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ROCKY POINT SITE:

PRELIMINARY DESCRIPTION AND ANALYSIS

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PRELIMINARY DESCRIPTION AND ANALYSIS

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of British Columbia

as required under the salvage excavation contract.

by

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October 15, 1974

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ABSTRACT

A two month archaeological field project was carried out during May and June 1974 so that powerlines from the Mica Dam Hydro-Electric Project could destroy a portion of the Rocky Point Site. This site (EdQx 20) is a habitation area characterized by winter housepit depressions and smaller non-habitation depressions.

Because of the limitations imposed on the data collection through the necessity of non-probablistic sampling, regional comparisons are impossible. In fact most types of archaeological problems such as changes in inter- and intra-site dispersion, culture-chronology, and culture ecology are not suited to being solved with the available data. Instead, emphasis is placed on the structuring of alternate theoretical questions around the data at hand and developing methodologies by which those questions may be answered.

Two problems in particular are analysed:

1) How does the observed archaeological structure reflect the socio-behavioral processes which caused them?

An hypothesis was formulated and the data necessary to test its hypothetical implications were collected.

2) How does the surface artifact distribution of an undefined habitation site correlate to subsurface activity aggregates.

Both problems require techniques of spatial analysis and two different types are used.

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Abbey Bates made the final copy of this report a tangible item, thanks to her persistance and homing instinct. A large number of the charts and diagrams were done by her as well as the entire typing job.

I, of course, alone am responsible for any errors in the final draft of this paper.

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CHAPTER 1 INTRODUCTION

Location and description

The Rocky Point Site (EdQx 20) is situated on the south bank of the South Thompson River approximately 30 km east of Kamloops, British Columbia. Rather than an independant site, it can be described as the westerly portion of a continuous zone of occupation which runs parallel to the river for more than 3 km. The area investigated is located between the Canadian Pacific Railway right of way to the south and the embankment of the river to the north.

Surficial indications of occupation include housepit depressions, small non-habitation depressions, scattered basalt flakes and bone fragments. These are located on the relatively soft flood plain deposits which are present along most of the South Thompson River. There are no distinct natural boundaries for the site other than the river and the hills directly to the south so it will not be possible to reliably quantify the total population of features present, without undertaking an extensive regional survey.

A concise description of the vegetational and faunal characteristics of the area is presented in the report by Sanger on his work at the Chase Burial Site (1968:89-91).

Salvage

The proposed construction of two hydroelectric power transmission towers within the site location prompted a two month salvage archaeological project from May to June 1974. The two

towers will be erected in late 1974 and 1975 and would have partially destroyed habitation and non-habitation features.

In addition to these activities partially completed by the British Columbia Hydro and Power Authority, local farming activities have disturbed many of the habitation depressions. Several of the housepit rims have been bull-dozed to create a level pasturage for grazing stock.

Further destruction along the southern edge of the site has been caused by the building of the C.P.R. line. This is evidenced by occupation layers in the cut bank facing the railway tracks, in addition to cultural debris below the disturbed face.

Virtually all previous research which has been carried out in the South Thompson River valley has been conducted under salvage conditions (Sanger 1968, Eldridge and Blake 1971, Johnson-Fladmark 1972, Wilson 1972,1973,1974 and Eldridge 1974). The result has been a haphazard attempt to recover samples which should some how represent culture-historical patterns within the area. This has not been accomplished and the data so far collected is essentially non-usable in the development of a culture sequence for the South Thompson portion of the Interior Plateau; as well as being of no value in the theoretical interpretation of prehistoric cultural activities as manifest throughout the region.

Research Problems

This research reported here is similar to previous research in that it is salvage oriented. The major difference however, lies in the acknowledgement of the limitations imposed on the

data through biased, non-statistical samples and the structuring of workable research problems around such obstacles.

There are three major restricting factors in the definition and applicability of most major research problems for which this site may have provided data.

1). As a result of the landscape alteration activities by both farming and railway construction, much of the settlement data has been obliterated. This would have biased and possibly hindered intra site statitical analysis.

2). The non-random restriction of archaeological sampling of the two transmission tower right of way transects, (each 20 m in width and 40 m long) (Fig. 1) eliminated the possibility of obtaining statistically valid descriptions of the culutural remains for the entire site.

3). The non-random selection of the site does not permit any statisitcally reliable statements about cultural activities which took place within the South Thompson River area, nor will it facilitate comparisons with other areas.

Despite these factors which limited the potential of the study, this site and others in the same condition will permit the investigation of several problems; some theoretical and some methodological.

The primary objective of this project concerns a problem which is theoretically as well as methodologically a grey area in archaeology; ie., how does the formal structure of artifactual and featural interrelationships reflect the past social processes which caused them? In order to interpret the relationship

between past behavioral processes and any archaeological context it is first necessary to objectively and reliabley descrjbe the observable structure. Unfortunately there exist no well developed methodologies whereby activity patterns within living areas can be delineated, and no theoretical models by which delineated structural patterns may be interpreted. Chapter 3 presents a tentative methodology and theoretical approach that is hoped will contribute towards the understanding of prehistoric behavioral processes.

The second objective which was undertaken involves a strictly methodological problem: How does the surface distribution of cultural items reflect subsurface activity loci? This problem has been studied else where (Binford 1970; Redman and Watson 1970), although none are directly applicable to the specific regional peculiarities of the South Thompson River. In many cases archaeological sites have been disturbed as a result of recent land modification activities such as farming. In circumstances like this, it is desirable to obtain settlement data which is still present in an altered yet useable form. Chapter 4 describes a method whereby surface distributions of artifactual data can aid in the delineation of subsurface features such as housepits.

The third and final reaearch objective of this project was to obtain samples representative of the portions of the site to be destroyed. Since only a portion of each cross-section was to be disturbed, it was decided that time limitations would necessitate concentration on data collection in the threatened

areas only; especially where they pertained to the first two problems. As a result one housepit was completely excavated, one housepit was randomly sampled and one cross-section was systematically intensively surface collected. A non-representative sample of one exploratory test unit from each cross-section was also recovered, both of which will be useful in defining future sampling procedures for the entire site. Chapter 2 presents the descriptive results of this objective.

CHAPTER 2 DESCRIPTIVE REPORT

This section will present a straight forward description of the data recovered during excavation so that comparisons, although not statistically valid, may be tentatively made. It is not the purpose of this description to place the material within known archaeological units, nor to revise existing units.

Cross-section A

The predominant feature excavated in this cross-section was a housepit clearly visable on the surface (Fig. 2). Excavation showed it to be located on an area of previous cultural occupation which betrayed no surfical signs of existance. This earlier occupation or continuum of temporary occupations may possibly underlay a major portion of the flood plain. There is evidence to indicate, as will be described later, that the earlier cultural depositions may be attributable to both featureless dwellings and semi-subterrainean houses.

The cultural material from cross-section A will be described under 3 separate areas; 1) the occupation of housepit A-1, and 2) the prehousepit occupation, and 3) the historic zone.

Housepit A-1

The surface of the housepit prior to excavation was very shallow, indicating that either a great deal of post-occupation deposition had occurred, or the floor was very shallow when originally constructed. The other housepit in the cross-section has a smaller surface diameter and depth than did this one, but was very disturbed as a result of recent bulldozing activities.

The diameter of housepit A-1 was estimated to be 9 meters while the maximum depth of the surface below natural ground surface was 0.55 meters.

This housepit was completely excavated as required by the outlined research objectives. This means that the entire population of cultural items and features of a preservable nature were recovered and that no estimates will be required in the description of the population parameters.

Artifacts

The quantification of the artifactual assemblage recovered is presented in Table 1. Where possible, functional classifications are used and based on what the morphological characteristics of the item indicate its use to have been. Types within a classification are based almost solely on morphology.

For the purposes of this report the term 'artifact' will refer to any culturally modified item which is portable and need not necessarily function as a tool. This definition will provide for the inclusion of some ecofacts as defined by Binford (1964:144-7) into the more general and convienient classification used here.

Projectile points (Table 8).

Corner notched. Of the 15 points which are notched from the corner of the basal-lateral juncuture, 1 has concave lateral edges (Fig. 3; f), and 10 have straight to convex lateral edges (Fig. 3; h-q), and 4 are basal hafting sections (Fig. 3; a-d).

Side notched. Both side notched points are black basalt. One is complete or unbroken (Fig. 3; g) while the other has the

basal section snapped (Fig. 3; e).

Miscellaneous. One unclassifiable point was recovered. The basal and tip sections are missing and it is possibly a fragmented side notched point (Fig. 3; r).

Knives (Table 9). This classification includes almost exclusively bifacial tools which do not display shaping for functions such as drilling or scraping. As no wear pattern analysis has yet been carried out in order to attempt positive identification of tool function, this classification is rather tentative.

Ovate. Three of the ovate knives were made of chert (Fig. 3; w,b',c'), and 1 was made of basalt (Fig. 3; e').

Semi-circular. There was one semi-circular basalt knife (Fig. 3; z). The haft section appears to have been snapped.

Blade. One basalt blade-shaped knife was recovered (Fig. 3; v). Its proximal end is marginally retouched and appears to have been shaped for hafting.

Basal section. One basalt rectanguloid basal fragment was found (no illustration).

Medial sections. There are 3 basalt knife fragments with both proximal and distal ends missing (Fig. 3; y,f'). One may be a fragment of a projectile point, but it is larger and more roughly shaped than the points collected.

Tip sections. Nine distal or tip sections of knives were also found. Of the total 8 are basalt (Fig. 3; s-u, and Fig. 4; a-d), and only 1 is made of chert (Fig. 3; x).

Miscellaneous. Thirteen amorphous fragments of knives were recovered (Fig. 4; a',d'). None appear to be fragments of

classifiable knives or other tools and will here be considered as unidentifiable. All but 1 are basalt.

Scrapers (Table 10). This classification includes almost exclusively unifacial tools whose working edge has a greater angle than knives and has secondary rather than tertiary flaking.

End scrapers. Five hafted end scrapers were found, 1 of chert (Fig. 4; y) and 4 of basalt (Fig. 4; x,d'-f').

Concave side scrapers. Two scrapers have primary retouch on both lateral edges. One has been tapered possibly to permit hafting (Fig. 4; n), while the other has no indication of hafting modification (Fig. 4; o).

Convex side scrapers. Six scrapers have working along one lateral convex edge (Fig. 4; v-w,z,a'-c'). Four of the 6 scrapers are basalt while the other 2 are chert.

Convex-concave scrapers. There are 4 scrapers which are curved so that one of the lateral edges is convex and the other concave (Fig. 4; r-u). Two are basalt and two are chert.

Gravers (Table 11). Two basalt engraving (fine scraping) tools were recovered from the housepit. Both of these have concave to straight lateral edges which converge to a blunt steep-sided distal tip (Fig. 4; p-q).

Burin (Table 12). One burinated flake was found. It had been struck from both ends so that a very sharp and strong incising tool was formed that could have be hafted from either end (Fig. 4; h).

Drills (Table 13). There were 3 basalt drills, 2 of

which were broken (Fig. 4; e-g). All have a thickness very nearly equal to one half their width or greater.

Retouched flakes. This classification includes all stone flakes which display marginal chipping along edges only. The chipping may have occurred intentionally in order to strengthen the working edge, or through actual use in cutting or scraping activities. There are 217 retouched flakes in total, most of which are basalt (Fig. 4; i-m).

Stone hammers (Table 14). Eight hammers were recovered, all of which are coarse-grained pebbles; completely unmodified except for pecking and spalling at either or both ends (Fig. 5; d,g-i).

Abraders (Table 15). Of the 4 abrader stones, 3 are fragments of sandstone slabs (Fig. 6; d-e,i), and 1 is a pebble which has had one of its surfaces used as a fine grained polishing tool (Fig. 6; h).

Cores. There are 33 amorphous fragments of stone which appear to have been the source material for flakes rather than products of the flaking process themselves. Of these, 20 are chert (Fig. 5; a), 10 are basalt (Fig. 5; e-f), and 2 are chalcedony (Fig. 5; b-c). In addition there is 1 large bifacially flaked piece of basalt which has no signs of secondary or tertiary flaking on its edges, and will be classified as an unspent core (Fig. 6; b).

Grinding slab (Table 16). One grinding slab with extensive wear on its ventral surface was recovered (Fig. 6; g). It appears to have been a portion of a larger grinding slab possibly a mortar, since the working surface is concave.

Net weights (Table 17). There are 2 slabs of coarse grained shale which have been chipped into a rectanguloid shape and slightly notched on each of their 4 edges (Fig. 6; a,c). Ethnographically Teit (1900:253) mentions that grooved stone sinkers were used in fishing activities, and these may be earlier versions of a similar tool.

Spall (Table 18). There is 1 granite spall which has been roughly shaped into a bifacial cutting or chopping tool (Fig. 6; f).

Chipping detritus. The largest proportion of artifacts recovered are unmodified stone flakes. All 4386 flakes of stone were found throughout the floor and roof-fill deposits. The majority of the flakes are basalt, however there are also a large number of chert, and some chalcedony flakes.

Bone. Extremely poor preservation conditions led to a small amount of bone remaining in the housepit. Most of the fragments which did remain are charred, and less than 2 cm maximum length. The only identifiable bones are: deer (Odocoileus hemionus), 1 astragulus and 1 phalange fragment; elk (Cervus canadensis), 2 metapoidial epiphyses, and 1 astragulus; dog (Canis familiaris), 1 distal phalange. As well several small rodent mandibles were recovered. The total number of fragments, including those which have been identified is 997.

Antler fragments. There is only 1 antler fragment represented in the housepit population. It is heavily decayed, but large enough to indicate that it is elk.

Tooth fragments. Other than small rodent teeth, there are 11 deer teeth and fragments of teeth. Because of the thick

resistant enamel they have been better preserved than the bone fragments.

Shell fragments. Only 1 small fragment of fresh water mussel shell has been preserved. It contains a portion of the hinge and has been identified as (Margaritifera margaritifera) a species common to the British Columbia Interior (Blake 1973).

Pigment. Eight fragments of red hematite were found in the housepit. All are less than 1 cm in diameter and 4 have a very fine dark red colour, while the others are more coarse and lighter in colour.

Features

Post holes (Table 19). These were one of the few types of features present in this housepit. A total of 7 were indicated by circular dark stains in the top of the wall-rim area of the house. It is possible however that they are attributable to rodent dens, since there were numerous tunnels throughout the housepit deposits. Although a distinction was made between these 7 depressions and other dark, soft areas of the floor because they had no signs of being joined to tunnels. All are located around the outer wall area and their positions may partially describe the outer edge of the wall where the roof joins the ground surface.

Floor, wall, rim. These are the only other features present inside the housepit occupation zone. Because of the shallowness of the house depression, the floor and wall cannot easily be distinguished from each other (Figs. 7,8). There is

a gradual slope upwards from the center of the floor to the wall. The wall itself gradually levels out and there is no pronounced rim area. This means that there was very little floor space wasted and that the wall in all but the south quadrant of the housepit was usable. Because the housepit is located on a flood plain which slopes down (north) towards the river, the south quadrant must have been dug deeper in order that the floor remain level. Therefore the wall is only well pronounced in the southern most part of the house.

The general shape of the depression suggests that it may not have been used as a winter dwelling in the ethnographic sense, but rather that it was less permanent and possibly even had a portable structure. The shallowness indicates that it could have been similar to a matlodge structure as described by Teit (1900:196-7) and inhabited during early spring or fall hunting and gathering activities. If this is the case it would be expected that no central inside hearth would have been necessary, since the weather at that time of year permits food preparation activities to take place outside. No hearth area was present on the floor, in fact very little charcoal and no wooden items were recovered at all. Fire cracked rock was present but no analysis of its distribution has been carried out at this point. The poor preservation is a result of the permeable soil which is subject to extreme annual variations in water content and occasional flooding.

Pre-housepit occupation

While excavating housepit A-1, it was discovered that an earlier occupation or group of occupations underlay the house-

pit. From the sample excavated it is evident that these underlying deposits are non-housepit in origin and seem to extend horizontally across the flood plain. These deposits will be labled pre-housepit since they occur below the housepit occupation, although in the separate test unit excavated they also occur stratigraphically level with the housepit layers.

The artifact sample recovered from the pre-housepit occupation is not statistically representative of the entire site population since it is restricted to 5 units non-randomly selected within the housepit A-1 grid and 1 test unit (Fig. 2) on the periphery of cross-section A. The data however, may be used to structure further sampling of the site.

Artifacts

Table 2 summarizes the quantification of the artifact sample recovered. There are no major differences between the content of housepit A-1 artifact population and the pre-housepit artifact sample, although it is impossible to make reliable comparisons. For this reason no descriptive measurments will be given.

Graver. There is 1 chert graving tool. It has an unmodified proximal end and its 2 concave lateral edges are unifacially chipped, converging to a blunt tip (Fig. 9; a).

Chisel. One green nephrite incising tool was found below the housepit deposits. One end is sharply bevelled, while the other is not as sharp and was probably the hafted end (Fig. 9; c).

Knives. There are 4 knives in total.

Ovate. One ovate, bifacially flaked basalt knife with its distal tip broken was found (Fig. 9; e).

Basal section. There is 1 basal or hafting section of a chert knife (Fig. 9; b).

Miscellaneous. In addition, 2 unclassifiable fragments of knives, both basalt, were recovered. One (Fig. 9; d) is bifacially flaked along one convex lateral edge, while the other is an amorphous fragment.

Retouched flakes. There are 13 basalt flakes with tertiary chipping along one or more lateral edges. All are unifacial and may have been either knives or light duty scraping tools (Fig. 9; f-i).

Pigment. Three small pieces of red hematite were found, all of which are light red in colour and smaller than 1 cm in diameter.

Chipping detritus. Of the 289 unmodified stone flakes, 264 are basalt, 6 are chert and 19 are chalcedony.

Bone fragments. None of the 31 fragments of bone are large enough to be identified. All are badly decomposed and probably represent only a small fraction of the original bone population.

Shell fragments. Four badly fragmented portions of fresh water mussel shell were excavated. All are Margaritifera m.

Features The sample of the pre-housepit occupation which was excavated contained no features other than the barely discernable floors. Since the soil tended to decay all usual biotic indicators of floors, such as charcoal and high humus content, it is almost impossible to distinguish between the various

pre-housepit occupations. The only sign of a gap in habitation occurred when a natural layer of sand or silt had been deposited.

Historic component

A total of 174 artifacts were recovered in this cross- section which are attributable to the most recent component (Table 3). None strongly indicate an actual habitation in the area; all are probably a result of recent activities such as railway construction and maintenance as well as ranching. No historic habitation of the housepit is present, although all of these artifacts were recovered during the excavation of the first 4 cm of the housepit deposits.

Nails. Twenty-seven heavily rusted nails were found on the surface layer of the housepit. All have square heads except for 1 which has a circular head (Fig. 9; o). Of the square headed variety, approximately half are short (Fig. 9; p-q), while the other half are larger and longer (Fig. 9; j-n).

Miscellaneous metal items. The largest percentage of the historic artifacts are small fragments of 1 or more metal containers (tin cans) (Fig. 9; u-w). There are 122 of these fragments including 3 lids. Four sections of a thick quage wire were also found, all are approximately 2 mm thick and 15 cm long. There was also 1 large bolt washer from the railway as well as 1 unidentifiable metal fragment.

Glass bottle fragments. Nineteen fragments of bottle glass were located above the housepit deposits (Fig. 9; r-t). They appear to originate from 3 separate bottles; each different in colour. There are 11 purple, 5 clear, and 3 brown glass fragments; all are too small to clearly indicate the bottle types.

Cross-section B

Three types of data were recovered from this cross-section, all of which are oriented towards separate problems. The description of the cultural material will fall into these three catagories: 1) systematic surface collection, both pre- and post-plow material combined, 2) housepit B-1 sample, the data collected from 10 excavated units randomly selected from within the sampling frame, and 3) miscellaneous cultural depressions, one test unit non-probablistically selected from within a small cultural depression.

Cross-section B is located 55 m east of cross-section A and is slightly further north. It is characterized by the same vegetation and has been subjected to similar disturbance through bulldozing. The visible cultural features consist of 1 housepit 12 m in diameter which had been completely filled in, and 3 smaller (1-2 m diameter) cultural depressions of unknown function (Fig. 10).

Systematic surface collection

Prehistoric artifacts The class and type distributions of the various artifacts collected are presented in Table 4.

Projectile points. A total of 6 projectile points were found, all of them basalt.

Corner notched. Both corner notched points display straight to convex lateral edges and straight bases (Fig. 11; c-d).

Side notched. There is only one side notched projectile point represented in the surface assemblage; it is

triangular in outline with 2 symetrical notches perpendicular to its long axis (Fig. 11; e).

Triangular unnotched. One triangular projectile point was recovered. It has a missing tip section and was possibly an unfinished side notched point (Fig. 11; f).

Tip section. One broken tip, most probably belonging to a projectile point basal section, was recovered (Fig. 11; a).

Miscellaneous. Apart from the classifiable point there was also one medial section of either a corner or side notched point (Fig. 11; b).

Knives.

Ovate. One basalt ovate knife was found; its tip section missing (Fig. 11; h).

Semi-circular. A basalt knife, formed into a semi-circular shape with a portion of one lateral edge modified to permit hafting was recovered (Fig. 11; l).

Spall knife. Two large spall knives (bifacially flaked) both of coarse-grained quartzite were collected on the surface of the cross-section (Fig. 12; k-l).

Miscellaneous. There is 1 unclassifiable knife fragment, the only chert knife recovered from the surface collection (Fig. 11; m).

Scrapers. One concave side scraper was found. It is basalt and displays steep unifacial flaking on one lateral edge only (Fig. 11; g).

Retouched flakes. Twenty-nine amorphous stone flakes which exhibited unifacial tertiary flaking on one or more lateral

edges were found, all but 3 chert specimens are basalt (Fig. 11; i-k,n).

Stone hammers. There are 3 coarse-grained stone hammers. All are unmodified water worn pebbles with slight indications of use on either end (Fig. 12; i).

