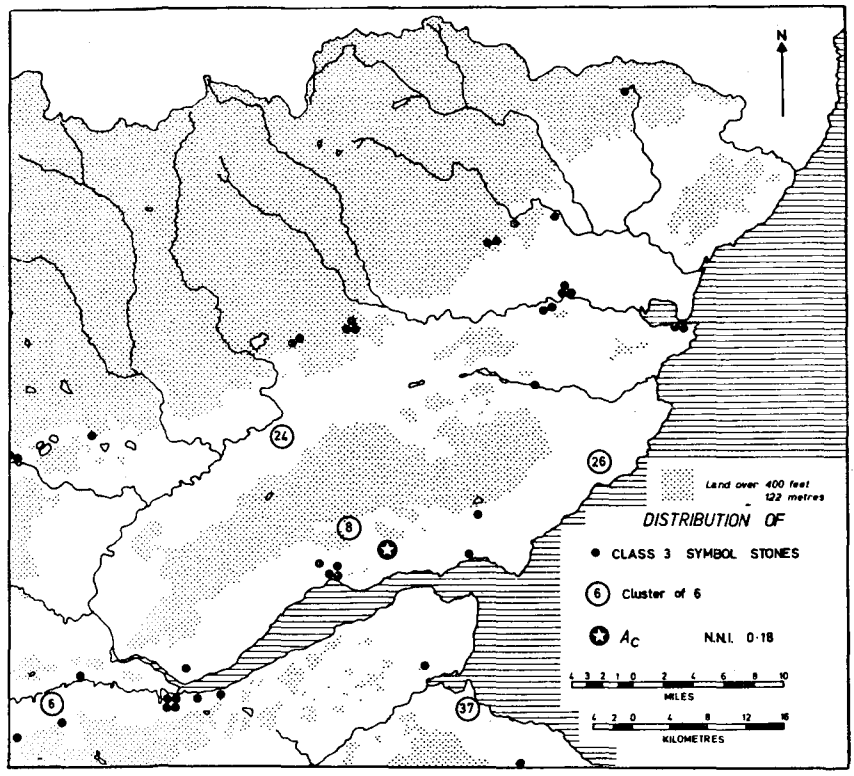

FIG. 13

DISTRIBUTION OF CLASS III STONES

in southern Pictland (p. 57 f.)

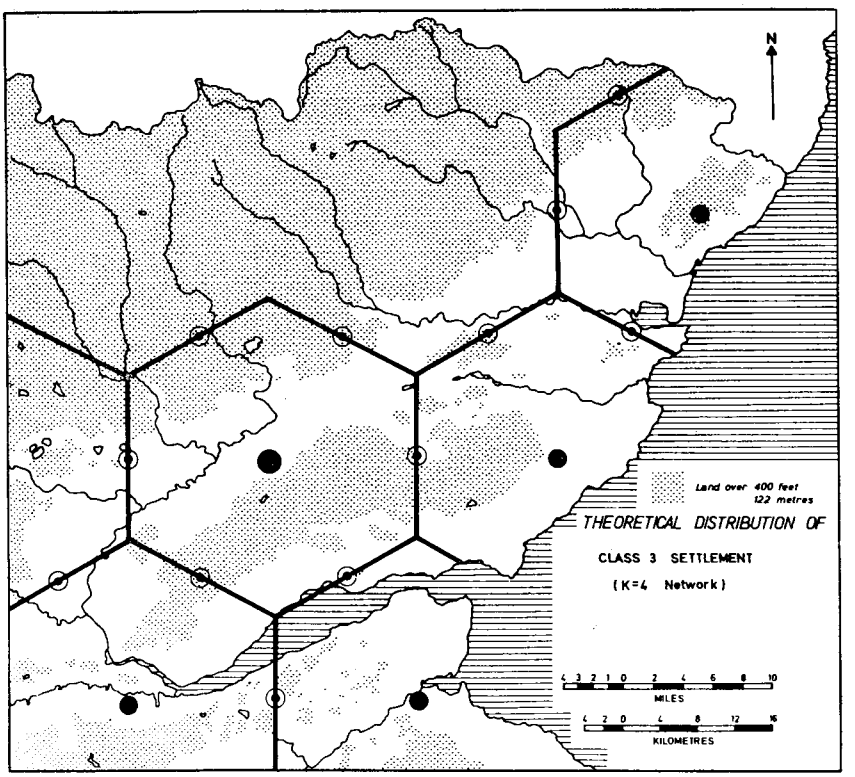

FIG. 14
THEORETICAL DISTRIBUTION OF CLASS III SETTLEMENT
in southern Pictland; K = 4 network (p. 58 f.)