Abrader. One fine grained sandstone abrader was recovered. It has linear striations on one face only.

Net weight. There was only one net weight found during surface collection. It was chipped from a small slab of shist and has slight notching on two of its four edges (Fig. 12; j).

Chipping detritus. There are 216 unmodified primary and secondary flakes which were distributed over the surface of this cross-section. All but a small number of chert and chalcedony flakes are basalt.

Bone fragments. Ninty-four bones, most of which are fragmented, were recovered. It is highly probable that these were present on the surface as a result of recent disturbance. The only identifiable fragments are: 1 elk distal femur fragment; 1 deer medial phalange fragment; and 1 dog medial phalange.

Fire cracked rock. There were 259 fire cracked rock fragments collected from the surface. All are either charred or exhibit heat fissures.

Historic artifacts Table 5 presents the quantification of historic artifacts.

Nails. There are 2 nails represented in the surface collection. One is square headed and is of the long shaft

variety, although this particular specimen is broken (Fig. 12; b), while the other is a recent round headed wire nail.

Miscellaneous metal fragments. This classification makes up the largest proportion of historic artifacts.

Nuts. Three large iron nuts, all badly rusted, were probably left behind during the construction of the railway. Two are square while the third is hexagonal (Fig. 12; g-h).

Metal container fragments. Two rusted metal fragments with folded rim sections were recovered. Both appear to be tin cans (Fig. 12; c).

Wire fragment. There is one fragment of a similar type of wire to that reported from cross-section A. It is also heavily rusted.

Miscellaneous. One large piece of iron was recorded. However, it is too badly fragmented to be identified.

Glass fragments. Two glass fragments (Fig. 12; a,d), were found; 1 is clear and the other translucent brown.

Rifle cartridge. The only rifle cartridge (copper casing) recovered from the site was one .22 calibre long shell. It was made by the Dominion Company and is of the rim fire variety (Fig. 12; e).

Ceramic fragment. One small fragment of a white glazed porcelain object was collected. It is too fragmented to indicate the type of source object (Fig. 12; f).

Housepit B-1

As a result of ranching activities, the rim of housepit B-1

was bulldozed onto the floor area. This meant that the ground surface of the cross-section was relatively level prior to the commencement of this project. Vegetation was almost completely covering the disturbed surface, however it still remained possible to delineate the lighter coloured rim area of the housepit. After systematic plowing for the surface collection portion of the research, the rim area of the housepit was clearly dis tinguishable from the darker disturbed zone. This enabled a sampling grid or frame to be set up over the housepit area so that non-systematic sampling techniques could be used. The size and circular shape of the feature indicated that it was a housepit and therefore it was not thought necessary to proceed with and exploratory test unit.

In order that the artifact assemblage may be reliably compared with other housepits which may be eventually excavated within the site as well as housepit A-1, it was necessary to obtain either the entire population of cultural items or as statistically accurate and precise a sample as possible. Time and economic considerations necessitated that efficient sampling procedures be brought into use and the following procedure was adopted. The maximum extent of the housepit was framed with a grid consisting of 148 1x1 m units. Each unit was assigned a sequential number, and a total of 10 units were selected using a table of random numbers. Only those units selected were excavated and thus, individual bias of the investigator is strongly limited. This type of sampling is 'simple random sampling' as described by Cochran (1963:18) and Kish (1965:36). It has been suggested

by Blake (1974:18-19) that under most conditions, such as housepit excavation, in order to obtain descriptions of the artifact population, it is desirable to utilize stratified rather than simple random sampling. This however, is only in cases where it can be assured that the sampling strata divisions reflect population heterogeneity. Since Housepit B-1 was so badly disturbed, yet lacked none of the original population, it is believed that stratification as suggested would not contribute towards increased sampling efficiency. It must be remembered when comparing this housepit sample with other statistically valid samples, that the outlined procedure may not reliably represent such cultural items as features or spatial patterns of artifacts, and that it was tested only with emprical descriptions of artifacts.

Artifacts

The sample distribution of artifacts by class as well as estimates of the population parameters are presented in Table 6. Formulas for estimating the population as well as 95% confidence limits are given by Cohran (1963:26). The large sample standard deviations have resulted in a wide range for the confidence interval in almost every class. Such gross limits may severely hinder fine comparisons, but neverthless it is possible to objectively evaluate the precision of the sample.

Chipping detritus. A total of 483 stone flakes were recovered. The largest proportion is basalt, but several chert and a small number of chalcedony flakes are also present.

Bone fragments. This class includes all vertebrate animal remains. None of those recovered show signs

of modification and in fact most are too fragmented and decayed to identify. The only identifiable bones are 6 lumbar vertebra and the sacrum of a beaver (Castor canadensis).

Retouched flakes. There were 81 unifacially chipped stone flakes. The largest proportion is again basalt with a small number of chert and chalcedony flakes also represented.

Scrapers. A total of 5 scrapers were found.

Convex sided. One chalcedony scraper with flaking along one lateral edge only (Fig. 11; t).

Straight sided. One straight sided basalt scraper with flaking along two converging lateral edges (Fig. 11; z).

Spall scraper. One large coarse-grained porous basalt spall with a roughly flaked concave scraping edge (Fig. 11; x).

Miscellaneous. Two unclassifiable basalt fragments with steep flaking along one lateral edge.

Drill. There was only one drill fragment recovered in the sample. It is a basalt medial section and its thickness is approximately as great as the maximum width (Fig. 11; q).

Knives. A total of 10 bifacially chipped stone tools are classified as knives.

Tip section. One distal tip of a basalt knife. It is unifacially flaked on one edge and bifacial on the other (Fig. 11; o).

Blade. One bilateraly chipped basalt blade was recovered. The proximal end is slightly modified for hafting (Fig. 11; u).

Miscellaneous. A total of 8 basalt knives are either amorphous or too fragmented to definitely classify (Fig. 11; v,a).

Graver. There was 1 chert graver included in the sample. It has straight lateral edges, unifacial chipping, and an unmodified hafting section (Fig. 11; p).

Projectile points.

Side notched. One side notched projectile point made of basalt has straight lateral edges and a straight base (Fig. 11; r).

Corner notched. The basal section of a corner notched basalt projectile point, similar to those recovered in the surface collection, was recovered (Fig. 11; s).

Core. There was only 1 basalt core found in the sample. Its thickness is approximately equal to its width. No secondary or tertiary flaking is evident (Fig. 11; y).

Features

Hearth pit. One hearth pit with a large amount of charcoal, ash and fire cracked rock was located on the outer rim area of the housepit. It appears to be stratigraphically isolated from the actual housepit deposits, and probably predates the housepit, since it is filled with hard packed soil similar to the sterile floor base of the housepit (Fig. 13).

Miscellaneous cultural depression. One test unit was excavated into what was originally thought to be a cache pit (Fig. 10) A circular depression 1.5 m in diameter and 15 cm deep appears to be the remnant of a larger cultural depression; possibly an isolation hut or small housepit. None of the stratified layers which were evident during excavation conform to the expected subsurface shape as indicated by the surface curvature.

Artifacts. Summary Table 7.

Knives. There is 1 large, oval, bifacially flaked chert tool. It has been classified as a knife although it may have been used as a large projectile point. There are no wear indications (Fig. 11; b'). In addition 1 miscellaneous basalt biface fragment was recovered.

Chipping detritus. There were 7 unmodified flakes of basalt recovered from the unit.

Bone fragments. Eight bone fragments were found, only 1 of which is identifiable; the scapula of a deer.

CHAPTER 3. SPATIAL ANALYSIS OF HOUSEPIT LIVING FLOOR

It has been previously said by others that the archaeological record is the material representation of past cultural systems, and that as the articulation between a culture and its environment changes so will its archaeological record (Binford 1964:426-427).

Many aspects of the social structure of prehistoric cultures are still a puzzle to paleo-anthropologists and may very well remain so. However, by viewing past cultures systemicly, it will be possible to attempt to answer some theoretical questions concerning them and perhaps to develop explanations of observed cultural pattern .

The discussion presented here will outline one possible method whereby a specific theoretical problem can be solved.

Problem

The social regulators governing the utilization of space within a limited area must have been one of the most important developments of culture. If it were not possible to cohabit with others of any particular group cooperatively and efficiently, then adaptation to most physical environments would have been impossible (Washburn and Lancaster 1968: 296). The problem, then is : how does the level of socio-behavioral complexity which allows the efficient utilization of space, permit a culture to adapt to its environment?

The problem can be seen when we study for example the ethnographic Interior Salish-speaking Indian groups. They are reported to have occupied semi-subterrainean dwellings or housepits for as long as 5 months during the winter of each year. The dwelling was usually occupied by one or more extended family units, all of whom were related. This could mean that between 20 to 100 people would have occupied a single dwelling,

depending upon its size (Teit 1900, 1906). In order that conflict over the right to perform certain tasks in certain areas be minimized, there must have been specific areas set aside or somehow demarked where in each task was carried out. It is not possible at this point to predict exactly which of the various activities would cause conflict when carried out in the same location, obviously those activities which did not necessitate simultaneous occurrence, had little potential for developing conflict; while those which were carried out by different individuals at the same time would have a greater chance of becoming trouble 'areas'. Observations in previously excavated housepits suggest that indeed certain areas of the housepit floor had larger numbers of specific items than did other areas of the floor (Blake 1974:36). This differential or non-random distribution of artifacts over a living area may possibly be explained in terms of socio-behavioral regulatory systems and how they help groups to interact cooperatively.

Hypothesis

One hypothesis which may be formulated as a result of these observations is: the degree of differentiation among areas of specific activity rises directly with an increase in the social complexity of any given group. This means that when faced with an environmental shift which permits or is caused by increased population size, the structural utilization of a restricted space will increase. An hypothesis such as this cannot be tested by selecting only one dwelling from one cultural region, but must incorporate cross-temporal as well as cross-cultural comparitive samples. It is believed that the prehistoric habitation site under study will provide an excellent opp-

ortunity for the preliminary development of a methodology necessary to test this hypothesis.

There are two basic requirements crucial to the testing of this hypothesis; 1) the spatial structure of the locations of activity within dwellings is a result of the social structure and patterns of the prehistoric culture under observation, and 2) the area to be excavated has not been disturbed subsequent to the initial deposition of the cultural material, so that it will be possible to define individual and group activities and the locations in which they took place.

Test Implications

The definition of activities in terms of prescribed function should ideally be the first step in the analysis.

Although it may be possible to recover artifacts from an occupation which are presumed to have been used in the performance of a task, it is very much more difficult to define the functions of groups of different items which together may have been used for specific functions. It is at present impossible to positively indentify functions for all individual tools let alone assemblages of seemingly unrelated tools. However, it is possible to differentiate between the formal characteristics of various items which, to a degree imply funcitonal variability (Binford 1964:426). For the purposes of this analysis, tools such as projectile points, and scrapers will be allotted names reflecting traditional functions which correspond to their ethnographic use, although their funcitons do not necessarily result in their deposition within the occupation floor. For instance the activity which resulted in a projectile point becoming a part of

this particular archaeological record, is definitely different from its function. It might have been deposited during the manufacturing or maintenance processes, simply lost, or intentionally discarded (Schiffer 1972:157-158). In any case, all tools of the same classification are likely to have been deposited as a result of a similar activity. This assumption will also permit the definition of activity areas represented by non-tool artifacts such as stone flakes. Regardless of the function of the flakes, they all represent a similar activity; that of stone tool manufacture. Even if it is not feasible to define the activities which caused the permanent archaeological record, it will be possible to define their areal boundaries.

Two of the primary implications of the hypothesis are therefore:

1) the distribution of artifacts within each classification should be non-random or significantly aggregated.

2) the degree of differentiation among each of the activities analysed should covary with the level of socio-cultural integration attained by each cultural group under study.

The scope of the analysis presented here will permit the testing of the first hypothetical implication only.

The Method

The testing of the first implication depends upon the reliable and accurate spatial analysis of artifact distributions. The development of techniques of spatial analysis has taken place primarily in the fields of plant ecology (Clark and Evans 1954; Thompson 1956,1958; and Pielou 1957, 1959) and cultural geography (Morisita 1959; Dacey 1963, 1964; Getis 1964; and Rogers 1965). This means that the methodologies resently available are not particularly well suited to arch-

aeological analysis. However, recent works by Wood (1971); Whallon (1973, 1974) and Washburn (1974) have contributed significantly to the archaeological application of spatial analysis.

The two main branches of spatial analysis are discrete count distributions for areal grids, and point to point distance distributions. The data requirements of each are substantially different as well as the types of problems for which they are suited. Summaries of each of the two broad categories are found in King (1969) and Pielou (1969).

The method which best met the data requirements necessary to test the above hypothesis is nearest neighbor analysis. This analysis permits the description of any bounded distribution of points (items) in terms of degree of aggregation and also makes possible the determination of the significant area encompassed by the distribtion. Most cell count methods provide only an estimation of the degree of departure from randomness and in the case of dimentional analysis of variance, as put forward by Whallon (1973), will allow a rather crude estimation of the size of the activity area.

The procedure followed in the nearest neighbor analysis of artifactual material from Housepit A-1, was relatively simple and easy to expedite. The entire housepit was excavated (Fig. 2) and two dimentional coordinates were recorded for nearly every artifact recovered. Some excavation conditions such as wet soil did not allow the in situ recovery of 100% of the artifact population, however the resultant bias introduced through incomplete population representation is small enough to be insignificant (Table 20).

The items recovered were then classified by 'functional' char-

acteristics when possible so that each classification could be analysed separately. Each class analysed was arbitrarily labelled with a corresponding activity. Activity A resulted in the distribution of deer (Odocoileus hemionus) teeth fragments, B resulted in the distribution of scrapers, C- projectile points, D- hematite, E- knives, F- retouched flakes, G- core fragments, H- chipping detritus, I- bone fragments.

The distance from each item r_i within a class to every other item, $r_{i+1}, \ldots\ldots r_{i+N}$ is measured, where N= total number of items within a class. The smallest neighbor distance is then recorded and the procedure repeated until each item's nearest neighbor is obtained. All of those items with no neighbor closer than the distance to the border are omitted from the analysis (Clark and Evans 1954: 449). All but those classes specified above had too few observations to permit a meaningful analysis after deletion of neighborless items (Fig. 24).

The next step in the analysis is one which has been modified to suit cultural data and probably involves the most hazardous of statistical assumptions. Can it be assumed that nearest neighbor distances are normally distributed when given a random distribution of points? In most archaeological applications of the analysis, only a small number of items is dealt with (less than 100) and it can be expected that the distribution of near neighbor distances will be positively skewed, ie. a larger number of distances in the smaller size range (Whallon 1974:19). It is also likely that the distribution of distances will be bimodal; two distinguishable peaks in the frequency polygon (Washburn 1974:322).

A description of the spatial distribution of items in terms of

the frequency distribution of its nearest neighbor distances can be obtained in two different ways. The first is that described by Clark and Evans (1954:447-448) and modified by Dacey (1963:507-508) and Pielou (1969:112). Briefly, this method utilizes a ratio between the observed mean of the nearest neighbor distances and the expected mean of the distances if it were a random distribution;

$$R = \frac{\bar{r}\ \text{observed}}{\bar{r}\ \text{expected}}$$

If the value of R is less than 1.0, the spatial distribution tends towards aggregation; if R is in the vicinity of 1.0 the distribution is random; and if it is greater than 1.0 and less than 2.1491 the points are uniformly spaced (Clark and Evans 1954:446-447). However, instead of calculating the significance of departure from an expected random R at 1.0, by the Clark and Evans method using a simple standard normal variate, a chi-square approximation of the standard normal variate, which is based on the poisson distribution, is used (Whallon 1974:19-21). The test of significant non-randomness is to either compare the observed chi-square to a table of chi-square distributions for populations where the value of $2N<30$, or to convert the chi-square to a standard normal deviate which can be compared to a table of areas under the normal curve, when $2N>30$ (Whallon 1974: 20). Therefore, at any predetermined level of probability it can be decided whether a distribution of items is aggregated, random, or uniform.

The other method for testing significance follows the same procedure, but uses different statistics. Washburn (1974:322-326) describes a method where by the median value of the nearest neighbor distribution is used to test for randomness as well as to define the

range of nearest neighbor values which are significantly close to the median. The median value does not greatly affect the testing of significance but is very efficient in the definition of cluster, since it reflects much more accurately the central tendency in clustered distributions. This means that when looking at the distribution of nearest neighbor distances of an aggregated point pattern, it is possible to determine more accurately the cut-off distance of the distribution. If the mean were used instead of the median, more weight would be given to unusual occurences of large distances which do not reflect the pattern (Washburn 1974:322). The formulae used in the calculation of 1) the degree of randomness and 2) the significant cut-off distance which establishes the point pattern boundary, are derived elsewhere and presented in adequate detail (Washburn 1974: 333-334). The cut-off distance is then used to encompass an area about each point which represents an area equal to X% of all significant nearest neighbor distances: in other words, the highly probable activity area. The percentage X desired is the level of probability used to test the null-hypothesis that: there is no significant difference between the observed artifact distribution and the expected random distribution of the same density of points per unit area. In the case of this study, the 0.05 probability level is used. A WATFIV computing program was written by the author which carries out nearest neighbor analysis for two dimentional point distributions. The analysis will use either median or mean statistics, and is modified to accept distributions of between N= 5 and 250 items. For larger values of N, program changes must be made (Appendix).

After the determination of degree of aggregation, and the boundaries of the artifact patterns, the next step is to calculate the total

area covered by each activity. When this is accomplished the area of overlap between each activity and every other activity separately can be calculated to give the index of differentiation. The index of differentiation will be defined as the average overlap area of any two or more activity areas divided by the mean A of their areas. This index gives a value between 0.0 and 1.0 depending upon the amount of spatial differentiation. If the specified areas completely overlap then Ø=A and Ø/A=1.0. If all areas are isolated from each other then Ø=0.0 and Ø/A=0.0, therefore, the geater the degree of differentiation the closer will be index value to 0.0.

In order to obtain a comparitive value for the entire occupation floor, the index of differentiation was calculated for each combination of two activities and the mean index of differentiation calculated by dividing the sum of the separate indices by the total number of combinations. This value will be meaningless in the description of the artifactual structure of any one dwelling, but will facilitate comparisons between occupation areas when similar activity classes are represented.

Results

The nearest neighbor analysis was carried out with both the mean test and the median test, in order to compare the effect of each in defining non-randomness. The only factor which might limit the validity of the significance test is the size of the living floor. In order to make the computing program relatively simple to use, it was necessary to extend the border of excavation with 9 sq. m of dummy grids so that the area would be rectangular. The maps showing artifact distribution show the actual excavated border and not that used

in the analysis. This had two effects which are thought will not significantly alter the analysis of points. The first is that it permitted the inclusion of more artifacts in the corner areas of the grid which would otherwise be excluded. This would result in a higher artifact density per unit area and thus tend to decrease significance of departure from expected randomness. The other effect is to increase the overall area and thus decrease artifact density per unit area, thereby raising the degree of significant departure from expected randomness. Hopefully, these two analytic defects will have the net result of cancelling each other out.

Table 21 illustrates that when the data was analysed by the mean nearest neighbor method, all point patterns but 1 were signigicantly aggregated. Activity I representing chipping detritus was not significantly concentrated, the visual plot showing a dispersal distribution as well (Fig. 22).

Implication 1) is confirmed by the use of the nearest neighbor statistics; that is patterns of artifact distributions are in fact located non-randomly about the occupation floor of a housepit. Over a period of time, artifacts from each activity appear to be deposited closer to other artifacts of the same class than would be expected if distribution was random.

The same conclusions are drawn from the analysis when the median rather than the mean nearest neighbor distance is used. The R ratios are slightly smaller on the whole for Washburn's R than they are for Clark and Evan's R, however the pattern of distribution is defined in the same manner (Table 22).

The next step in the testing of the hypothesis requires that the

degree of differentiation between activities within the housepit be determined. Whallon's cut-off distance is at present the most feasible and possibly reliable method by which to define significant clusters. He however assumes that the distribution of nearest neighbor distances is normal, and that 95% of all potentially significant distances is encompassed up to the point which is 1.65 standard deviations above the mean (Whallon 1974:23). Nearest neighbors are not normally distributed in clustered distributions, but tend towards a positive skew in the direction of the smaller distances and sometimes even toward bimodal curves (Washburn 1974:322). Under these circumstances the following technique devised by Whallon will be modified using a cut-off point determined by the median rather than the mean. A circle with a radius equal to the median cut-off distance is drawn around each observational point. The outer boundary formed by the intersecting circles is taken to represent the perimeter of the activity area. The total area can easily be calculated by counting the squares of fine grid overlay map and interpolating the area enclosed in the curved lines. Figures 15-23 show the distribution of each artifact class and the significant area of its distribution. Each map was then compared with every other map to determine the amount of area which the two activities shared. With this data it was then possible to show the index of differentiation for each pair of activities as well as to show the average index for all combinations of pairs (Table 23).

Summary

Statistically it has been possible to show that most of the

various classes of artifacts are not distributed randomly on the occupation floor of Housepit A-1. There is a measurable degree to which these activities are spatially differentiated; a product of the integrative behavior of the past group. In order to test whether or not the level of socio-behavioral complexity varies among groups inhabiting different enviromments, it must be shown that the archaeological structure of an occupation site reflects the complexity. It is hoped that the above methodology will contribute towards future research in this sector of paleo-antropology, and that the theoretical problems are closer to being solved.

CHAPTER 4 SPATIAL ANALYSIS OF SITE SURFACE COLLECTION DISTRIBUTIONAL DATA

Archaeological sites are being destroyed in ever increasing numbers, and there is very little that can be done to stop this day by day destruction. It may in some instances be possible to use data which is still present though disturbed through recent farming activities, if the subsurface structure can be located and described. The presence of a destroyed housepit in cross-section B of this site has allowed experimentation with a technique of analysis which may describe the processes that lead to an observed surface distribution of artifacts.

Problem

The problem defined is: what are the operating types of processes which cause observed distributions of artifacts on the surface of a habitation site. Two broad types of processes will be studied in this preliminary analysis, 1) random, independant distributional processes, and 2) contagious, dependant distributional processes.

The locations of artifacts on the surface should be related to the locations of artifacts within the ground, providing no drastic alteration has occurred to the site. Binford has shown that there is a correlation between surface distributions of artifacts, and the intensity of the occupation of a site (1970:88).

If this is the case, it can be also be shown that the cultural processes which caused the subsurface structure are the same processes which cause the surface structure. If the distribution of artifacts is clustered, for instance as rep-

resented by a habitation, surface artifacts will tend to be closer to the origin of the activity.

It will be argued here that the process which accounts for the distribution of artifacts in an occupation site consisting of discrete habitations is a contagious one. This means that on a surface area containing one or more habitations, the occurrence of 1 artifact will increase the probability of another being found near it. This type of distribution fits the negative binomial function (Feller 1943:389-393; Bliss 1953:177). If the observation of one artifact has no influence on the location of another artifact they are said to be statistically independant events and will conform to a random distribution described by the Poisson function. Both types of distributions rely on counts per unit area and can be tested for goodness of fit relatively easily. These distributions are discussed in relation to settlement patterns by Wood (1971:66-70) and their underlying causative processes. Therefore, an objective criterion is availiable when deciding whether or not an artifact distribution is significantly clustered enough to represent a subsurface activity location.

Method

The area under study was divided into a grid of equal sized units. Each unit was 1 meter square, and the total area contained 800 sq. m. The size of each unit, or quadrat will affect the randomness of distribution, especially when dealing with units close to the size of the clustered phenomenon under study (Pielou 1957:32). For purposes of the analysis however, only one size of quadrat will be used, and the data is in a form such that it

may be modified for techniques requiring various quadrat sizes.

Each of the quadrats was then surface collected so that the total population of items for the cross-section was recovered. The number of quadrats containing each of the different artifact densities from 0 items per unit to 7 or more intems per unit was then quantified. The resulting frequency distribution obtained for each of the various classes of artifacts recovered, was then compared to the two different expected probability distributions (Ondrick and Griffiths 1969).

If the distribtion conforms to an expected Poisson distribution then it is highly probable that a random process has occurred. It does not however, mean that no habitation area is present, but that either of two things could have hapened; 1) the distribution of surface artifacts has not been sufficiently disturbed to allow for large enough representation of the population or it has been too badly disturbed, or 2) a different type of activity, one which might cause diffuse artifact distributions, has taken place. Some types of activities not actually associated with a concentrated occupation may leave randomly distributed artifact patterns.

In some cases a large area may have only one cluster of artifacts present. When this occurs it is much easier to define the locus of clustering and possibly the type of activity which led to its formation, simply by visual inspection. However, when further investigation such as excavation is to proceed from the surface definition of the site, it will be useful to be able to define the degree of clustering the distribution represents. If the distribution is highly clustered then a

greater amount of confidence can be placed in relationship between surface and subsurface distributions. The quadrats with occurrences of artifacts could be used as the sampling population for the subsurface structure.

In a site containing more than one habitation, say an entire village site, which has had surficial features removed, a different method of defining the spatial extent of each cluster may be more reliable. Whallon (1973) reviews the archaeological application of dimentional analysis of variance and this type of analysis may be more useful than the present analysis when multiple clusters are concerned.

The next step was to determine how well uniform plowing of the surface may better indicate clusters of items. Since as in the case of cross-section B, only the housepit area had been plowed initially (Figs. 1,10), it was thought that homogeneous plowing of the surface would indicate activities which had not previously been noted on the surface. The whole cross-section was disc-plowed to an average depth of 10 cm in order to remove the vegetation cover and loosen the sod layer. The same grid of quadrats was then re-collected and the same procedure for the post-plow data was used as was used for the pre-plow collection.

Results

The classes of artifacts recovered are summarized in Chapter 2. Most classes had too few observations of each item to permit reliable analysis, and were combined together into 1 group along with the 3 separately analysed groups; chipping detritus,

bone fragments, and fire cracked rock (Figs. 26-35).

This means that only some activities are represented individually, and that their distribution indicates the locations where the specific activity took place. Disturbance from plowing will make a fine grained analysis of specific activity locations impossible but it will be possible to observe the entire cluster of activities represented in a housepit occupation. Table 24 shows that none of the artifact distributions either before plowing, after plowing, or all combined, fitted an expected random Poisson distribution. This means that the distribution of artifacts could be either more aggregated or more uniform than random. This problem is solved by then fitting the observed distributions to the negative binomial distribution; if they fit (a 0.05 level of probability is used) by use of the chi-square statistic, a aggregated distribution of artifacts is evident.

The spatial distributions of all artifacts analysed were not significantly different from the expected negative binomial distribution, except for bone fragments. Too few observations were present so that a chi-square goodness of fit could not be performed in this classification. This means that in all but one individual classification tested, the distributions were aggregated (Table 24); the combined total of all artifacts for each collection revealed the best fit to a contagion description.

There was not a great deal of difference between pre- and post-plow distributions although the post-plow patterns are slightly less random. This was probably caused by plowing the al-

ready disturbed housepit area, giving differential access to subsurface artifacts. In order to test whether or not the duplicate disturbance of the housepit area greatly affected the degree of clustering recognized, it had to be known whether subsurface habitations were present but not indicated by surface plowing. The east margin of the cross-section was mechanically trenched to a width of .75 m and a depth of 1.5 m. Two small cultural depressions, possibly housepits, were stratigraphically revealed, both of which showed no surface indication before or after plowing (Fig. 25). When comparing clusters within a defined boundary, it appears to be desirable that the whole area be subjected to the same amount of disturbance. This was not the case in the analysis presented here and therefore statements concerning the subsurface structure of the entire cross-section cannot be reliably made.

In conclusion, it is essential that more objective means of data collection and analysis such as this are brought into use if we are to utilize the prehistoric record in developing laws governing cultural process. The author agrees completely with the statement by Robert Whallon (1974a:494) that "if [the method presented here] can be useful to someone else in coping with the analysis of spatial patterning in his data then it will have served its main purpose."

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Table 1. Prehistoric artifact summary for Housepit A-1.

Class	Type	Number	Percent of total
Projectile points		18	0.31
	corner notched	15	
	side notched	2	
	miscellaneous	1	
Knives		31	0.54
	ovate	4	
	simi-circular	1	
	blade	1	
	medial sections	2	
	basal sections	1	
	tip sections	9	
	miscellaneous fragments	13	
Scrapers		17	0.29
	end scrapers	5	
	concave side scrapers	2	
	convex side scrapers	6	
	combined convex-concave side	4	
Gravers		2	0.03
Burin		1	0.01
Drills		3	0.05
Retouched flakes		217	3.79

Table 1. continued

Class	Type	Number	Percent of total
Hammers		8	0.13
Core fragments		33	0.57
Abraders		4	0.06
	sandstone slabs 3		
	pebble 1		
Grinding slab		1	0.01
Net weights		2	0.03
Spall		1	0.01
Chipping detritus		4368	76.31
Bone fragments		997	17.41
Antler fragment		1	0.01
Pigment fragments		8	0.13
Tooth fragments (deer)		11	0.19
Shell fragment (fresh water)		1	0.01
TOTAL		5724	99.89

Table 2. Pre-housepit artifact summary for Cross-section A.

Class	Type	Number	Percent of total
Graver		1	0.28
Chisel		1	0.28
Knives		4	1.15
	basal sections 1		
	miscellaneous 2		
	ovate (frag.) 1		
Retouched flakes		13	3.75
Pigment		3	0.86
Shell fragments		4	1.15
Chipping detritus		289	83.52
Bone fragments		31	8.95
TOTAL		346	99.94

Table 3. Historic artifact summary for Housepit A-1 surface

class	Type	Number	Percent of total
Nails		27	15.51
	square headed (long)	12	
	square headed (short)	14	
	round headed	1	
Miscellaneous metal items		128	73.56
	metal container fragments	122	
	wire fragments	4	
	railway washer	1	
	miscellaneous	1	
Glass bottle fragments		19	10.91
	purple	11	
	clear	5	
	brown	3	
TOTAL		174	99.98

Table 4. Prehistoric artifact summary for Cross-section B surface collection.

Class	Type	Number	Percent of total
Projectile points		6	1.68
	corner notched	2	
	side notched	1	
	triangular-unnotched	1	
	tip section	1	
	miscellaneous	1	
Knives		5	1.40
	ovate fragment	1	
	semi-circular	1	
	spall	2	
	miscellaneous	1	
Scrapers		1	0.28
	concave sided	1	
Retouched flakes		29	8.14
Hammers		3	0.84
Abrader		1	0.28
Net weight		1	0.28
Chipping detritus		216	60.67
Bone fragments		94	26.40
TOTAL		356	99.97
Fire cracked rock		259	42.11
All other (as above)		356	57.88
TOTAL		615	99.99

Table 5. Historic artifact summary for Cross-section B surface collection.

Class	Type	Number	Percent of total
Nails		2	15.38
	square headed (long)	1	
	round headed	1	
Metal fragments		7	53.84
	railway nuts	3	
	metal container frags.	2	
	wire fragment	1	
	miscellaneous	1	
Glass bottle fragments		2	15.38
Ceramic fragment		1	7.69
Rifle cartridge .22 calibre		1	7.69
TOTAL		13	99.98

Table 6. Artifact summary and population estimates for Housepit B-1.

Class	Sample n_1	n_2	n_3	n_4	n_5	n_6	n_7	n_8	n_9	n_{10}	Σn	% of total	Sample standard deviation	Sample mean as estimate of pop. mean	95% confidence limits	Population total estimate	95% confidence limits
Chipping detritus	113	76	62	19	11	14	100	20	44	24	483	58.6	35.6	48	± 25	7148	± 3632
Bone fragments	66	7	43	11	3	1	71	0	18	21	241	29.24	25.3	24	± 17	3567	± 2580
Retouched flakes	20	12	5	3	3	0	15	4	13	6	81	9.71	6.1	8	± 4	1199	± 626
Scrapers	1	1	1	0	0	0	1	1	0	0	5	0.60	0.5	0.5	± 0.3	74	± 51
Drills	1	0	0	0	0	0	0	0	0	0	1	0.12	0.3	0.1	± 0.3	15	± 31
Knives	3	2	0	0	1	0	3	0	0	1	10	1.21	1.2	1.0	± 0.8	148	± 121
Projectile points	1	1	0	0	0	0	0	0	0	0	2	0.24	0.4	0.2	± 0.26	30	± 41
Cores	0	0	0	0	0	0	0	0	1	0	1	0.12	0.3	0.1	± 0.2	15	± 31
Graver	0	0	0	0	1	0	0	0	0	0	1	0.12	0.3	0.1	± 0.2	15	± 31
TOTAL											824	99.97				12211	± 7144

Table 7. Artifact summary for miscellaneous cultural depression, Cross-section B

Class	Type	Number	Percent of total
Chipping detritus		7	41.17
Knives		2	11.76
	ovate (possible projectile point) 1		
	miscellaneous 1		
Bone fragments		8	47.05
TOTAL		17	99.98

Table 8. Projectile points; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.	neck width mm.
Corner notched				
1) concave sided				
2869	—	11	2.5	7
Mean	—	—	—	—
Range	—	—	—	—
2) Straight to convex				
2496	34	—	6	13
5684	46	27	6.5	13.5
1354	35	21	6	11
5147	33	21	6	13
3345	35	17	5.5	10
505	28	15.5	4	9
4229	42	20	6	12
2140	29	19	5	15
1497	44	23	8	13
2253	—	25	—	11
Mean	32.6	18.9	5.3	12.1
Range	28.0-46.0	15.5-27.0	4.0-8.0	9.0-15.0
3) Basal sections				
5432	—	—	—	12
1252	—	—	—	13
1568	—	—	—	14
582	—	—	—	—

Table 8. cont'd.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.	neck width mm.
3) Basal sections cont'd.				
Mean	—	—	—	13
Range	—	—	—	12.0-14.0
Side notched				
5169	21.5	14.5	4	9
186	—	8.5	2.5	5
Mean	—	11.5	3.3	7
Range	—	8.5-14.5	2.5-4.0	5.0-9.0

Table 9. Knives; Housepit A-1.

Artifact EdQx 20:A1-	Type	length mm.	width mm.	thickness mm.
381	ovate	71	32	15
3297	"	62	31	11
2274	"	44	30	7
1967	"	—	22	5.5
Mean		44.3	28.8	9.6
Range		44.0-71.0	22.0-32.0	5.5-15.0
2505	semi-circular	41	32	7
1042	blade	52.5	14	4
4250	basal section	—	31	13.5
1791	medial sections	—	21.5	5
305	" "	—	29	8
4530	" "	—	30	10
Mean		—	26.5	7.7
Range		—	21.5-30.0	5.0-10.0
1393	tip sections	—	20	5
3206	" "	—	19.5	9
810	" "	—	26	9
5751	" "	—	21	5
4704	" "	—	19	7.5
3496	" "	—	16	3.5
6052	" "	—	23	5
5833	" "	—	13	3
1686	" "	—	14	4
Mean		—	19.1	5.7
Range		—	13.0-26.0	3.0-9.0

Table 9. cont'd.

Artifact EdQx 20:A1-	Type	length mm.	width mm.	thickness mm.
4924	fragment	49	—	11
3661	"	31.5	—	11
4233	"	48	—	10
5821	"	38	—	6
1567	"	56	—	8
4293	"	35	—	9
976	"	30	—	4
1549	"	26	—	6
4442	"	26.5	—	9
3642	"	21	—	2
5728	"	22	—	2.5
5827	"	18.5	—	4
Mean		33.5	—	6.9
Range		18.5-56.0	—	2.0-11.0

Table 10. Scrapers; Housepit A-1.

Artifact EdQx 20:A1-	Type	length mm.	width mm.	thickness mm.
3396	end scrapers	31	25	6
211	"	35	34	10
3092	"	31	22	8
4217	"	45	31	7.5
317	"	25	22.5	6
Mean		33.4	26.9	7.5
Range		25.0-45.0	22.0-34.0	6.0-10.0
3427	concave side	47.5	28.5	5
5303	"	43.5	22.5	4
Mean		45.5	25.5	4.5
Range		43.5-47.5	22.5-28.5	4.0-5.0
1397	convex side	35	25	8.5
5337	"	29.5	25	8
2488	"	37	35	8
1982	"	29	25	7
5271	"	36	22.5	7
1650	"	44	23	9
Mean		35.1	25.9	7.9
Range		29.0-44.0	22.5-35.0	7.0-9.0
3547	combined convex and concave	32	21.5	7
6081	"	32	19	5.5
1004	"	47	18	6
4661	"	38	16	5

Table 10. cont'd

Artifact EdQx 20:A1-	Type	length mm.	width mm.	thickness mm.
	combined convex and concave			
Mean	cont'd	37.3	18.6	5.9
Range		32.0-47.0	16.0-21.5	5.0-7.0

Table 11. Gravers; Housepit A-1.

Artifact EdQx 20:A1-	width mm.	thickness mm.
3095	12	4
5370	8.5	4
Mean	10.3	4
Range	8.5-12.0	—

Table 12. Burin; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.
6031	49.5	10	6

Table 13. Drills; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.
706	24	8	4
1737	27	7	4.5
4242	—	13	5
Mean	25.5	14.0	6.8
Range	24.0-27.0	7.0-13.0	4.0-5.0

Table 14. Stone hammers; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	diameter mm.
541	90	40
3503	56	40
699	51	40
1161	64	41
5012	75	47
83	85	47.5
Mean	70.2	42.6
Range	51.0-90.0	40.0-47.5

Table 15. Abraders; Housepit A-1.

Artifact EdQx 20:A1-	Type	length mm.	width mm.	thickness mm.
2141	sandstone slab	98	63	15
5172	"	42	38	25
5713	"	67	54	21
Mean		69	51.6	20.3
Range		42.0-98.0	38.0-63.0	15.0-25.0
3204	granite pebble	76	30	—

Table 16. Grinding slab; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.
401	115	43.5	41.5

Table 17. Net weights; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.
990	57	55	7
5084	52	44	15
Mean	54.5	49.5	11
Range	52.0-57.0	44.0-55.0	7.0-15.0

Table 18. Spall; Housepit A-1.

Artifact EdQx 20:A1-	length mm.	width mm.	thickness mm.
4113	102.5	74	24

Table 19. Post holes; Housepit A-1

Feature No.	Diameter cm.	Depth of hole below floor cm.
1	10.8	17.0
2	12.0	10.1
3	12.9	6.9
4	8.4	7.4
5	14.1	8.8
6	6.7	5.8
7	7.2	5.0
Mean	10.3	8.7
Range	6.7-14.1	5.0-17.0

Table 20. Housepit A-1; provenience data recovery rate.

Class	Number of art. with provenience	Number of art. without provenience	Total	Percentage of total without prov.
Chipping detritus*	3982	386	4368	8.83
Bone fragments*	956	41	997	4.41
Abraders	4	0	4	0.0
Knives*	31	0	31	0.0
Gravers	2	0	2	0.0
Scrapers*	17	0	17	0.0
Projectile points*	18	0	18	0.0
Hammers	8	0	8	0.0
Drills	3	0	3	0.0
Grinding slab	1	0	1	0.0
Net weights	2	0	2	0.0
Spall (cutting tool?)	1	0	1	0.0
Burin	1	0	1	0.0
Shell fragment	1	0	1	0.0
Antler fragment	1	0	1	0.0
Pigment (hematite)*	8	0	8	0.0
Tooth fragment (deer)*	11	0	11	0.0
Core fragments*	33	0	33	0.0
Retouched flakes*	207	10	217	4.60
Combined total	5287	437	5724	7.63

* classes with enough observations of artifacts to permit nearest neighbor analysis.

Table 21. Housepit A-1; nearest neighbor analysis using mean.

Activity	Number observed	Number too close to border	Number analysed	Density per cm^2	Observed $\bar{r}$ cm	Expected $\bar{r}$ cm	Clark and Evans R	Standard normal deviate	Thompson's Chi-Square	Degrees of freedom	Pattern	95% cutoff distance cm
A	11	4	7	0.000007	109.4	188.9	0.58	—	16.2	14	aggregated	218.7
B	17	7	10	0.000010	73.8	158.1	0.46	—	6.2	20	aggregated	133.9
C	18	6	12	0.000012	88.4	144.3	0.61	—	6.2	24	aggregated	142.6
D	8	1	7	0.000007	91.0	188.9	0.48	—	3.8	14	aggregated	143.3
E	31	7	24	0.000024	71.0	102.0	0.69	3.15	—	—	aggregated	121.8
F	207	10	197	0.000197	26.4	35.6	0.74	6.29	—	—	aggregated	53.6
G	33	9	24	0.000024	59.6	102.0	0.58	4.25	—	—	aggregated	100.3
H	3982	35	3947	0.003947	7.1	7.9	0.89	1.77	—	—	random	10.7
I	954	17	937	0.000937	10.45	16/33	0.64	3.57	—	—	aggregated	21.5

Table 22. Housepit A-1; nearest neighbor analysis using median.

Activity	observed median r cm	expected median r cm	Washburn's R	Pattern	95% cutoff distance cm
A	75.0	177.5	0.42	aggregated	106.3
B	62.8	148.5	0.42	aggregated	62.8
C	75.6	135.5	0.55	aggregated	83.2
D	111.8	177.5	0.63	aggregated	111.8
E	57.1	95.8	0.59	aggregated	79.9
F	24.0	33.4	0.71	aggregated	26.2
G	59.0	95.8	0.61	aggregated	63.6
H	6.53	7.4	0.87	random	7.2
I	8.3	15.3	0.54	aggregated	9.9

Table 23. Index of Differentiation.

Activity	A	B	C	D	E	F	G	H	I	Total area cm^2
A	—									182,974
B	0.17									99,126
C	0.14	0.41								210.874
D	0.53	0.60	0.43							175,945
E	0.16	0.29	0.48	0.16						297,991
F	0.58	0.60	0.52	0.72	0.68					90,697
G	0.48	0.27	0.38	0.43	0.14	0.69				226,736
H	0.86	0.51	0.55	0.40	0.66	0.87	0.56			197,427
I	0.03	0.28	0.39	0.31	0.42	0.59	0.30	0.41	—	192,460

Average differentiation - 0.44

Table 24. The fit of surface collection data to discrete distributions.

Class	Poisson Fit X^2	D.F.**	Pattern	Negative binomial fit X^2	D.F.	Pattern
Chipping detritus						
1) pre-plow	16.1	1	non-random	2.4	7	aggregated
2) post-plow	18.1	1	non-random	1.2	2	aggregated
Bone fragments*						
1) pre-plow	50.5	1	—	—	—	—
2) post-plow	—	—	—	—	—	—
Fire cracked rock						
1) pre-plow	35.9	1	non-random	1.2	6	aggregated
2) post-plow	391.7	2	non-random	6.1	9	aggregated
All artifacts combined						
1) pre-plow	290.7	2	non-random	10.4	9	aggregated
2) post-plow	319.4	2	non-random	11.1	12	aggregated
Pre-plow and post-plow: all artifacts combined	538.6	3	non-random	20.1	17	aggregated

* too few items to permit analysis.

** D.F. = degrees of freedom.

Fig. 1. Site map, EdQx 20.