independently. Note has already been made of a movement to lower ground as represented by the location of Class II symbol stones. Possibly this occurred as a result of a shifting emphasis from a predominantly pastoral to an arable economy; or else, improvements in agricultural technology may have engendered a pattern of nucleated rather than dispersed farmsteads. All the above factors are consistent with the local situation and events and could have combined to bring about a reorganization of Pictish society, possibly along Anglo-Saxon lines, around this time. After all, parallels have been drawn between relief sculpturing on Anglian crosses and Pictish sculptured stones,[14] and if Anglian influence was felt in Pictland in this sphere, it could equally well extend to other aspects of culture.

CLASS III MONUMENTS AND PIT PLACE NAMES

The distribution of Class III stones (FIG. 13) exhibits a continuation and intensification of trends previously observed in the distribution of Class II symbol stones, with the exception that the area S. of the Tay estuary is well

[14] Henderson (1967).

represented in the overall distribution with 40 per cent of the total number of stones. The north-eastward spread of the distribution continues, however, in the area N. of the R. Tay with eight stones discovered beyond the R. South Esk. The preponderance of Class III stones in Fife and E. Perthshire has had the effect of pulling the arithmetic mean centre once again S. of the Sidlaw Hills. The most distinctive characteristic of the distribution is the intense clustering, with only four sites accounting for ninety-five stones or 68 per cent of the total. The nearest neighbour index falls to a new low of 0.18, reflecting this feature.

The stochastic model was not used to produce a theoretical distribution of Class III monuments, primarily because 141 rounds of computation would have been necessary, but also because the value of the technique has been proved in respect of Class I and II symbol-stone distributions, showing it to be a useful predictive model in the analysis of spatial distributions. Instead, an alternative theoretical model of settlement based upon the work of Christaller[15] was used. By means of a direct comparison of the actual settlement pattern with different theoretical models, an assessment may be made of the forces governing the distribution of settlement. The study area ideally would be an homogeneous plain, and so allowances must be made for the actually diverse nature of the terrain. Christaller formulated three types of model or network corresponding to three principles of settlement distribution: market, transport, or administrative orientation. In geographical terms these are labelled $K = 3$, $K = 4$, and $K = 7$ networks respectively, where K is equivalent to the total number of settlements served by a central place of the next highest order. It can be seen that such a model will produce a hierarchy of settlement. The different theoretical networks were compared with the actual distribution of settlement, and it was found that a $K = 4$ network gave the best approximation to reality. FIG. 14 illustrates the theoretical distribution of settlement of a $K = 4$ network, allowing for the absence of settlement in the highland zone; one high order settlement, five intermediate, and twelve low order settlements are shown. Comparison of this distribution with that of FIG. 13 reveals that in addition to the correlation of the high order settlement with the site of the Class III stones at Meigle, four of the five intermediate settlements correspond closely to Dunkeld, St. Vigeans, Abernethy, and St. Andrews. The settlement indicated in the vicinity of Laurencekirk, however, has no counterpart in reality; but nearby Arbuthnott with 12th-century associations may have had earlier connexions yet. Of the twelve low order settlements, eight may be reasonably associated with known Class III stone sites. In view of the diverse nature of the landscape the degree of conformity between the theoretical and actual distribution is remarkably high, the correlation not being expected to occur by chance.

With a $K = 4$ network, the close correspondence between the theoretical scheme and the actual distribution indicates that settlement was transport orientated or, in other words, that routes influenced the settlement pattern. It is beyond the scope of this paper to attempt to determine where routes lay in Pictish times, but this would be a useful exercise in the future. The location of the settlements

[15] Christaller (1933).