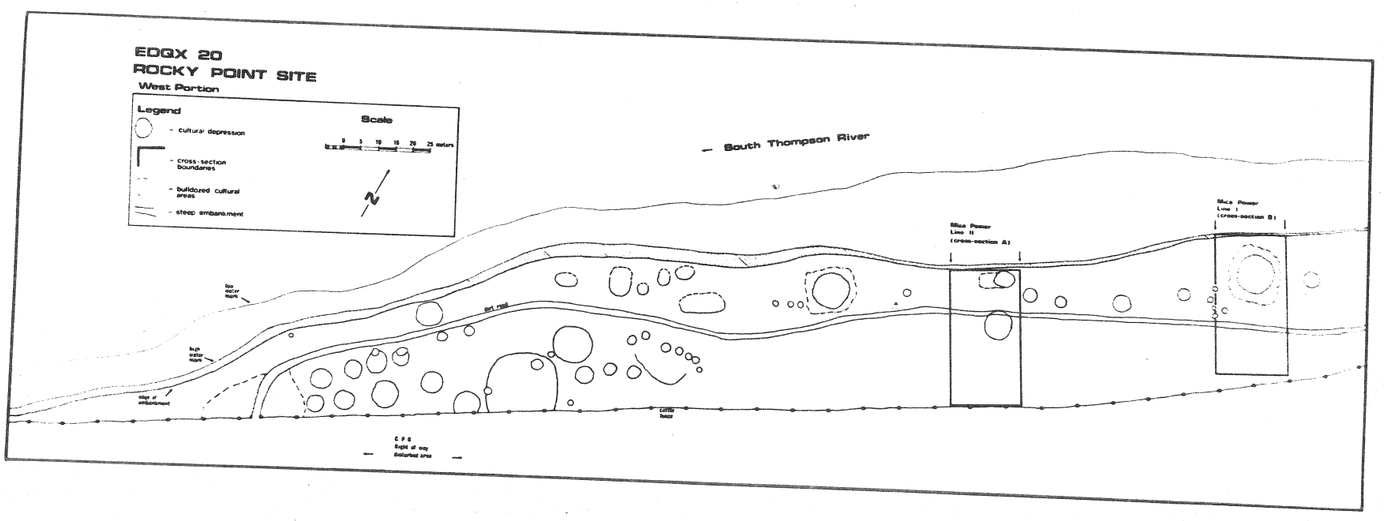
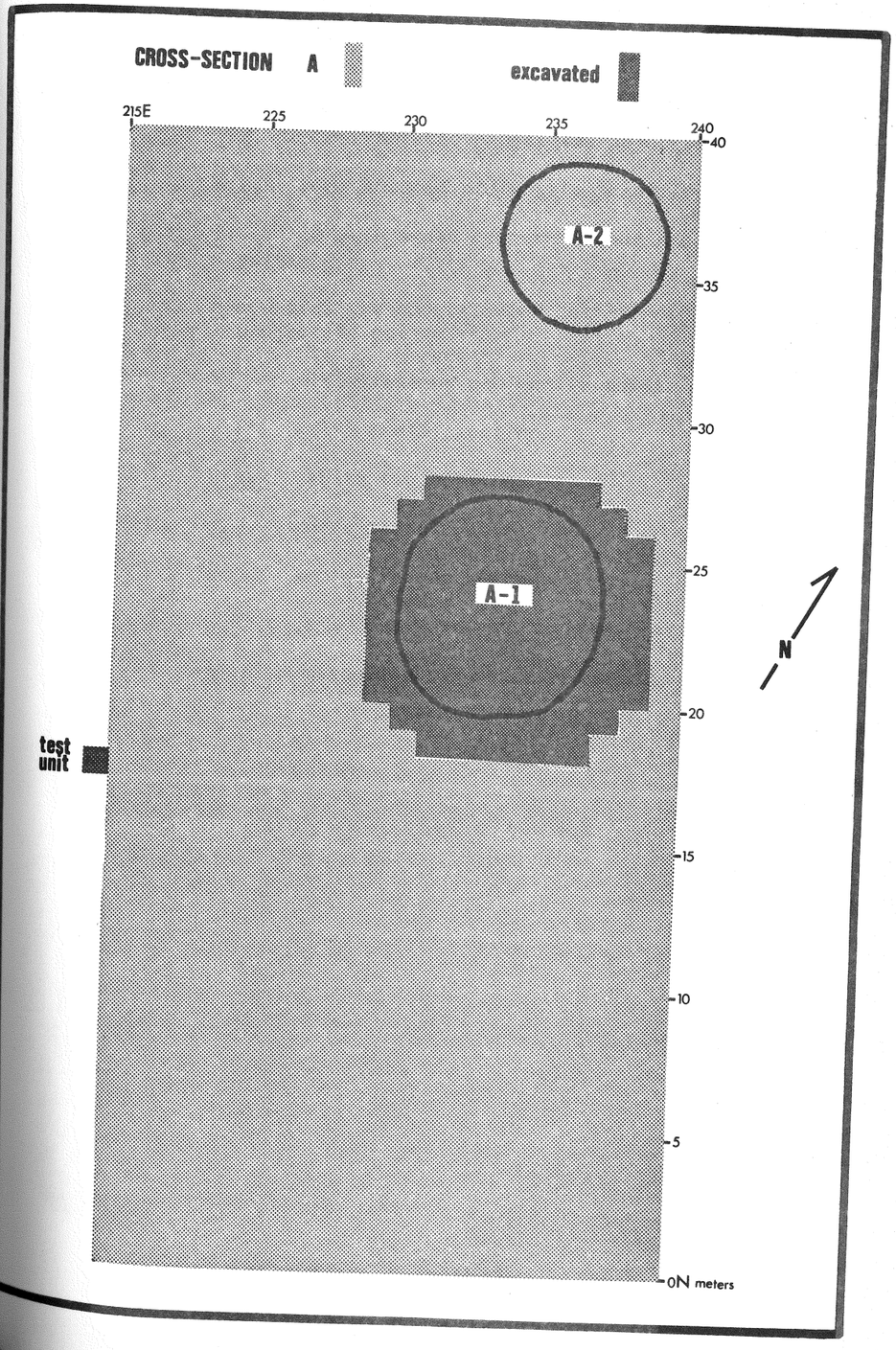

EDQX 20
ROCKY POINT SITE
West Portion
Legend
- cultural depression
- cross section boundaries
- bulldozed cultural areas
- steep embankment
Scale
0 5 10 15 20 25 meters
South Thompson River
Silica Power Line II (cross-section A)
Silica Power Line I (cross-section B)
low water mark
high water mark
edge of embankment
dirt road
cattle fence
C P R Right of way disturbed area

Fig. 2. Cross-section A.


CROSS-SECTION A
excavated
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A-2
A-1
test unit
N

Fig. 3. Housepit A-1; projectile points and knives.

a-d. corner notched projectile point bases.

e,g. side notched projectile points.

f. concave sided corner notched projectile point.

h-q. straight-convex sided corner notched projectile points.

r. miscellaneous projectile point.

y,f'. knife medial sections.

s-u,x. knife tip sections.

v. knife blade.

z. semi-circular knife.

w,b',c',e'. ovate knives.

a',d'. miscellaneous knife fragments.

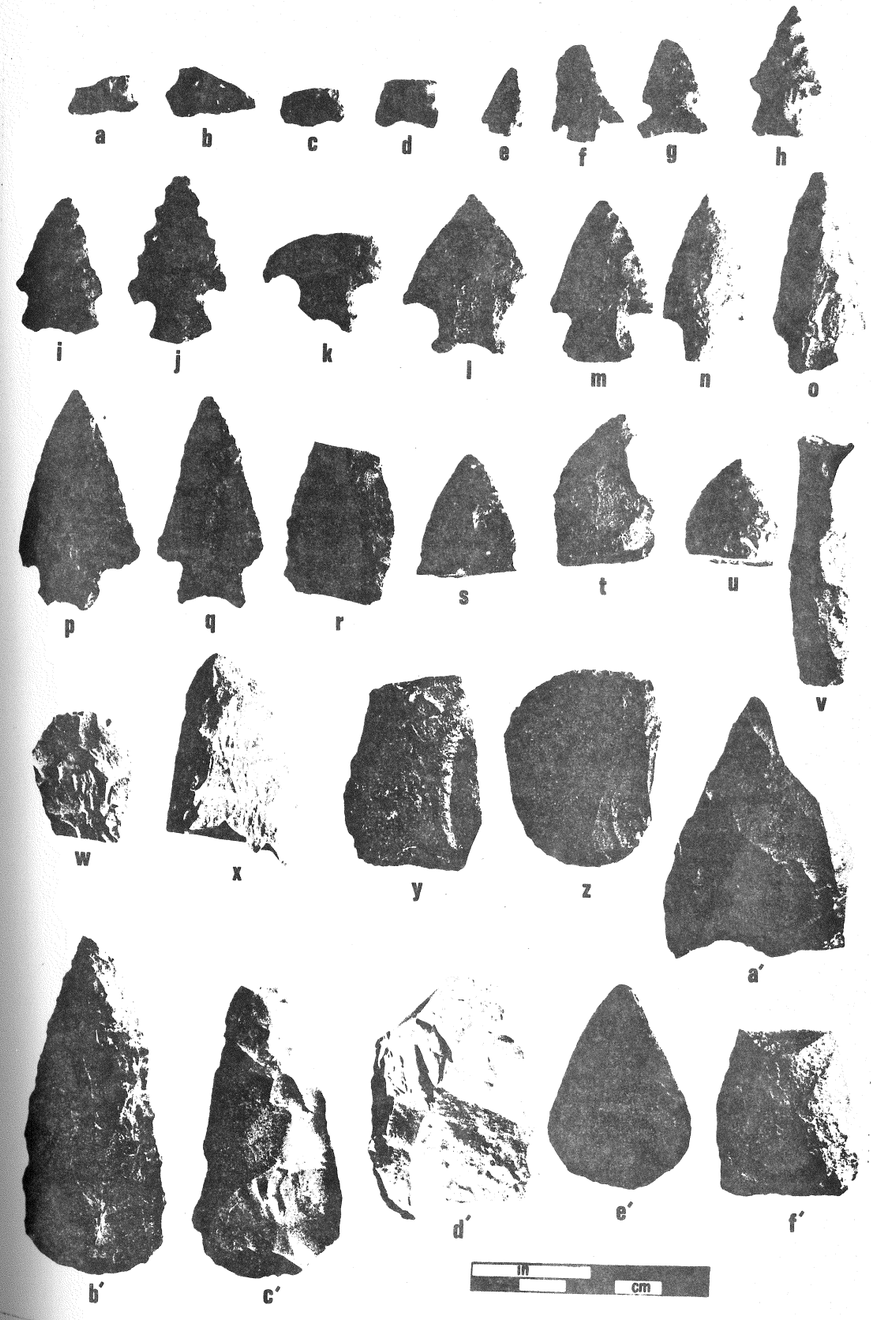
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Fig. 4. Housepit A-1; knives, drills, burins, retouched flakes, scrapers, and gravers.

a-d. knife tip sections.

e-g. drills.

h. burin.

i-m. retouched flakes.

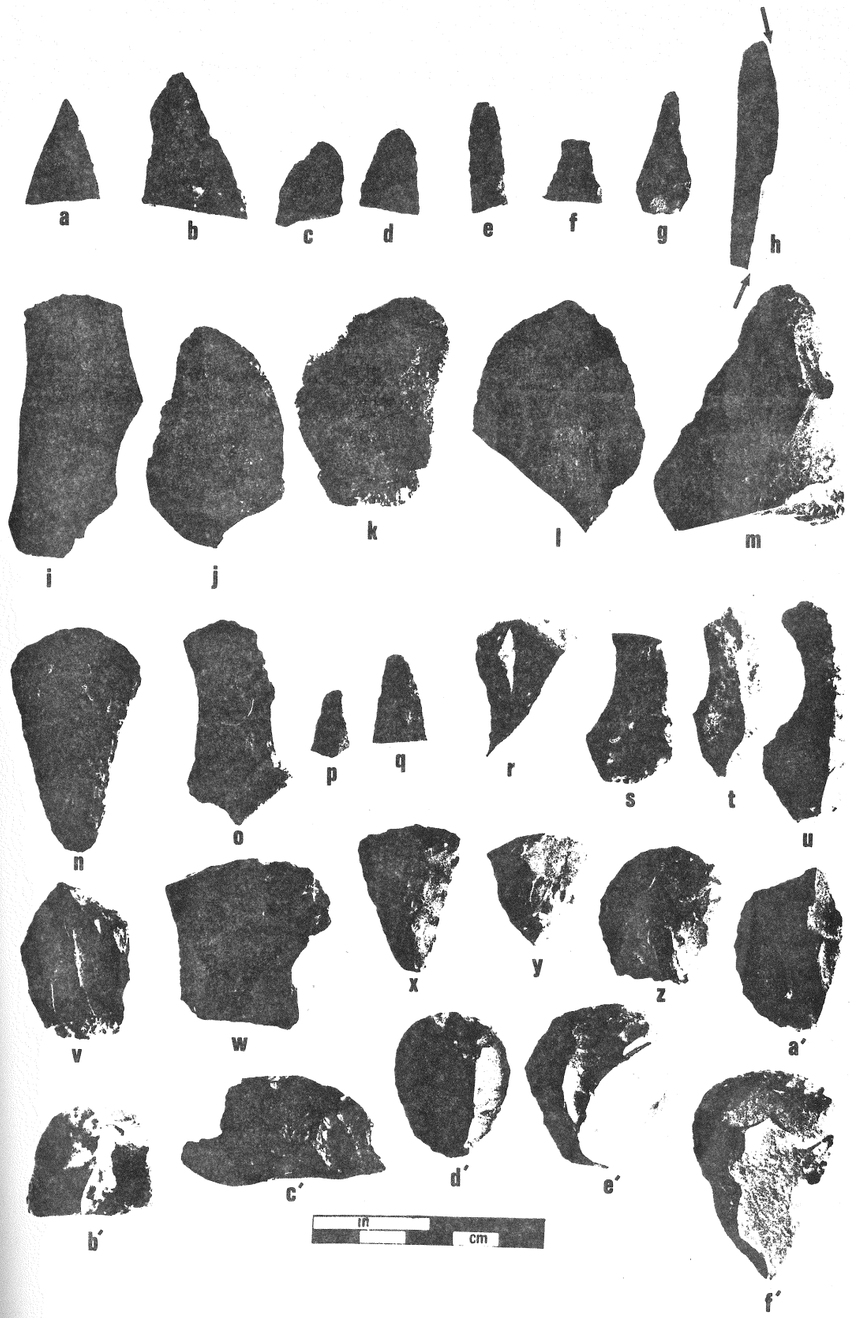
n-o. concave side scrapers.

p-q. gravers.

r-u. combined convex-concave scrapers.

v,w,z,a'-c'. convex side scrapers.

x-y,d'-f'. end scrapers.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cm

Fig. 5. Housepit A-1; cores, core fragments, and hammers.

a-c,e-f. core fragments.

d,g-i. hammers (battered pebbles).

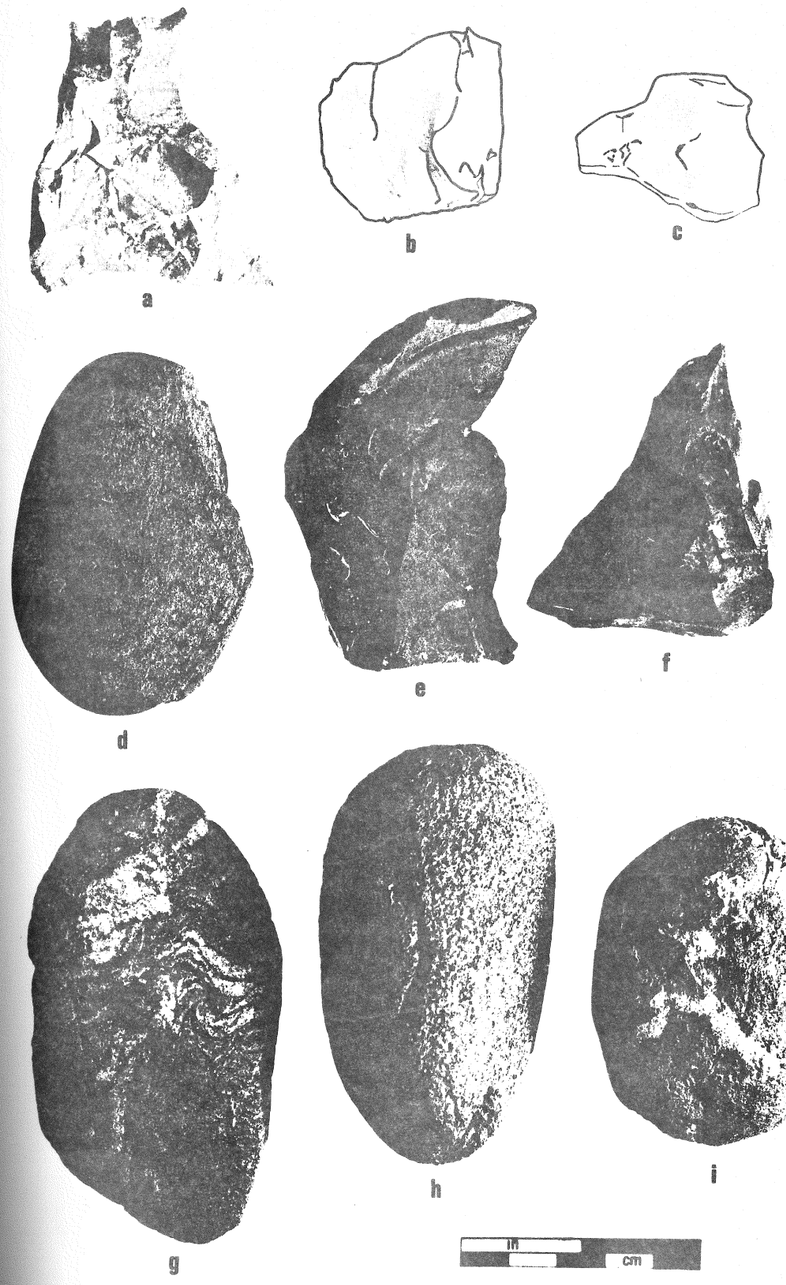

a
b
c
d
e
f
g
h
i
in
cm

Fig. 6. Housepit A-1; net weights, core, granite spall, abraders, and grinding slab.

a,c. net weights.

b. core

d,e,i. sandstone abraders.

f. granite spall knife.

g. grinding slab.

h. abraded pebble.

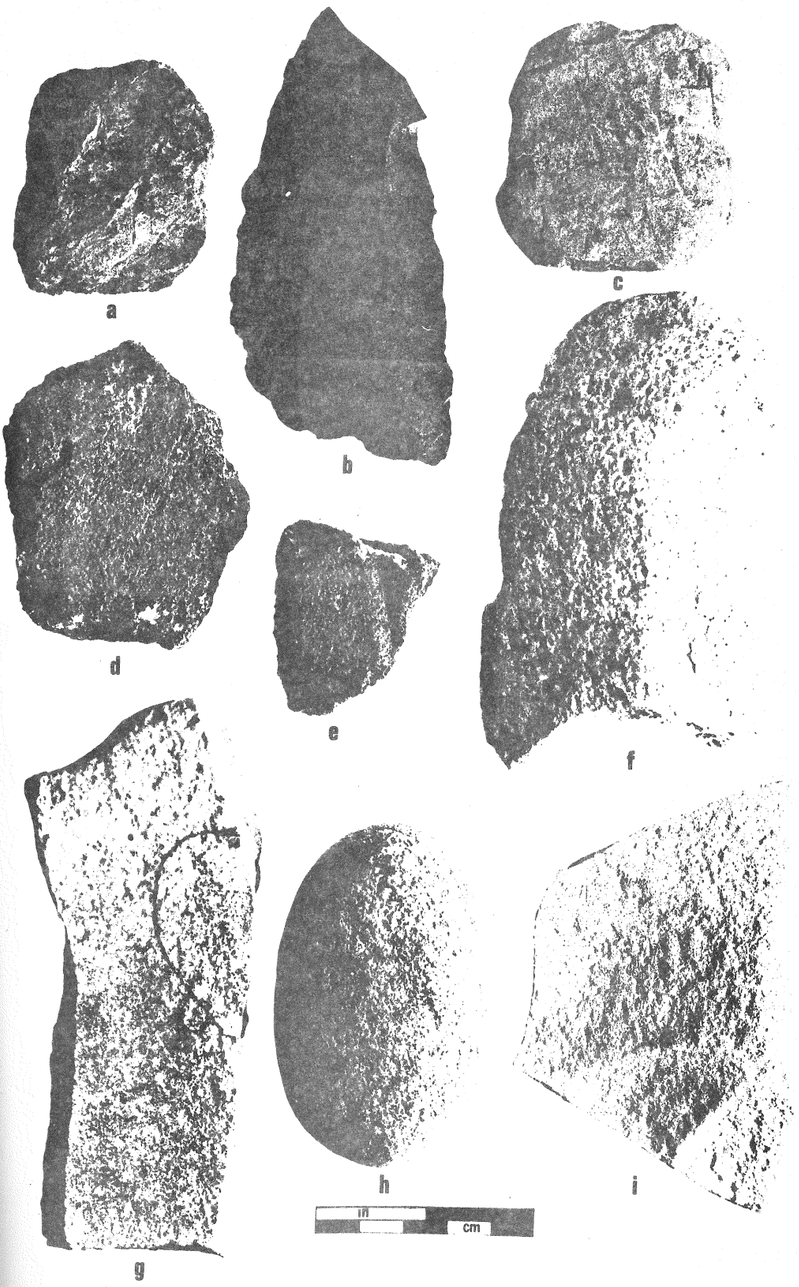

a
b
c
d
e
f
g
h
i
in
cm

Fig. 7. Housepit A-1; N.-S. stratigraphic profile.

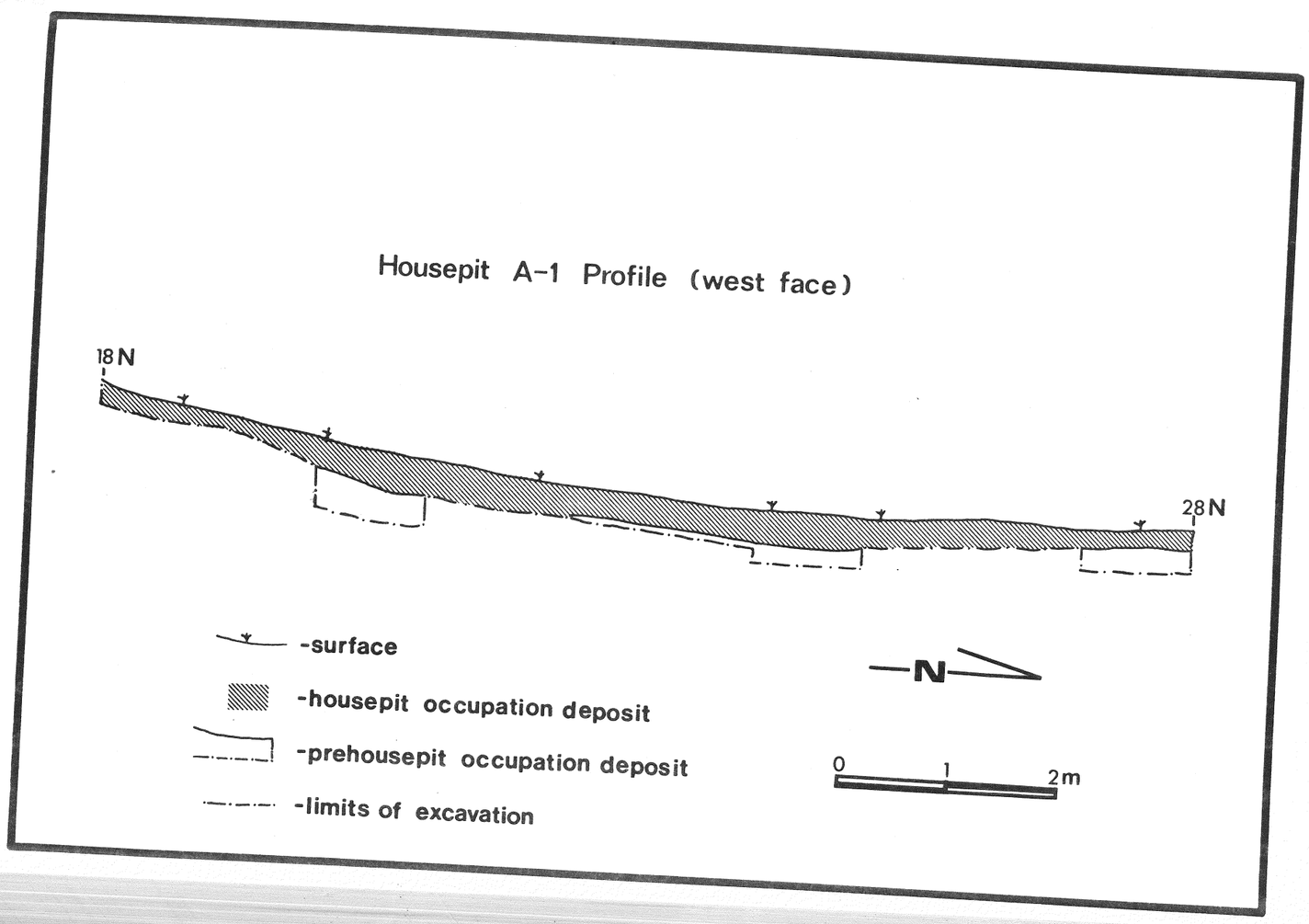

Housepit A-1 Profile (west face)
18N
28N
-surface
-housepit occupation deposit
-prehousepit occupation deposit
-limits of excavation
N
0
1
2m

Fig. 8. Housepit A-1; E.-W. stratigraphic profile.

Housepit A-1 Profile (north face)

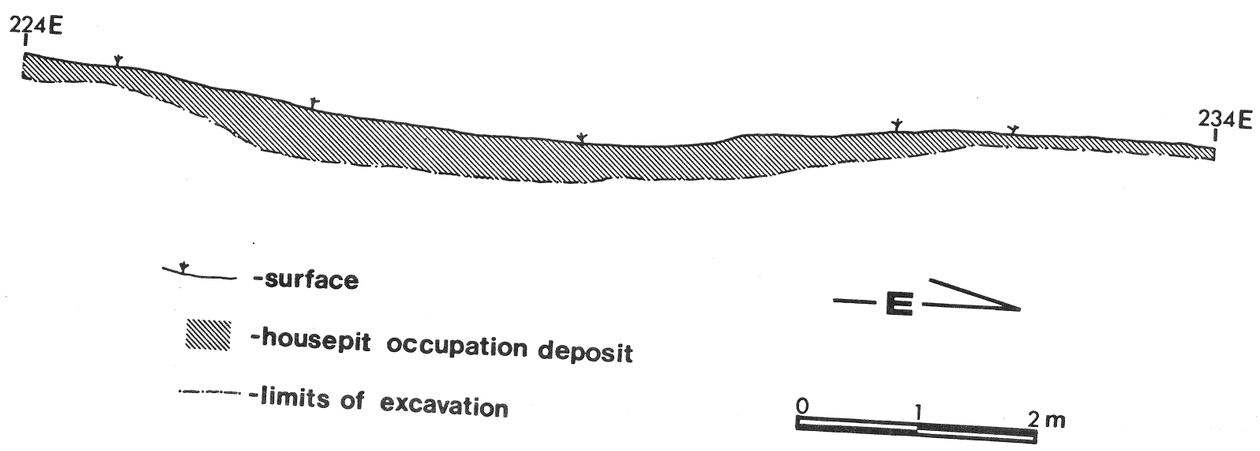


Fig. 9. Cross-section A; pre-housepit artifacts, and historic artifacts.

A. Pre-housepit artifacts.

a. graver.

b. knife basal section.

c. nephrite chisel.

d. miscellaneous biface fragment.

e. ovate knife basal section.

f-i. retouched flakes.

B. Historic artifacts (surface, housepit A-1).

j-n. square headed nails, long.

o. round headed nail.

p-q. square headed nails, short.

r-t. glass bottle fragments.

u-w. metal container fragments.

a
b
c
d
e
f
g
h
i
j
k
l
m
n
r
s
o
p
q
t
u
v
in
cm
w

Fig. 10. Cross-section B.

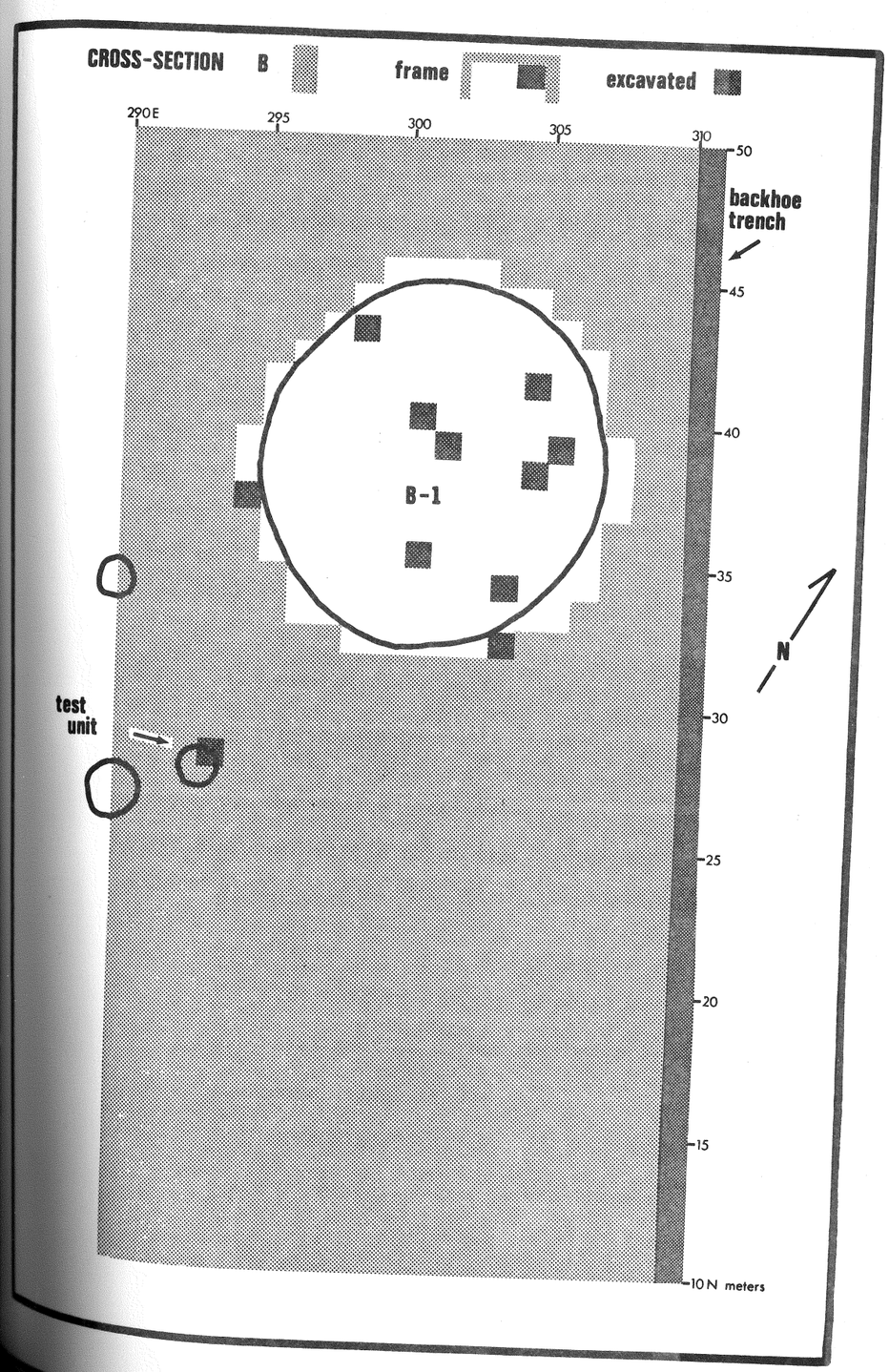

CROSS-SECTION B
frame
excavated
290E
295
300
305
310
50
45
40
35
30
25
20
15
10 N meters
backhoe trench
B-1
test unit
N

Fig. 11. Cross-section B; surface collection artifacts; Housepit B-1 excavated artifacts; and artifacts from miscellaneous cultural depression.

A. Prehistoric artifacts from C-S B surface.

a. projectile point tip.

b. miscellaneous projectile point fragment.

c-d. corner notched projectile points (straight-convex sides).

e. side notched projectile point.

f. triangular-unnotched projectile point.

g. concave sided scraper.

h. ovate knife fragment.

i-k,n. retouched flakes.

l. semi-circular knife.

m. miscellaneous knife fragment.

B. Housepit B-1 artifacts.

o. projectile point tip.

p. graver.

q. drill.

r. side notched projectile point.

s. basal section corner notched projectile point.

t. convex side scraper

u. knife blade.

v,y,a'. miscellaneous biface fragment.

Fig. 11. cont'd.

w. hammer.

x. spall scraper.

z. straight sided scraper.

C. Miscellaneous cutural depression. C-S B.

b. oval knife.

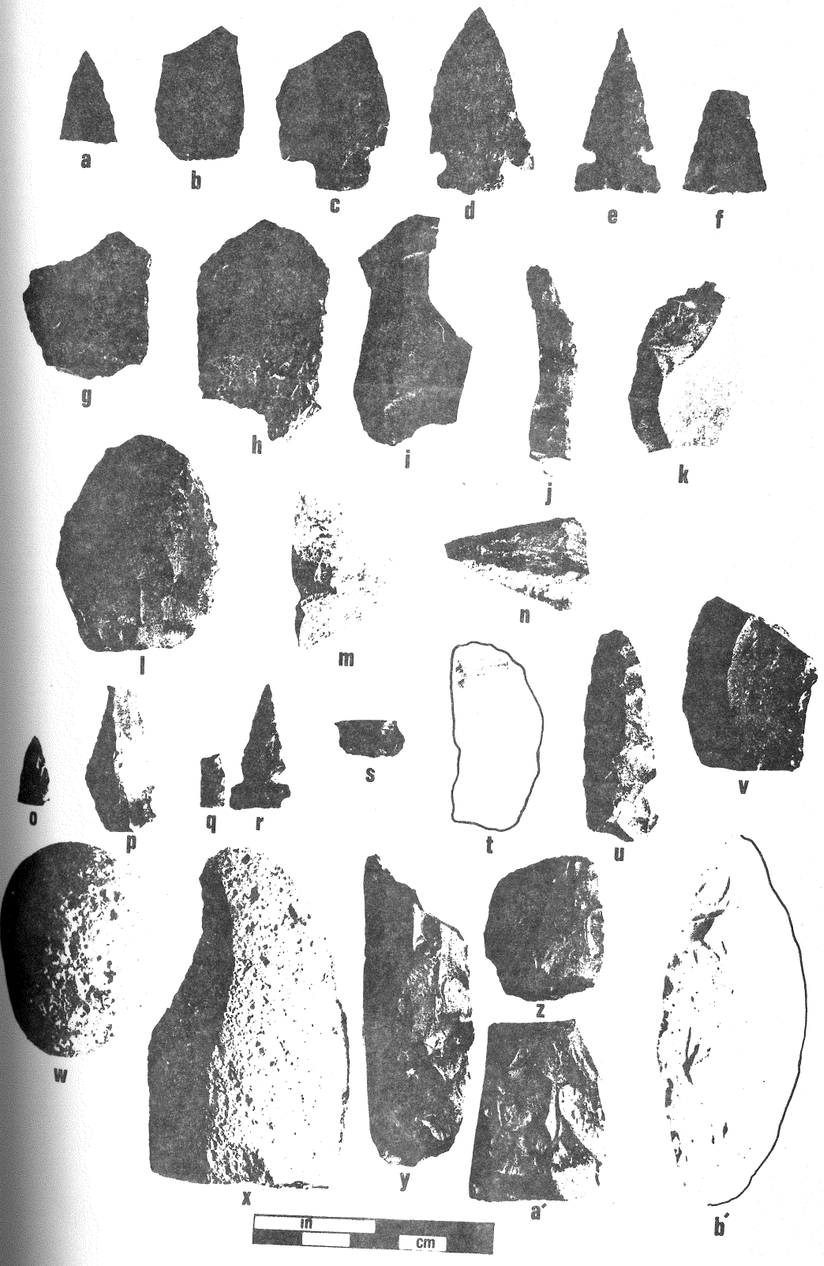

a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
p
q
r
s
t
u
v
w
x
y
z
a'
b'
in
cm

Fig. 12. Cross-section B; surface collection artifacts.

A. Historic artifacts.

a. bottle glass fragment (clear).

b. square headed nail.

c. metal container fragment.

d. bottle glass fragment (brown).

e. 22. calibre rifle shell.

f. ceramic fragment.

g-h. large nuts from railway.

B. Prehistoric artifacts.

i. hammer.

j. net weight (notched rectanguloid slab).

k-l. spall knives.

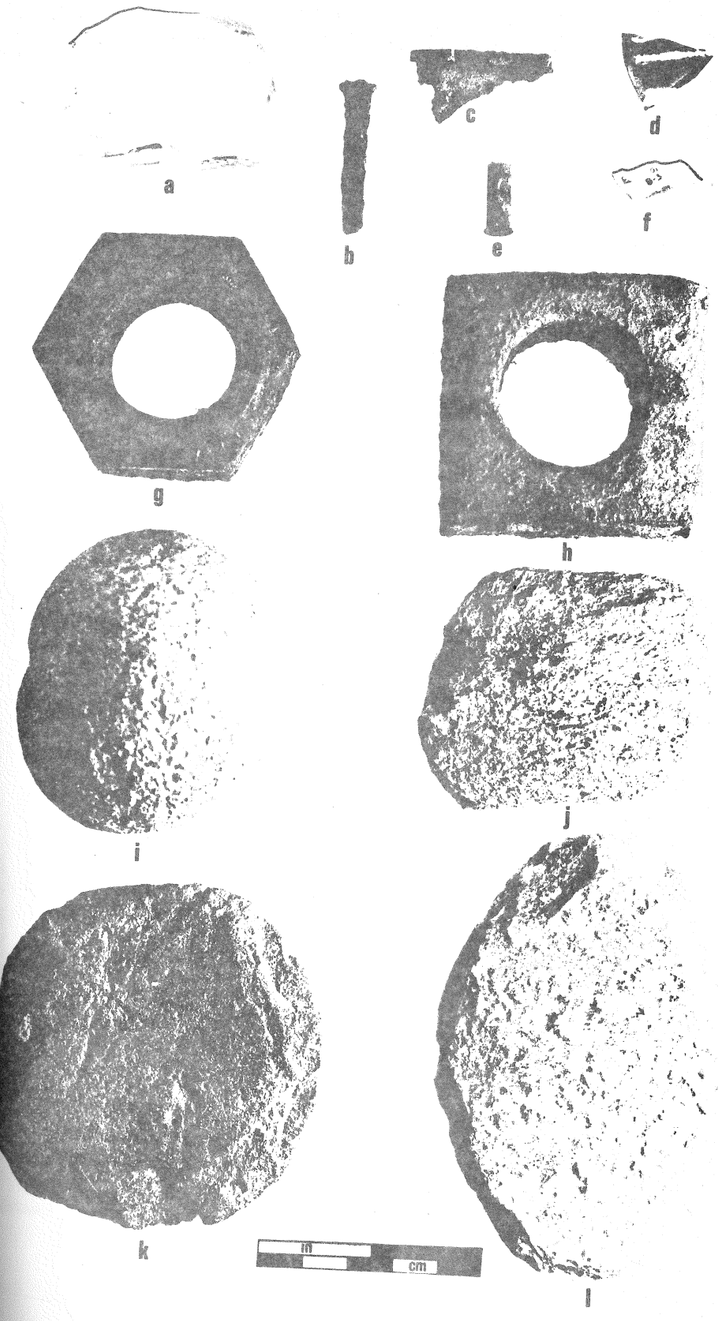
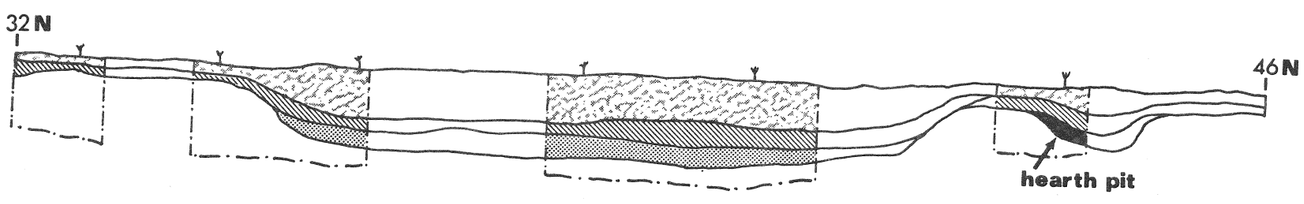

a
b
c
d
e
f
g
h
i
j
k
l
in
cm

Fig. 13. Housepit B-1; N.-S. stratigraphic profile.

Housepit B-1 Composite Profile (west face)



- surface
- bulldozed zone
- housepit occupation 1
- housepit occupation 2
- ash and cobble layer
- sterile
- limits of excavation

N

0 1 2 m

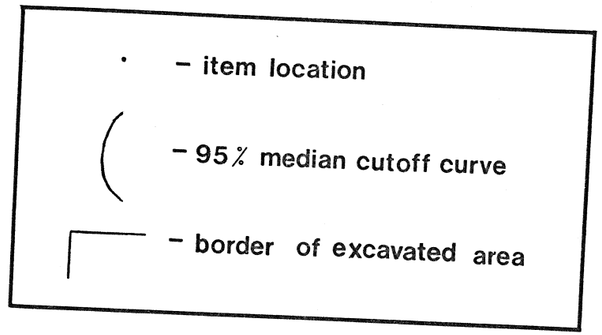
Fig. 14. Legend for Housepit A-1 artifact distributional maps, (Fig. 15-23), used in nearest neighbor analysis.

LEGEND

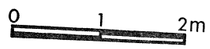
Artifact Distributions In Housepit A-1

Nearest Neighbor Analysis

Figures 15 - 23



scale



total length – 10 meters

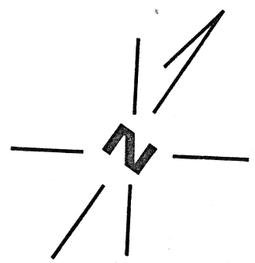


Fig. 15. Distribution of deer tooth fragments.

A deer tooth fragments

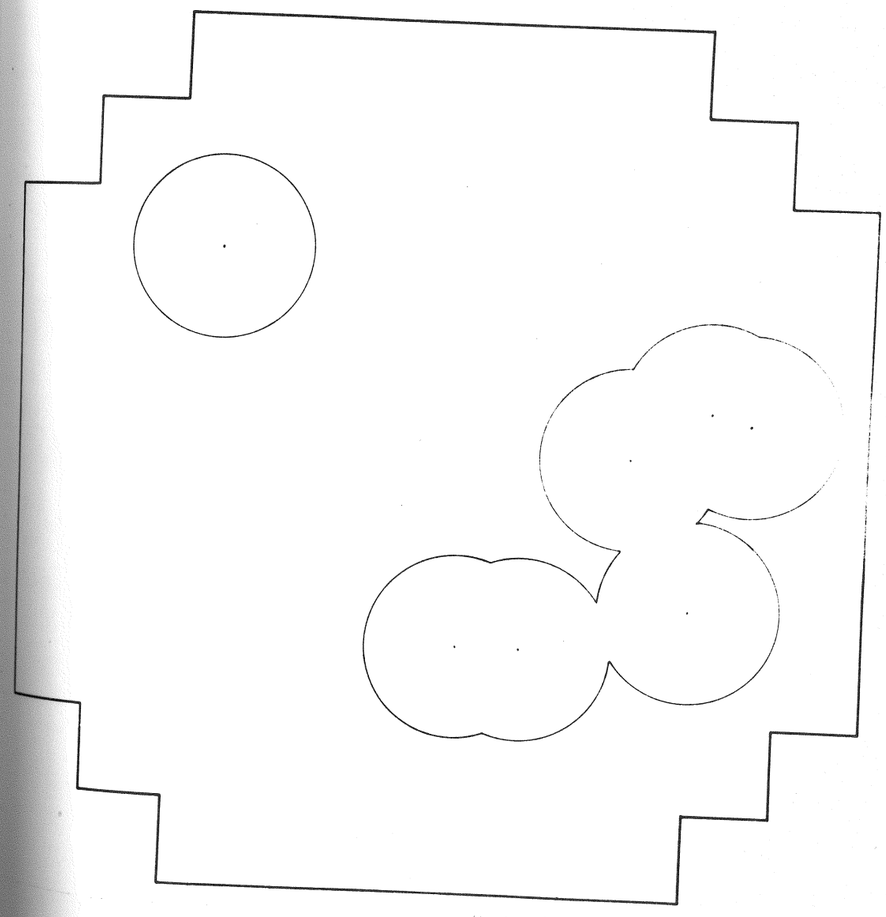


Fig. 16. Distribution of scrapers.