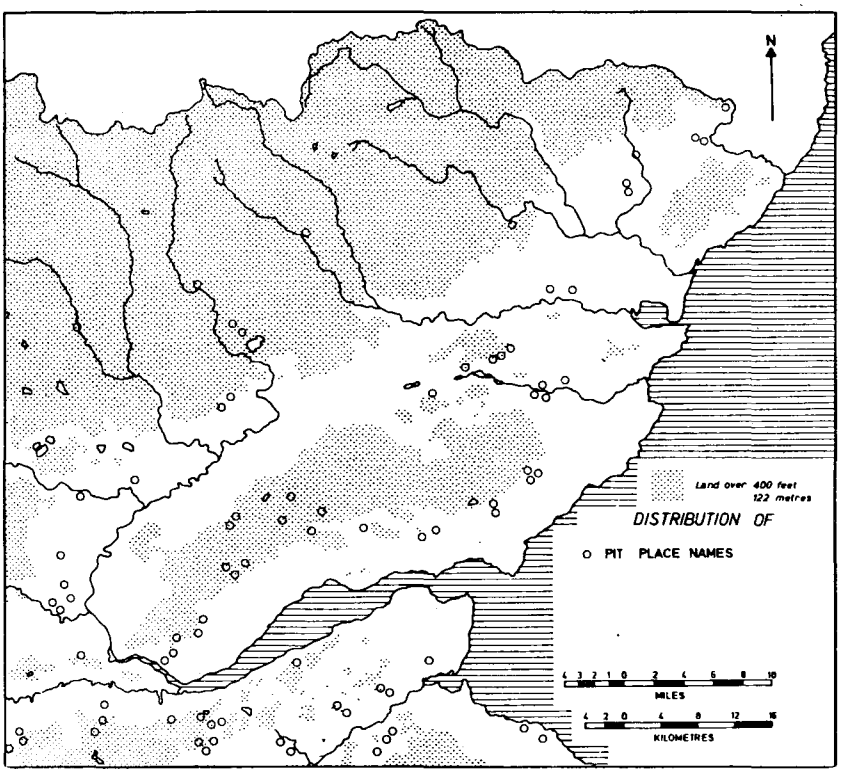

FIG. 15
DISTRIBUTION OF *PIT* PLACE NAMES
in southern Pictland (p. 59 f.)

themselves and particularly their postulated relationship to routeways suggest that Pictish power, in this area at least, was very much land-based. The infrequent use of coastal sites at any period leads to the conclusion that the Pictish way of life was not intimately associated with the sea, a conclusion reached similarly by Small[16] in an examination of the Norse evidence in Scotland.

Further evidence relevant to the nature of Pictish settlement possibly may be deduced from the distribution of the *pit* place-name element (FIG. 15). Nicolaisen,[17] however, argues in favour of a date after 843 for these place names on the basis of the Gaelicization of the other elements in them. Philological evidence, however, is inconclusive in this instance, and any additional evidence from another source would prove valuable. A comparison of the distribution of *pit* place names with that of Class III stones reveals that the distributions of both are almost completely exclusive or, in other words, there is a very strong negative correlation between them; yet both are to be found on comparatively good agricultural land. This situation could arise only if the two distributions were contemporary. *Pit*

[16] Small (1968).
[17] Nicolaisen (1968).

place names referred originally to individual farm sites or homesteads and were dispersed widely over the study area with the exception of the highlands. Almost certainly in Pictish times these were self-supporting economic units which did not contribute to the larger settlements; the economic interdependence of town and country is essentially a functional response to industrialization which did not take place until centuries later. The larger settlements themselves, therefore, had to be self-supporting economic units (though presumably there was specialization of labour within them); and they must have had associated agricultural areas, which naturally would have been in the immediate vicinity of the site. Such a system precluded the establishment of homesteads in the area surrounding a settlement. A division between an urban and rural population thus existed in Pictish times, though the term 'urban' must be used cautiously. *Pit* place names and Class III stones are, therefore, inferred to be contemporary.

DISTRIBUTION AND ENVIRONMENT

So far, analysis of a series of distributions by means of a variety of techniques has been attempted. Techniques of this nature are ideal for testing hypotheses and relationships, but their limitations must be constantly borne in mind as, in the extreme case, conclusions may become divorced from reality. A statistical model is nothing more than an aid to comprehension, and in itself is not an explanation. Changes in distribution during Pictish times have been examined, and these distributions have been found to relate to specific phenomena at specific times, but there still remains a need to explain the distributions themselves. A closer examination of the nature of the environment at this time is indispensable to such a study.

The period under consideration falls within the cool and wet sub-Atlantic climatic phase, when the tree limit was lowered, peat development occurred in suitable basins and spread to lower altitudes, marsh and swamp formation was encouraged by conditions of waterlogging, and podzolization and gleying of soils increased. Undoubtedly a contraction of areas favourable to settlement occurred during the iron age period and following, as witnessed by the depopulation of the highland glens. Whittington and Soulsby[18] found that *pit* place names showed an overwhelming affinity for Brown Forest soils, which is certainly not the case with Class I symbol stones, as revealed by TABLE III. Settlement during this period has been shown already to be strategically orientated, and there can be little doubt

TABLE III

CLASS I STONES AND SOILS

	No. of sites of Class I symbol stones
Brown Forest soils	7
Soils developed on fluvioglacial deposits	3
Soils developed on raised beach deposits	0
Podzols, other than above	7
Gleyed soils	0

[18] Whittington and Soulsby (1968).

that the price of a defensive site was a limited choice of agricultural land. Invariably Class I symbol stones when associated with forts are found on much lower ground than the fort itself, but in all cases sloping land was favoured, and a southerly aspect seems to have been more important than a particular soil type.

Class II symbol-stone sites, on the other hand, illustrate a changing emphasis. The increasing importance of Brown Forest soils is demonstrated clearly in TABLE IV. Podzols other than fluvioglacial soils would seem to have been avoided deliberately, since podzols of the Aldbar series almost everywhere in this area are associated with highly favoured Brown Forest soils of the Balrownie series; however, a third of the sites are to be found on fluvioglacial deposits, so this may be in fact a distortion of the true picture. Fluvioglacial soils are found almost

TABLE IV

CLASS II STONES AND SOILS

	No. of sites of Class II symbol stones
Brown Forest soils	30
Soils developed on fluvioglacial deposits	18
Soils developed on raised beach deposits	0
Podzols, other than above	4
Gleyed soils	0

exclusively along major river courses, and proximity to fresh water rather than the agricultural value of the soils would probably have been the greater attraction. In almost all cases the distribution of fluvioglacial soils is confined to a narrow linear band parallel to the watercourse where more fertile loam soils would be readily accessible.

The distribution of Class III stones sites in relation to soils is illustrated in TABLE V. These figures should be qualified to a certain extent. Of the thirty-seven sites on fluvioglacial deposits twenty-six are at St. Vigeans and a further six at Forteviot. In both cases, the soil on which the site stands is not representative of the immediate area. Similarly, as with the raised beach deposits, the St. Andrews group accounts for all but one of the thirty-eight stones. The adjacent Brown Forest soils were undoubtedly of dominant agricultural importance. There can be no doubt that from at least the time of the Class III stones onwards, and probably from the period of Class II stones, settlement was intimately related to

TABLE V

CLASS III STONES AND SOILS

	No. of sites of Class III symbol stones
Brown Forest soils	63
Soils developed on fluvioglacial deposits	37
Soils developed on raised beach deposits	38
Podzols, other than above	3
Gleyed soils	0

the agricultural potential of the environment but, as was pointed out earlier, the distribution of settlement was influenced by other factors. A number of areas still remain, however, where the agricultural potential was never realized. There are also two places, Dunkeld and Strathmartine, which retained their importance throughout the Pictish period, possibly for reasons connected with their strategic significance in the control of routes rather than with their agricultural value.

FIGS. 16a, 16b and 16c depict the negative areas of occupation with respect to Class I, Class II and Class III symbol stones respectively, and FIG. 16d includes the areas which remained negative throughout. These constituted the highland zone, most of the Howe of the Mearns and Garvock Hills, the E. part of the Sidlaw Hills, the Carse of Gowrie, the Tay Valley approximately between Perth and Stanley, and the NE. extremity of Fife. Absence of settlement in two of these, the