B scrapers

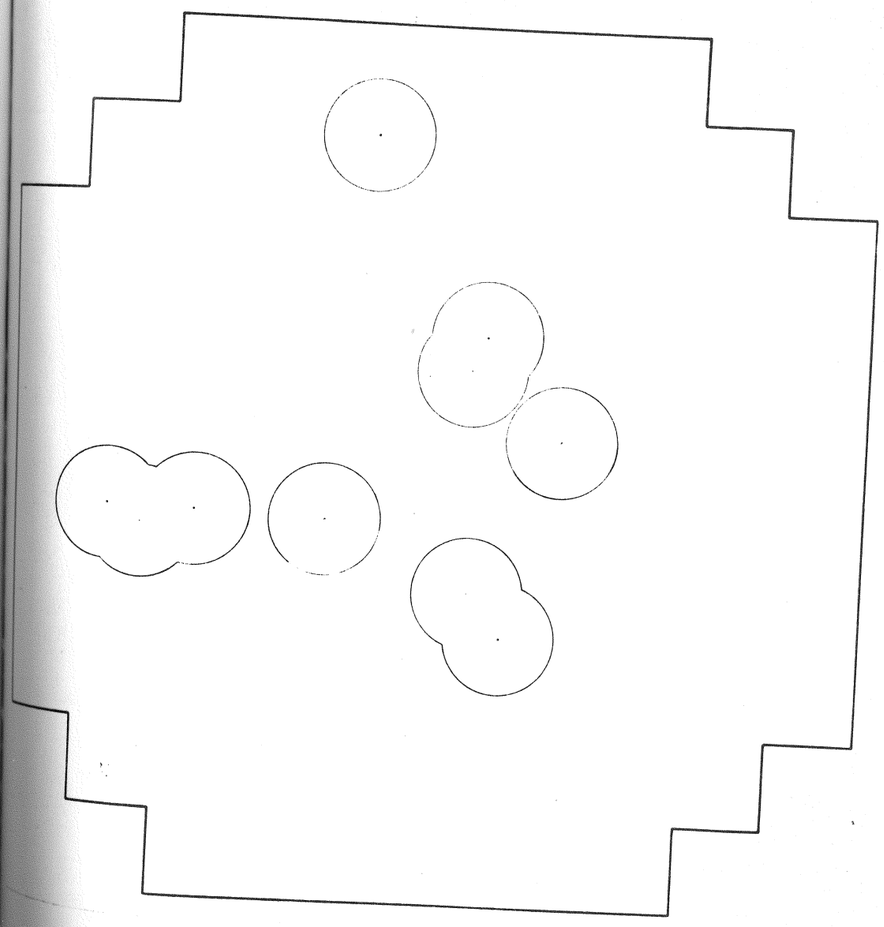


Fig. 17. Distribution of projectile points.

C

projectile points

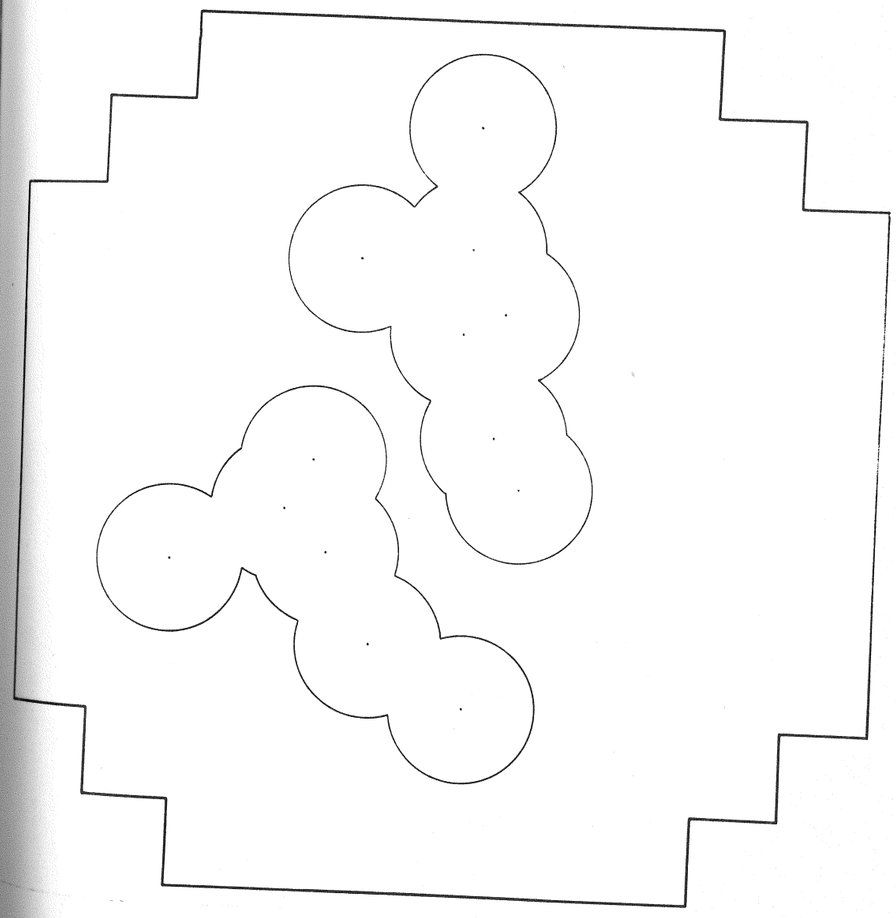


Fig. 18. Distribution of hematite.

D

hematite

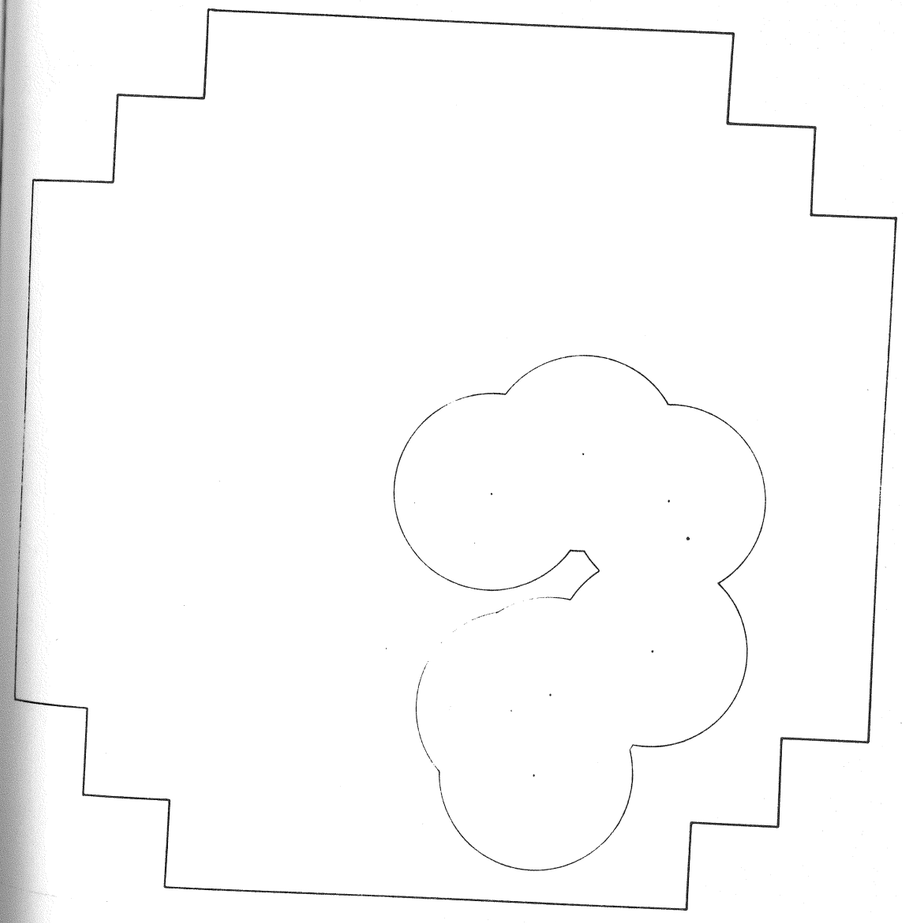


Fig. 19. Distribution of knives.

E knives

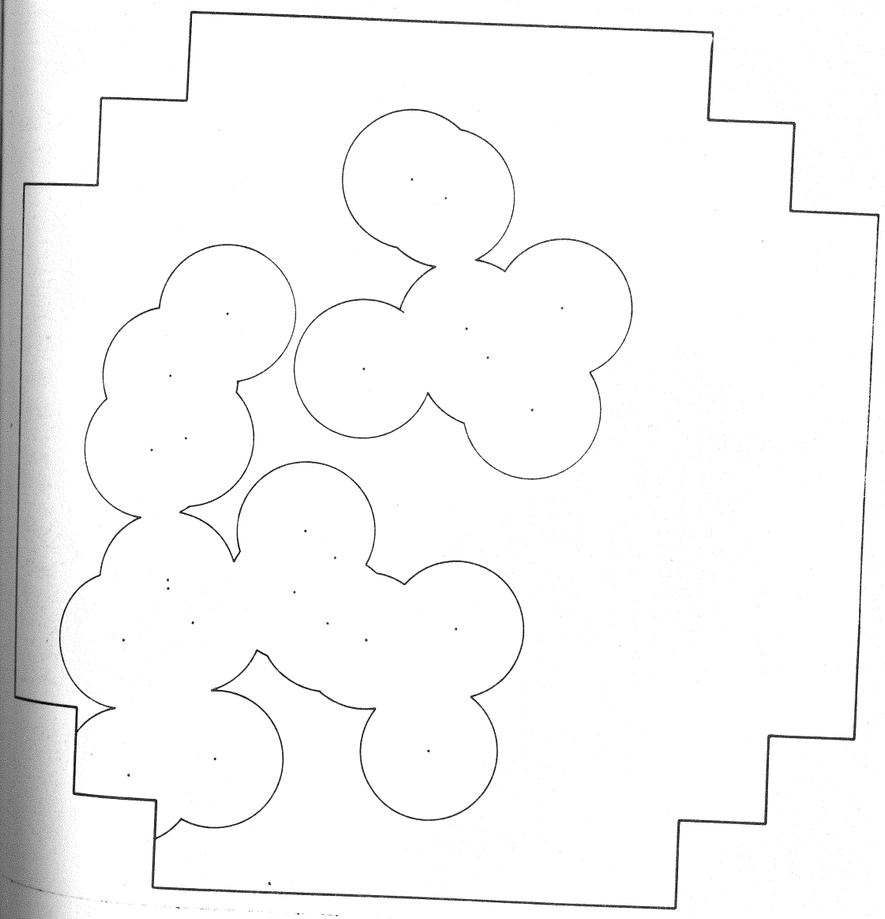


Fig. 20. Distribution of retouched flakes.

F retouched flakes

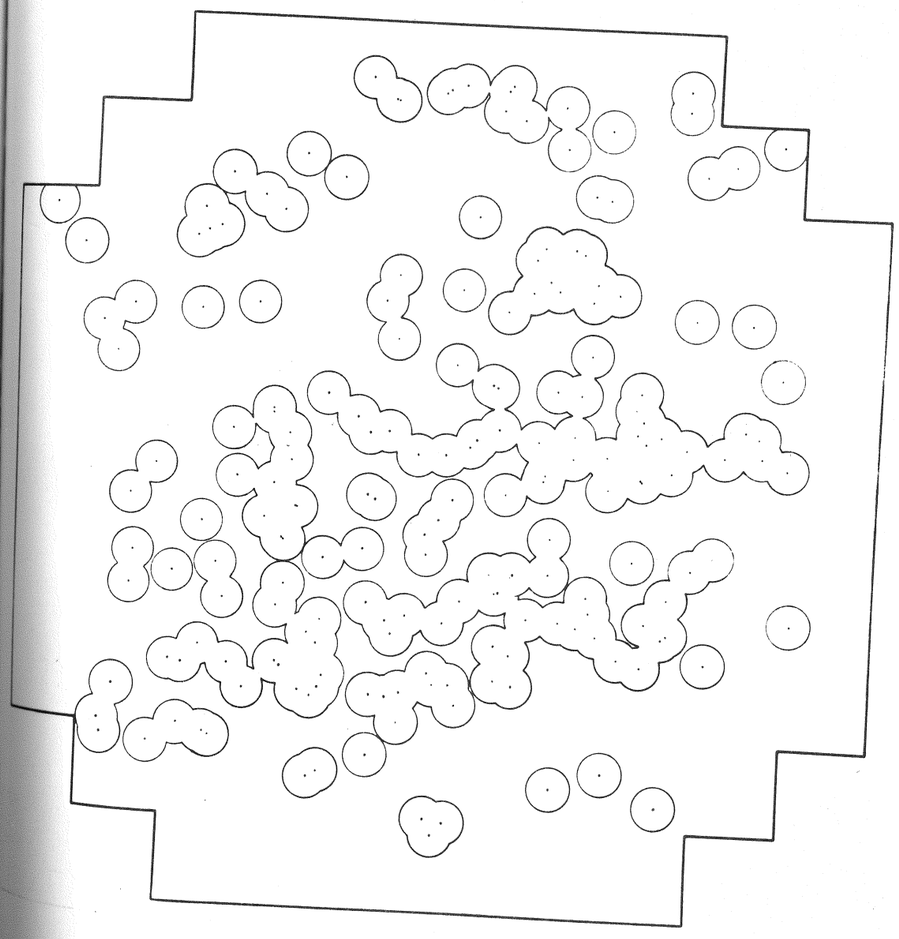


Fig. 21. Distribution of core fragments.

G core fragments

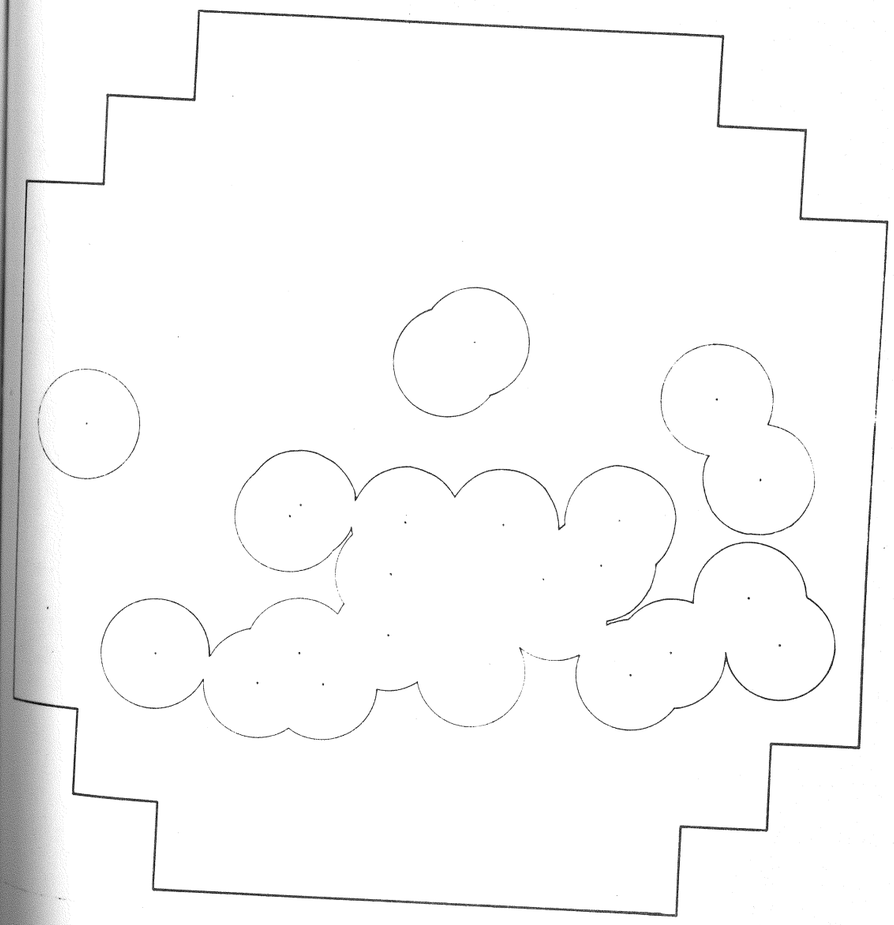


Fig. 22. Distribution of chipping detritus.

H chipping detritus

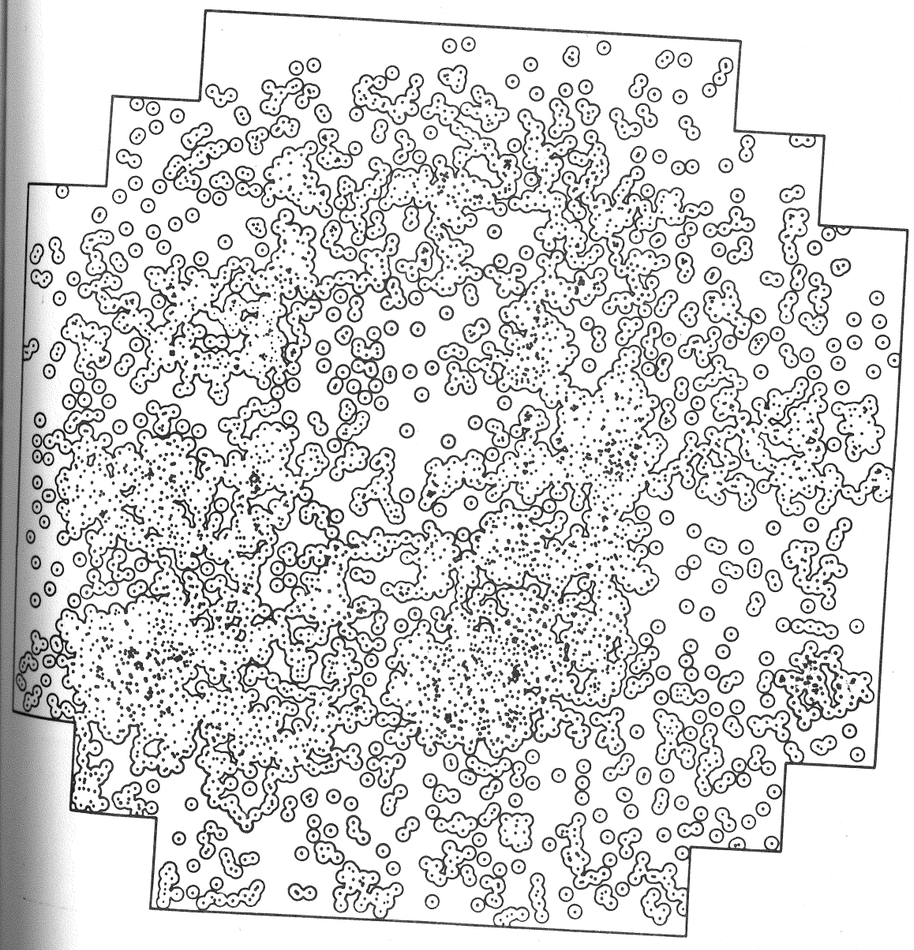


Fig. 23. Distribution of bone fragments.

I bone fragments

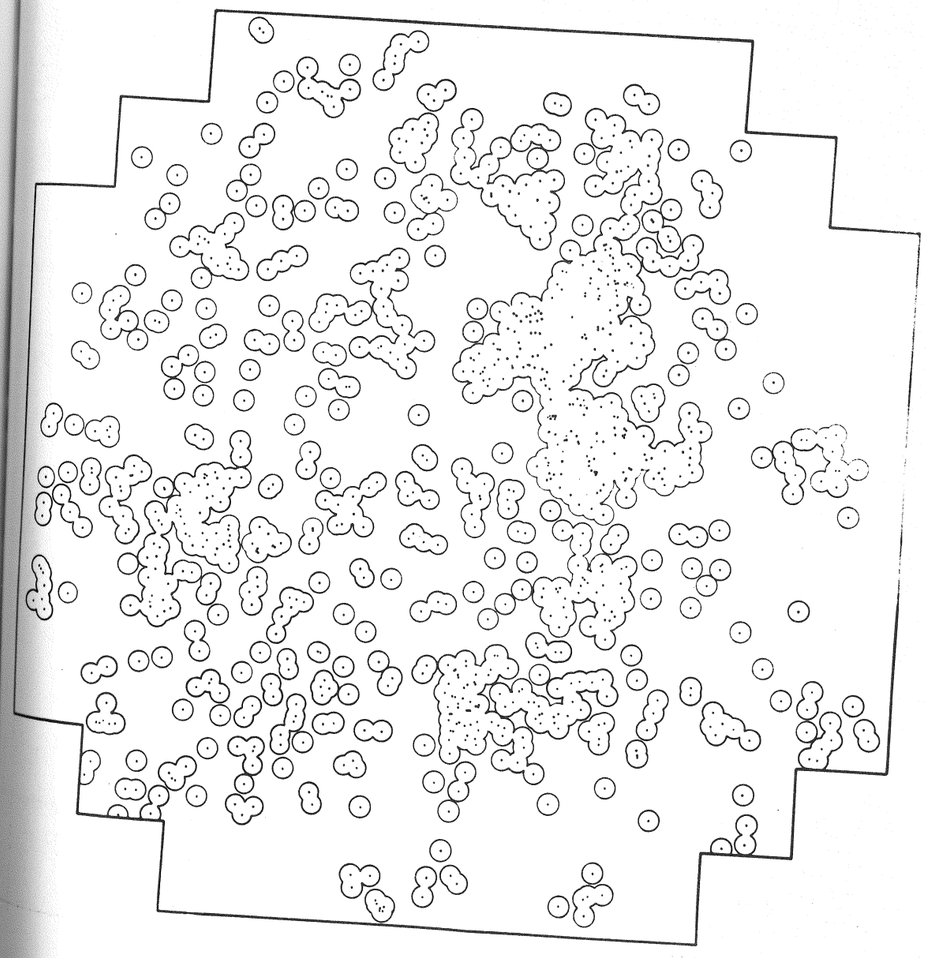


Fig. 24. Distribution of Housepit A-1 artifacts not used in nearest neighbor analysis.