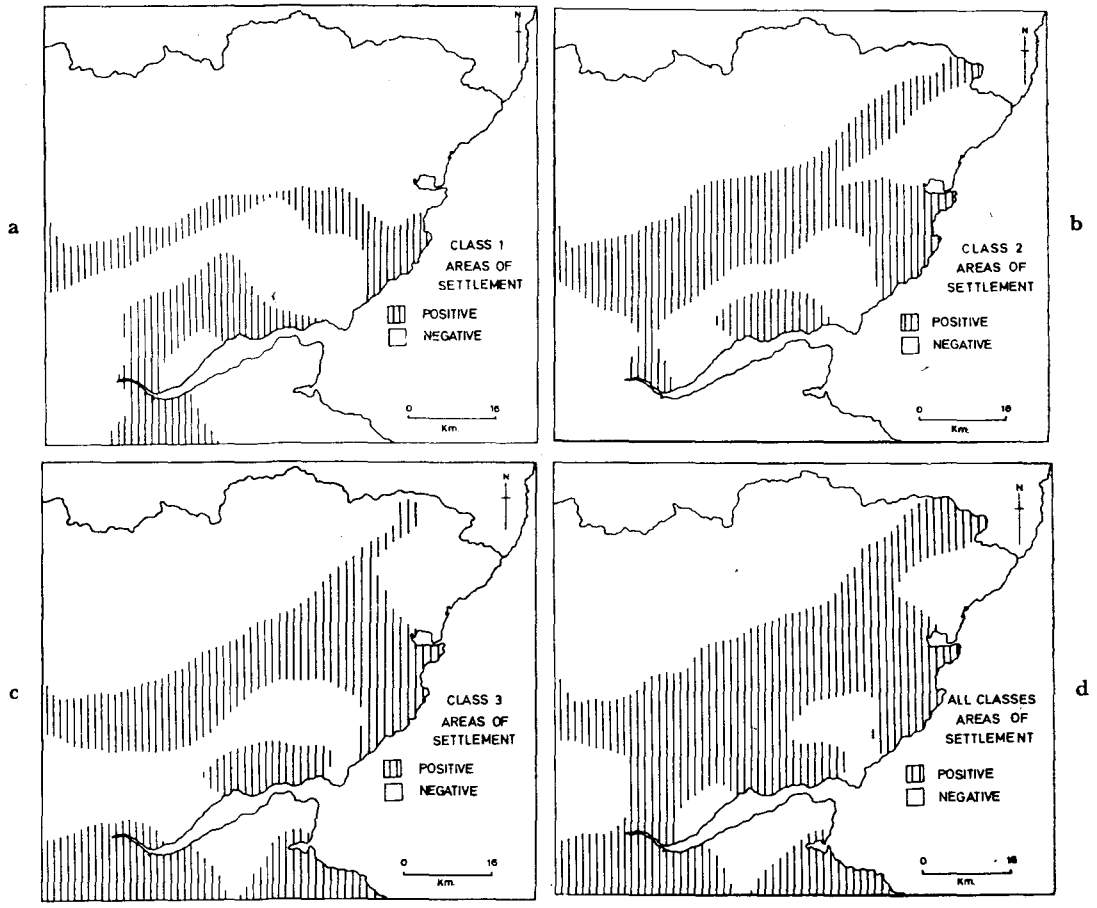

FIG. 16

AREAS OF SETTLEMENT IN SOUTHERN PICTLAND (p. 62 f.)

a. Class I settlement; *b*. Class II settlement; *c*. Class III settlement; *d*. settlement of all classes

highland zone and the Carse of Gowrie is easily explicable. In the case of the former, steep slopes and high elevation would preclude permanent occupation; in the case of the latter, heavily gleyed soils would not have been amenable to Pictish agriculture. Lack of settlement over much of the remainder cannot be explained so readily. Undoubtedly poor drainage in parts of the Vale of Strathmore and the Howe of the Mearns would have rendered some localities uninhabitable, but only to a fairly limited degree. Areas of windblown sand also, as at Tentsmuir, Buddon Ness and Montrose, and sandy soils developed on raised beach deposits S. of Arbroath would not have supported agriculture, but such conditions affect only very localized sites. The remaining areas contain a preponderance of Brown Forest soils with high agricultural potential, yet no symbol stones bear witness to their utilization. The answer to this problem almost certainly lies in the fact that these areas were heavily forested, and reference to Anderson[19] bears this out unequivocally; ancient records indicate the existence of three major forests prior to 1300. FIG. 17 maps major environmental features which would have deterred settlement during Pictish times and includes the extent of these forests as determined by Anderson. The great forest of Plater in the valley of the R. South Esk probably was responsible for limiting settlement in Class I times to the area to the S. It was only subsequently that a route was pushed through along the highland edge and a limited amount of settlement could take place. The forest on the E. margin of the Sidlaws remained throughout the period. Perhaps significantly, the Picts chose this area to give battle to the Anglo-Saxons in 685.

Superimposed on the environmental features in FIG. 17 is the distribution of all symbol stones and *pit* place names. It can be seen that a majority of *pit* place names fall within the forested areas. It is obvious that many of the homesteads represented by the *pit* element must in fact be forest clearings. The same process which took place in the S. of England some three centuries earlier, was then occurring in southern Pictland. The element *pit* is now recognized as referring to a parcel of land associated presumably with a farm or homestead; if this parcel of land traditionally were a clearing in a forest, the word *pit* might be analagous to the Anglo-Saxon *den*, *hurst*, and *field*. It does not follow, however, that each single *pit* place name referred to a forest clearing, just as many settlements bearing the aforementioned Anglo-Saxon suffixes were never forest clearings. There is, nevertheless, a very definite association between the appearance of the *pit* place-name element and the extent of early forests; furthermore, the proliferation of the later Gaelicized *bal* element in relation to forests, particularly that at the E. end of the Sidlaws is considered significant in this respect. More intensive investigation of this phenomenon, however, extends beyond the scope of this paper.

CONCLUSIONS

It would seem from the above evidence that certain associations and features of settlement within the Pictish context have been demonstrated for the area studied. In summary, the main characteristics may be listed as follows:

[19] Anderson (1967).

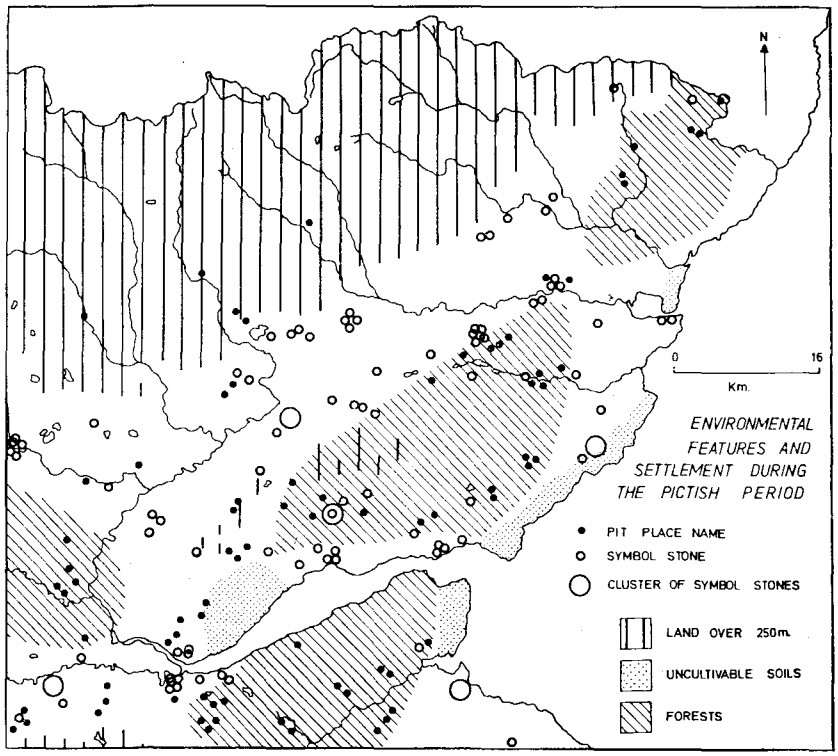

FIG. 17
ENVIRONMENTAL FEATURES AND SETTLEMENT
during the Pictish period (p. 63)

(1) The distribution of Class I symbol stones is related more to the distribution of forts than to the agricultural potential of the environment.
(2) The distribution of Class II symbol stones shows greater independence of the forts; it points to aggregation and nucleation, and to more rigorous environmental controls; furthermore, the overall northward shift in the distribution cannot be explained on environmental grounds.
(3) The distribution of Class III stones approximates to a theoretical, regular, hierarchical pattern of settlement.
(4) The distributions of Class III stones and *pit* place names are mutually exclusive and contemporary.
(5) A majority of *pit* place names occur within forested areas and therefore may have been forest clearings.
(6) Soils are of increasing importance throughout the Pictish period in the determination of settlement sites.

It would be unwise to attempt to draw any firm or far reaching conclusions from the above analysis of the distribution of Pictish symbol stones. Certain

relationships have been shown to exist, and this is the limit of the capabilities of statistical analysis, as well as the limit of the purpose of this paper as defined at the outset. These relationships have been interpreted as far as possible within the limits of available knowledge and within the spatial context of the area studied. The risk of misinterpretation must be high where there are so many unresolved problems of dating, function, and association of symbol stones; but if nothing has been achieved, yet the importance of the environmental context of archaeological distributions has been emphasized, their relationship to settlement demonstrated, and the validity of this approach established. Extrapolation beyond the area studied is impossible and no claim for universality of results can be made, but it is hoped that this paper has shown the need for an expanded study of the whole of Pictland from which more positive and significant conclusions may be reached.

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