Distribution Of Miscellaneous Artifacts

▲ –abrader

△ –drill

□ –spall

i –graver

3 –burin

4 –grinding slab

2 –unworked shell

○ –unworked antler

● –net weight

■ –hammer stone

N

0 1 2m

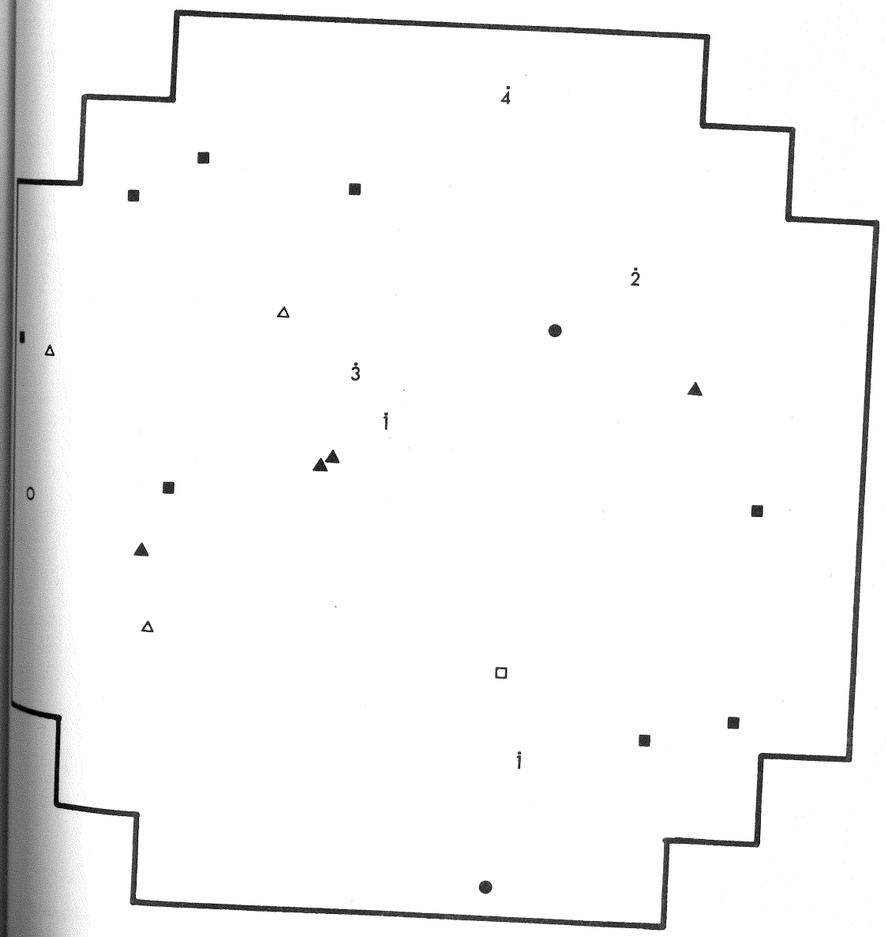
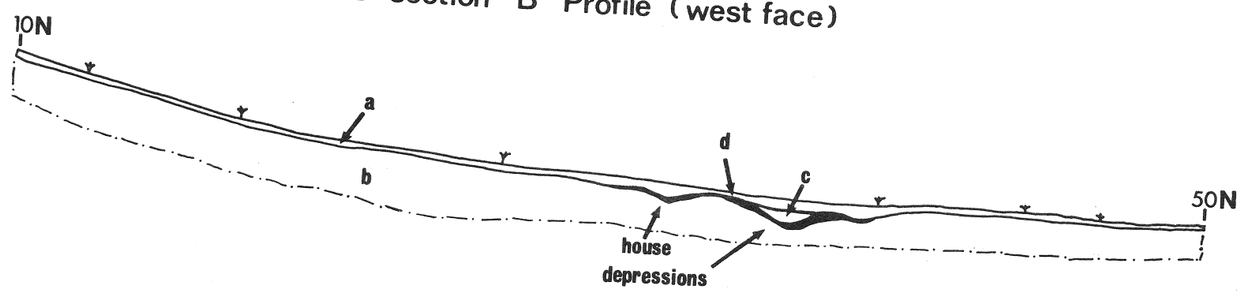


Fig. 25. Cross-section B; backhoe trench stratigraphic profile.

Cross-section B Profile (west face)



- -surface
- a - soil horizon
- b - natural silt and clay
- c - cultural occupation zone
- d - floor
- - limits of excavation

N

0 5 10m

Fig. 26. Legend for Cross-section B surface collection distributional maps, (Figs. 27-35).

LEGEND

Surface Collection Distributional Maps

Figures 27-35

Artifact Densities Per Unit

1 one item

2 two items, etc.

3

4

5

6

7 seven or more items

scale

total length N-S 40 meters

total width E-W 20 meters

1X1 meter grid

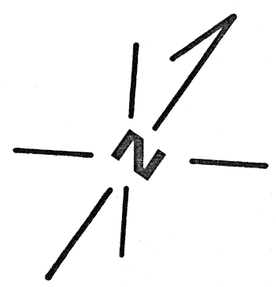


Fig. 27. Pre-plow distribution of chipping detritus.

Fig. 28. Pre-plow distribution of bone fragments.

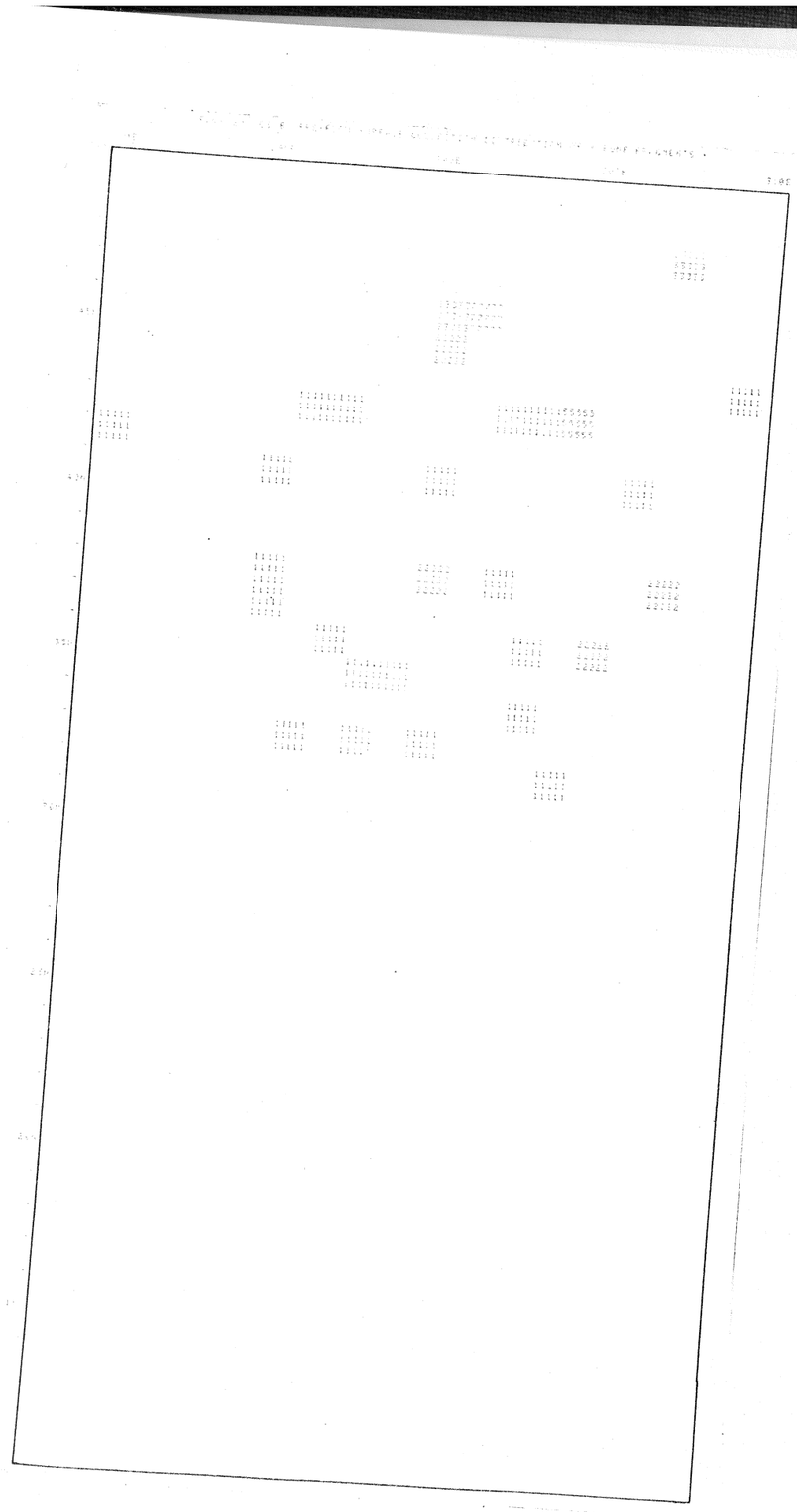


Fig. 29. Pre-plow distribution of fire cracked rock.

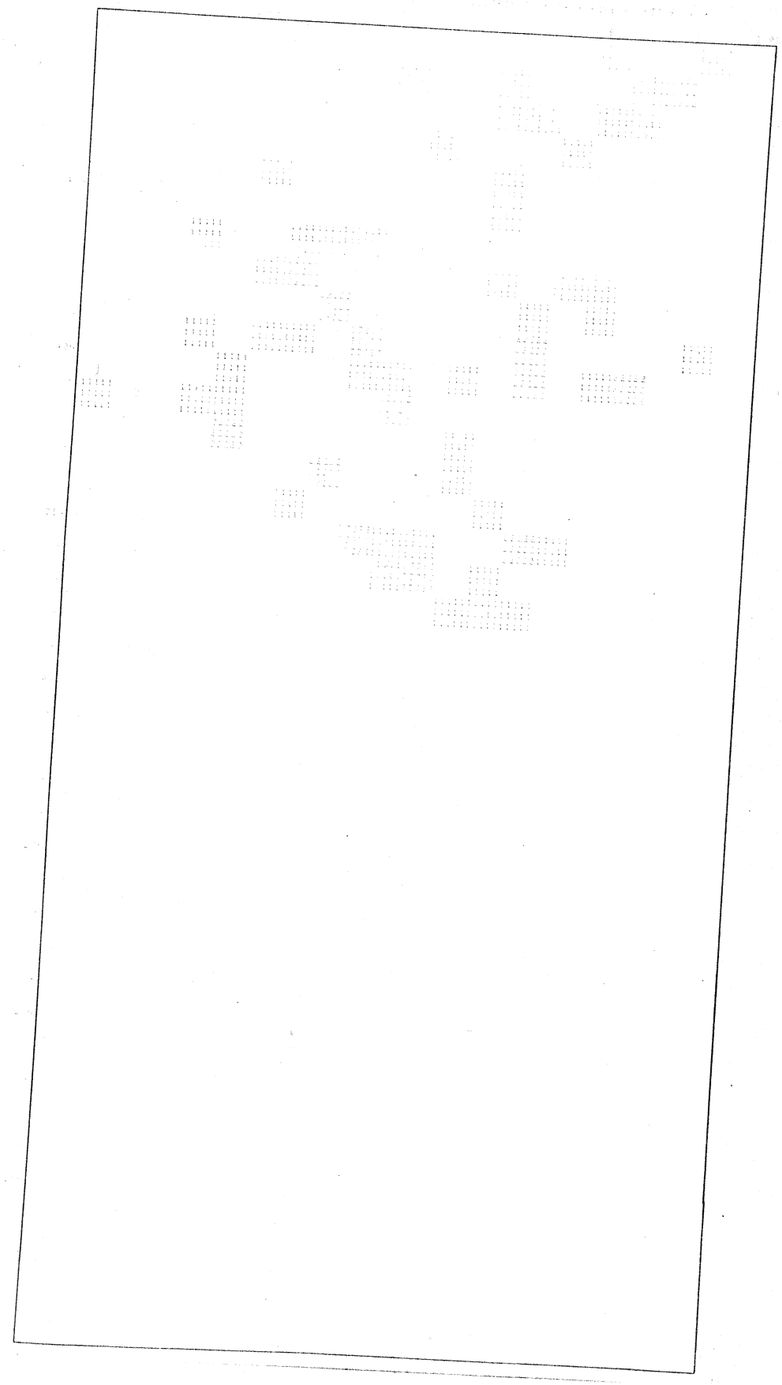


Fig. 30. Pre-plow distribution of all artifacts combined.

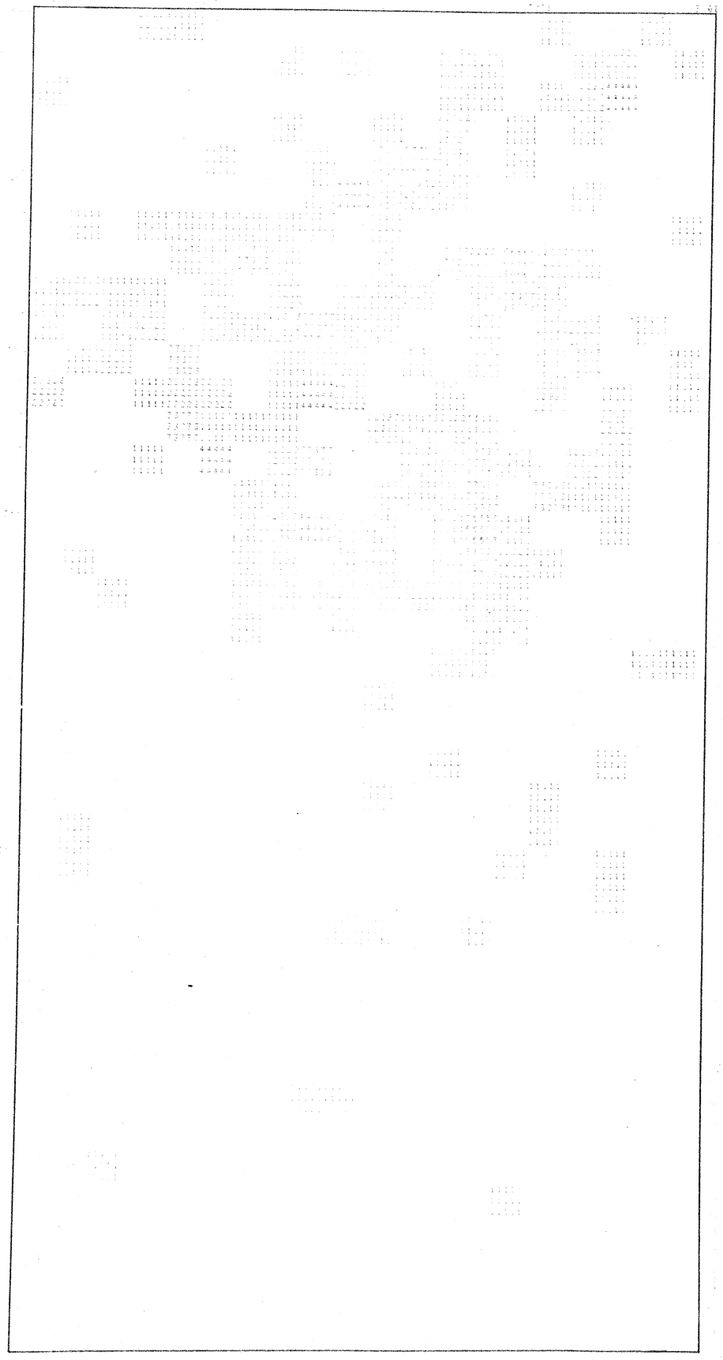


Fig. 31. Post-plow distibution of chipping detritus.

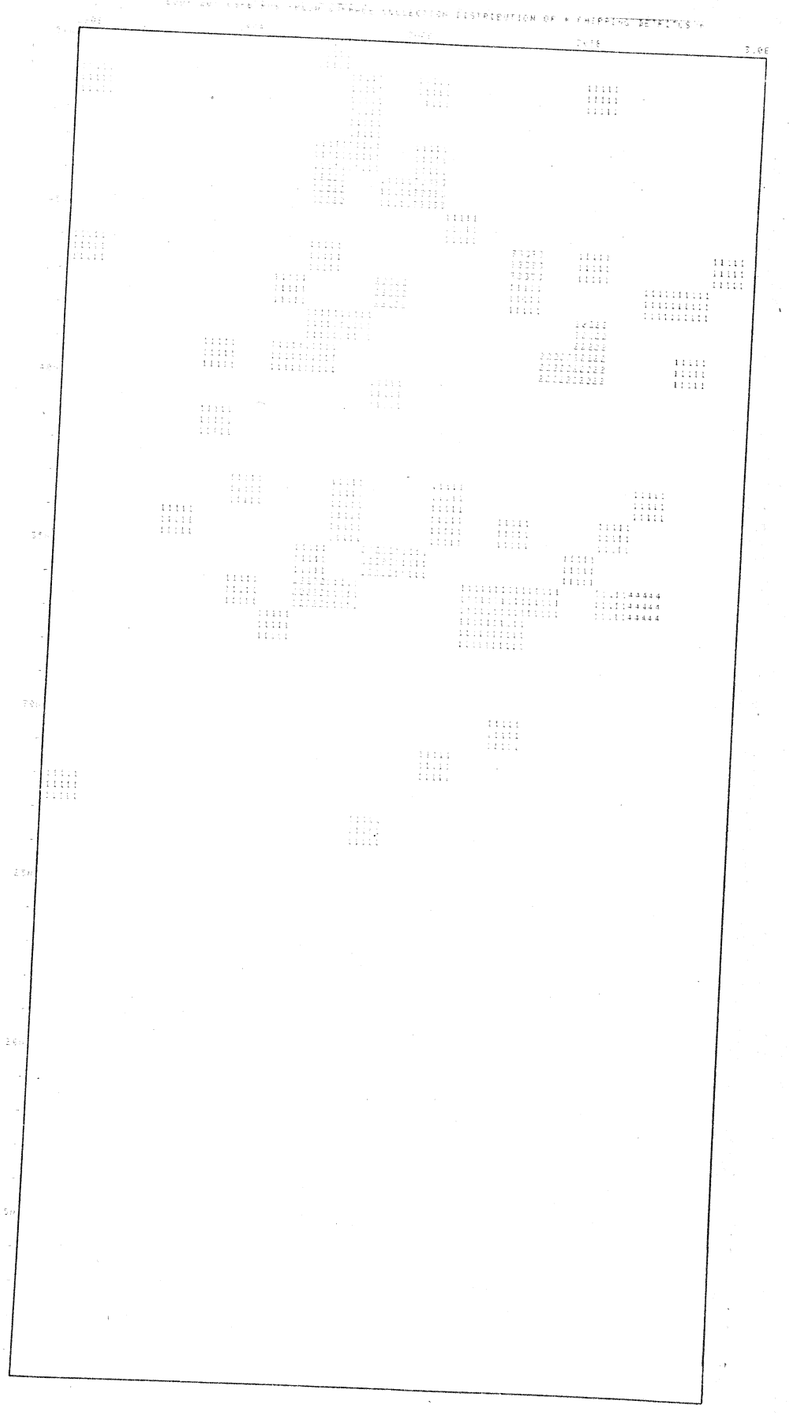


Fig. 32. Post-plow distribution of bone fragments.


BOOK 10 CS-B POST-PLCH SURFACE COLLECTION DISTRIBUTION OF + BONE FRAGMENTS +
1.0E
2.0E
3.0E
4.5N
4.0N
3.5N
3.0N
2.5N
2.0N
1.5N
1.0N

Fig. 33. Post-plow distribution of fire cracked rock.

Fig. 34. Post-plow distribution of all artifacts combined.

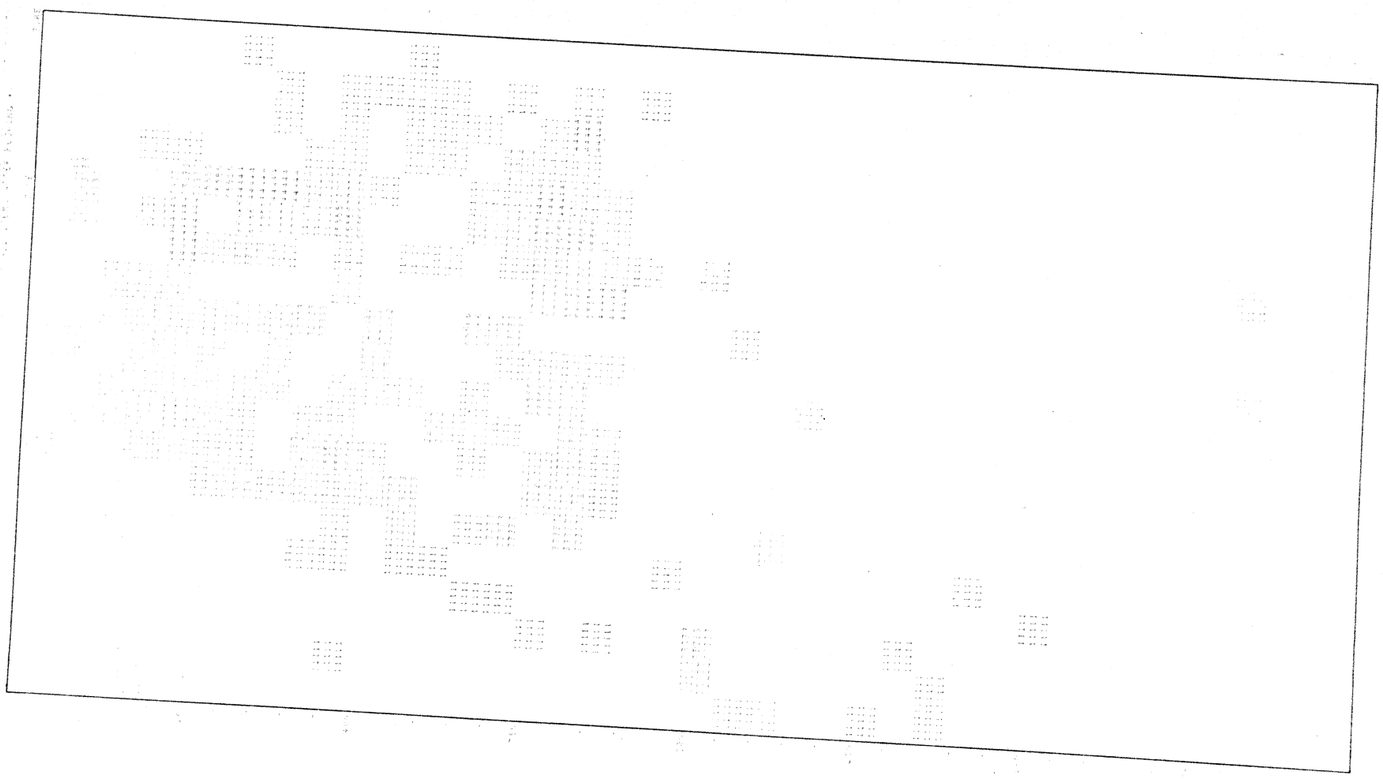
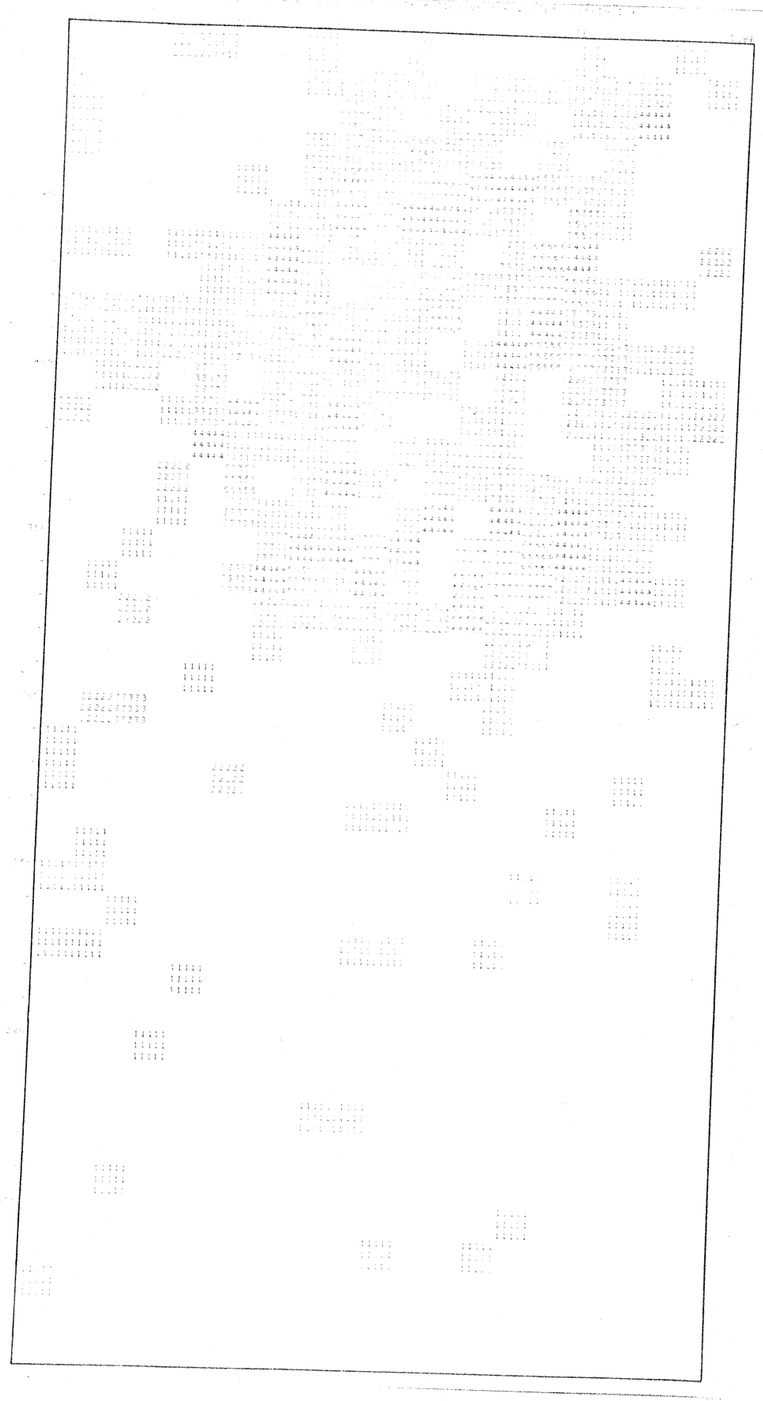


Fig. 35. Pre- and post-plow distribution of all artifacts combined.



APPENDIX. A WATFIV COMPUTER PROGRAM FOR NEAREST NEIGHBOR ANALYSIS.

Version 1 - Preliminary program easily translatable to FORTRAN IV.

For use with data stored on tape.

```
C     T. MICHAEL BLAKE
C     ****************************************************************
C
C     NEAREST NEIGHBOR ANALYSIS OF TWO DIMENSIONAL POINT PATTERNS REPRE-
C     SENTING ARTIFACT DISTRIBUTIONS ON A LIVING FLOOR
C     INPUT *****
C         CARD 1, NUMBER AND CODED CLASSIFICATIONS OF PARTICULAR ARTI-
C                 FACTS TO BE ANALYSED. FORMAT(I2)
C         CARD 2-4, NUMBER AND CLASSIFICATIONS OF ALL ARTIFACTS WITH
C                 WHICH DATA MAY BE COMPARED (FORMAT(I2,2X,80(2X,I2))
C         CARDS 5-X, DATA CARDS-ONLY THE DATA ITEMS REQUIRED ARE READ,
C                 SO DATA CARDS CAN SUIT ANY FORMAT AS LONG AS THE READ
C                 FORMAT IS MODIFIED.
C         CARD X+1, BORDER COORDINATES FOR AREA BEING STUDIED. N=Y AXIS;
C                 E=X AXIS.  SHOULD BE LISTED IN FOLLOWING ORDER FOR
C                 SQUARE STUDY AREA: LARGEST Y, SMALLEST Y, LARGEST X,
C                 SMALLEST X.  THEN TOTAL AREA UNDER STUDY SHOULD BE
C                 READ IN SAME SCALE AS X,Y MEASUREMENTS. FORMAT FREE
C     FEATURES *****
C         TWO TESTS OF SIGNIFICANCE ARE USED TO TEST THE HYPOTHESIS THAT
C         THE DISTRIBUTION OF POINTS ARE RANDOM. 1) COMPARISON OF NORMAL
C         STANDARD DEVIATE BASED ON STANDARD DEVIATION OF EXPECTED N N.
C         DISTANCES TO NORMAL DISTRIBUTION.  2) A) COMPARSON OF OBSERVED
C         DISTANCES TO EXPECTED DISTANCES GIVEN A CHI SQUARE DISTRIBUT-
C         ION WITH 2N DEGREES OF FREEDOM (WHEN 2N<30)
C         B) COMPARISON OF AN ESTIMATED NORMAL STANDARD DEVIATE BASED ON
C         CHI SQUARE ESTIMATE TO NORMAL DISTRIBUTION. (WHEN 2N>30)
C
C         THE 0.05 LEVEL OF SIGNIFICANCE IS USED.
C
C     ****************************************************************
C
      CHARACTER*2 IND(73),ISTOR1(5912)
      CHARACTER*20 A(2)/'PROJECTILE POINTS','SCRAPERS'/
      CHARACTER*10 B(3)/'  RANDOM  ','AGGREGATED',' UNIFORM  '/
      INTEGER NPROV(2,50),EPROV(2,50),DELETE,E(4),NHOLD,EHOLD,PNUM,F
      INTEGER H,U,BD(4),CLA(73),ISTOR4(5912),NUM(2),G
      INTEGER*2 ISTOR2(5912),ISTOR3(5912)
      REAL LAMDA,RSD(50)
              COMMON PNUM,RSD
      READ6,IE
      READ4,(CLA(K),K=1,IE)
    4 FORMAT(2(I2))
      READ6,ID
    6 FORMAT(I2)
          READ3,(IND(IX),IX=1,ID)
    3 FORMAT(20(2X,A2))
              READ7,(E(IS),IS=1,4)
    7         FORMAT(I4,1X,I4,1X,I5,1X,I5)
              READ1,IAREA
    1         FORMAT(I7)
      READ(3,29)(ISTOR1(I),ISTOR2(I),ISTOR3(I),ISTOR4(I),I=1,100)
   29 FORMAT(100(A2,I1,I4,I5,/))
      REWIND 3
```

```
      II=100
      DO 90 NNN=1,IE
90    NUM(NNN)=0
      DO 20 IB=1,II
      F=1
      G=2
      H=3
      U=4
      DO 5 K=1,IE
      KF=CLA(K)
      IF(ISTOR1(IB).EQ.IND(KF)) GO TO 11
5     CONTINUE
      GO TO 20
11    IF(ISTOR2(IB).EQ.2) GO TO 12
      GO TO 20
12    NUM(K)=NUM(K)+1
      NP=NUM(K)
      NPROV(K,NP)=ISTOR3(IB)
      EPROV(K,NP)=ISTOR4(IB)
20    CONTINUE
      DO 21 K=1,IE
      PNUM=NUM(K)
      IZ=1
      DELETE=0
      SORSD=0
                SPOO=0
        SUMSML=0
      KIB=NUM(K)
      DO 23 I=1,KIB
      SMALL=1000000000
      DO 22 NP=2,PNUM
      D=(((NPROV(K,F)-NPROV(K,NP))**2)+((EPROV(K,F)-EPROV(K,NP))**2)
     *)
        D=SQRT(D)
      IF(D.GT.SMALL) GO TO 22.
      SMALL=D
22    CONTINUE
      BD(F)=E(F)-NPROV(K,F)
      BD(G)=NPROV(K,F)-E(G)
      BD(H)=E(H)-EPROV(K,F)
      BD(U)=EPROV(K,F)-E(U)
      SMBD=BD(F)
      DO 24 KK=2,4
      IF(BD(KK).LT.SMBD) GO TO 25
      GO TO 24
25    SMBD=BD(KK)
24    CONTINUE
      MMP=1
      NHOLD=NPROV(K,F)
      EHOLD=EPROV(K,F)
      NUMB=PNUM-1
      DO 26 MM=1,NUMB
      MMP=MMP+1
      NPROV(K,MM)=NPROV(K,MMP)
```

```
      EPROV(K,MM)=EPROV(K,MMP)
   26 CONTINUE
      IF(SMALL-SMOLD)27,27,28
   28 PNUM=PNUM-1
      DELETE=DELETE+1
      GO TO 23
   27 NPROV(K,PNUM)=NNOLD
      EPROV(K,PNUM)=ENOLD
      RSD(I2)=SMALL
      SUMSD=(RSD(I2)**2)+SUMSD
      SUMSML=SUMSML-SMALL
      I2=I2+1
   23 CONTINUE
C SIGNIFICANCE USING NORMAL AND CHI SQUARE DISTRIBUTIONS.
      I2=I2-1
      OBMNR=SUMSML/PNUM
                RNUM=PNUM
      RHO=RNUM/IAREA
                INUM=PNUM
                DO 89 IFAR=1,INUM
                SPOO=((RSD(I2)**2)*(2*(RHO**2 1.4159)))-SPOO
   89           CONTINUE
      EXMNR=1/(2*SQRT(RHO))
      R=OBMNR/EXMNR
            XRPO=(PNUM*RHO)
      SIGEMR=0.26136/SQRT(XRPO)
                SIGOBM=SQRT((SUMSD/PNUM)-(OBMNR**2))
      C=ABS((OBMNP-EXMNR)/SIGEMR)
      SW=0
      CALL SORT
      KR=(PNUM/2)+1
      RMED=RSD(KR)
      REXMED=SQRT(0.69315/(3.14285*RHO))
      EEDR=RMED/REXMED
      KCOFF=(PNUM+(1.65*SQRT(RNUM)))/2
      RCOFF=RSD(KCOFF)
      PRINT40,A(K),NUM(K),DELETE,PNUM,IAREA,OBMNR,EXMNR,R,SIGEMR,RHO,SIG
     *OBM
      PRINT35,RMED,REXMED,EEDR,RCOFF
   35 FORMAT(/T34,'OBSERVED MEDIAN - ',F9.4,/T34,'EXPECTED MEDIAN - ',
     *F9.4,/T34,'WASHBURNS R - ',F9.4,/T34,'95% CUTOFF USING MEDIAN - ',
     *F9.4/)
   37 PRINT42,C
   40 FORMAT(' ',/,'0',T8,'* NEAREST NEIGBOR ANALYSIS - TEST FOR RANDOM
     *ESS OF DISTRIBUTION *'//T11,'***** ARTIFACT CLASSIFICATION: ',A
     *20,/T11,'***** STATISTICS GENERATED',',/T24,'NUMBER OF OBSERV
     *TIONS - ',I4,/T24,'NUMBER TOO CLOSE TO BORDER - ',I4,/T24,'
     *MBER REMAINING FOR ANALYSIS - ',I4,/T24,'TOTAL AREA OF STUDY F
     *OOR - ',I7,' SQ.CM.',/T24,'MEAN NEAR NEIGHBOR DISTANCE - ',F9.3
     *' CM.',/T24,'EXPECTED NEAR NEIGHBOR DISTANCE - ',F9.3,' CM.',/T2
     *4,'CLARK AND EVANS R RATIO - ',F9.3,/,T11,'***** TEST OF SIGN
     *FICANCE USING NORMAL STANDARD VARIATE',/,/T24,'STANDARD ERROR OF
     *MEAN EXPECTED N N. DISTANCE - ',F9.3,/T24,'OBSERVED DENSITY',F12.
     *,' PER SQ.CM.',/T24,'STANDARD DEVIATION OF OBSERVED N N. DISTANC
     *S - ',F9.3/)
```

```
 42 FORMAT('0',/T21,'NORMAL STANDARD VARIATE = ',F9.4)
    IF(C-1.5E)30,31,31
 30 NNN=1
    GO TO 34
 31 IF(C-1.96)32,32,33
 32 NNN=2
    GO TO 34
 33 NNN=3
 34  PRINT41,B(NNN)
 41 FORMAT('0',/T21,' A 0.05 PROBABILITY LEVEL THE DISTRIBUTION IS SIG
   *NIFICANTLY ',A10)
    IF(SU.EQ.0) GO TO 9
    GO TO 90
  9 SU=SU*1
    LANDA=RHO*3.14159
              CHO=PNUM*(SP00/PNUM)
    CHI=2*LANDA*SURSD
    IKF=2*PNUM
              IF(IKF.GT.30) GO TO 99
    PRINT43,CHI,IKF,CHO
 43 FORMAT(' ',T11,'*****  TEST OF SIGNIFICANCE USING CHI SQUARE.',/,T2
   *4,'CHI SQUARE = ',F7.4,'    DEGREES OF FREEDOM = ',I2,/,T30,'SEE T
   *ABLE OF CHI SQUARE DISTRIBUTIONS',/,T25,'THOMPSONS CHI = ',F7.4)
              GO TO 98
 99   C=ABS(SQRT(2.*CHI)-SQRT((2.*IKF)-1))
                   PRINT45
 45                FORMAT(' ',T11,'***** TEST OF SIGNIFICANCE USING NOR
   *MAL APPROXIMATION OF CHI SQUARE:',/,/)
    GO TO 97
 98   COFF=OBMNR+(1.65*SIGDEM)
    PRINT62,COFF
 62 FORMAT(' ',T25,'95% NORMAL CURVE CUTOFF DISTANCE = ',F9.3)
 21 CONTINUE
    STOP
    END
                  SUBROUTINE SORT
                  COMMON PNUM,RSD
                  REAL*8 RSD(50)
                  INTEGER PNUM
                  DO 10 J=1,PNUM
                  COUNT=0
                  M=PNUM-J
                  DO 20 I=1,M
                  BIS=RSD(I+1)
                   IF(RSD(I).LE.BIS) GO TO 20
                   SWTCH2=RSD(I)
                   RSD(I)=RSD(I+1)
                   RSD(I+1)=SWTCH2
                   COUNT=COUNT+1
 20                CONTINUE
                   IF(COUNT.EQ.0) GO TO 77
                   M=M-1
 10                CONTINUE
 77              RETURN
                   END
```

Sample Input.

```
AN 3AB 4AD 5BE 6BI 7BL 8BU 9BO10BB11CL12CH13CN14CY15CO16CR17DI18DM19DS20
FI23FB24GR25GS26HS27HF28HE29HH30IP31KN32MB33MA34MN35MI36ML37NT38MF39AC40
MF43MW44NA45NB46NE47NY48PF49PN50PI51PE52PG53PO54PA55PF56PG57PB58PA59PC60
SF63SA64SL65SC66UA67UF68UO69UB70UN71TU72TP73UD74  75  76  77  78  79
2     1867     22926
2     1830     23196
4        0         0
2     1960     22791
2     1999     22937
2     1925     23236
2     2061     22543
2     2036     22574
2     2027     22669
```

data section may be stored on tape.

etc..

```
1800 23400 22400
000
```

Sample Output. Simulated distribution of random points- note input data for this distribution not given.

```
ST NEIGBOR ANALYSIS -- TEST FOR RANDOMNESS OF DISTRIBUTION -
* ARTIFACT CLASSIFICATION: SCRAPERS
* STATISTICS GENERATED:
        NUMBER OF OBSERVATIONS -    25
        NUMBER TOO CLOSE TO BOARDER -    5
        NUMBER REMAINING FOR ANALYSIS -    20
        TOTAL AREA OF LIVING FLOOR -   360000.00 CM.
        MEAN NEAR NEIGHBOR DISTANCE -     61.619 CM.
        EXPECTED NEAR NEIGHBOR DISTANCE -     67.082 CM.
        CLARK AND EVANS R RATIO -     0.918
* TEST OF SIGNIFICANCE USING NORMAL STANDARD VARIATE:
        STANDARD ERROR OF MEAN EXPECTED N N. DISTANCE -      7.841
        OBSERVED DENSITY  0.00005556 PER 60 CM.
        STANDARD DEVIATION OF OBSERVED N. N. DISTANCES -     20.997
                OBSERVED MEDIAN -    58.9466
                EXPECTED MEDIAN -    63.8069
                WASHBURNS R -     0.9355
                95% CUTOFF USING MEDIAN -    62.6498

    NORMAL STANDARD VARIATE -     0.6967

    A 0.05 PROBABILITY LEVEL THE DISTRIBUTION IS SIGNIFICANTLY    RANI
* TEST OF SIGNIFICANCE USING NORMAL APPROXIMATION OF CHI SQUARE:

    NORMAL STANDARD VARIATE -     1.1959

    A 0.05 PROBABILITY LEVEL THE DISTRIBUTION IS SIGNIFICANTLY    RANI
        95% NORMAL CURVE CUTOFF DISTANCE -     96.265
```

Simulated distribution of aggregated points- note

input data for this distribution not given.

```
NEIGHBOR ANALYSIS - TEST FOR RANDOMNESS OF DISTRIBUTION.
IMPACT CLASSIFICATION: PROJECTILE POINTS
STATISTICS GENERATED.
      NUMBER OF OBSERVATIONS -      25
      NUMBER TOO CLOSE TO BOARDER -    3
      NUMBER REMAINING FOR ANALYSIS -    22
      TOTAL AREA OF LIVING FLOOR -    240400.00 SQ CM
      MEAN NEAR NEIGHBOR DISTANCE -     46.893 CM.
      EXPECTED MEAN NEIGHBOR DISTANCE -     63.960 CM.
      CLARK AND EVANS  R  RATIO -        0.635
TEST OF SIGNIFICANCE USING NORMAL STANDARD VARIATE.
      STANDARD ERROR OF MEAN EXPECTED N N. DISTANCE -      7.129
      OBSERVED DENSITY  0.00009114 PER SQ CM
      STANDARD DEVIATION OF OBSERVED N. N. DISTANCES -     31.514
                  OBSERVED MEDIAN -     33.1210
                  EXPECTED MEDIAN -     60.9747
                  WASHBURNS R -      0.5513
                  95% CUTOFF USING MEDIAN -     35.6890

   NORMAL STANDARD VARIATE -      3.2362

   A 0.05 PROBABILITY LEVEL THE DISTRIBUTION IS SIGNIFICANTLY AGGREGATE
TEST OF SIGNIFICANCE USING NORMAL APPROXIMATION OF CHI SQUARE.

   NORMAL STANDARD VARIATE -      2.6165

   A 0.05 PROBABILITY LEVEL THE DISTRIBUTION IS SIGNIFICANTLY AGGREGATE
      95% NORMAL CURVE CUTOFF DISTANCE -     92.851
```