AN EXAMINATION OF RELATIONSHIPS BETWEEN ARTIFACT CLASSES AND FOOD RESOURCE REMAINS AT DEEP BAY, DiSe 7

by

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

in

THE FACULTY OF GRADUATE STUDIES

(Department of Anthropology and Sociology, University of British Columbia)

We accept this dissertation as conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

June, 1977

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ABSTRACT

This dissertation examines the idea that ethnographically reported relationships between artifact classes and faunal food resource remains can be detected in an archaeological context. A detailed site report is presented for Deep Bay (DiSe 7), including analyses of the artifact and faunal assemblages, and quantitative techniques are employed to search for associations between faunal and artifact variables in this site. The results of four analyses are compared, and the recurring associations of variable pairs are interpreted in the light of ethnographic and ecological data. The various lines of evidence relevant to the most likely season of site occupation are also examined. It is concluded that some of the ethnographically reported food resource procurement patterns can successfully be detected in the archaeological record. Evidence is presented that suggests the existence of food resource procurement systems centered around herring, deer, sea mammal, and migratory waterfowl. The site was most likely occupied during the late winter and early spring, primarily for deer hunting and herring fishing, and secondarily for sea mammal and waterfowl hunting. The acquisition of molluscs is considered to be a given. This subsistence pattern appears to have varied little over the past 2000 years. It is also concluded that the same techniques could be used profitably for similar studies in the future.

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ACKNOWLEDGEMENT

While the prose of this dissertation was written by myself, the labor of many people is incorporated herein. First, I would like to thank my committee members for their assistance and encouragement. They are David F. Aberle, J.E. Michael Kew, R.G. Matson (advisor), Donald H. Mitchell, Richard J. Pearson, and Elvi Whittaker. I would also like to thank my field crew for a very pleasant and profitable summer. They are Mona Childe, Ann-Marie Fenger, Yvonne Heagle, Don Howes, Helen Lemon, Dan MacPherson, Heather Maximea, Laura Ann Recalma, Judy Reid, Ruby Reid, Val Sizertz (nee Patenaude), and Arlene Yip. My thanks also to the many employees of the British Columbia Provincial Museum and the Archaeological Sites Advisory Board and all the volunteers who contributed their efforts to the project. Thanks are also due to the Archaeological Sites Advisory Board of British Columbia for granting me an excavation permit and funds for the project. I further wish to express my appreciation to the Qualicum and Comox Bands for permission to excavate in their territory, and to Mr. and Mrs. Tyerman (owners of Lot 73), Mr. and Mrs. Belyck (owners of Lot 81), and Mr. and Mrs. Thomas (owners of Lots 1 and 2) for permission to work on their properties.

My special thanks to Val Sivertz and Pat Miller for their valuable assistance with the faunal and skeletal analyses, to Dr. Michael Church and Mr. Hans Schreier of the Department of Geography for their assistance with the soil analysis, to Dr. C. Rowles of the Forestry Department for permission to test soil pH in the forestry laboratory, and to C. Moira Irvine for producing the figures and photographs. Figure 1 was originally drawn by Nancy Condrashoff of the Archaeology Division of the British Columbia Provincial Museum.

Finally, I would like to express my deepest appreciation to my wife, Linda, for her assistance with the analyses and for typing all drafts of this dissertation. Without her patience, encouragement, and hard work it would not have been written.

Any errors or omissions in this dissertation are entirely my responsibility.

CHAPTER I

AIMS

This study is based on the analysis of data collected by the author from the site at Deep Bay (DiSe 7), which is situated on the east coast of Vancouver Island approximately five miles north of Big Qualicum River. The research design called for a quantitative search for relationships between artifact and faunal variables. These relationships were then to be discussed in terms of relevant ecological and ethnographic analogues in order to gain some insights into the portion of the aboriginal subsistence round conducted at Deep Bay.

The ethnographic and ecological literature relevant to the Gulf of Georgia area indicates that food resources available to the Coast Salish were characterized by "1) a variety of types of food, including sprouts, roots, berries, shellfish, fishes, waterfowl, land and sea mammals; 2) local variation in the occurrence of these types, due to irregular shore lines, broken topography, differences between fresh and salt water, local differences in temperature and precipitation; 3) seasonal variation, especially in vegetable foods and in anadromous fishes; 4) fluctuation from year to year, in part due to the regular cycles of the different populations of fish, in part to less predictable changes, as in weather" (Suttles 1960:302; also Suttles 1962:527-529). In these two articles, Suttles builds the argument that an adaptive relationship exists between variation in abundance of food resources, on one hand, and maintenance of complex systems of redistribution and social rank on the other. In particular, variations in prestige are seen primarily as an indirect result of unpredictable variations in food resource availability. Another recent article has demonstrated at the .05 probability level that the rank of southern Kwakiutl local groups could be predicted from the rank of salmon availability in each local group's territory (Donald and Mitchell 1975:344).

The authors cited above have dealt with such variables as kinship, population, rank, and prestige in their discussions, but to date only one northwest coast study (Fladmark 1974) has examined cultural and environmental relationships in an archaeological context. No archaeological study has used quantitative methods to examine these relationships, nor have specific relationships between particular aspects of culture and environment been demonstrated archaeologically. This lack of close attention to specific ecological relationships has also meant that, until very recently, the faunal assemblages from archaeological excavations were largely ignored in either excavation or analysis. The consequent preoccupation with artifacts as the primary data base on which archaeological analyses were conducted has contributed to, first, a number of difficulties in assigning assemblages to their proper phases or culture types and establishing reliable correspondences between these units (see Mitchell 1971a,Table VI, Table XII) and, second, a tendency in local archaeological research not to incorporate the proposed sources of environmental and cultural variation into archaeological interpretations. The inability of archaeology to keep abreast of current ethnological models has been labelled "paradigm lag" (Leone 1972:16).

The vast majority of faunal remains recovered from Gulf of Georgia middens belong to species that were exploited as food resources by the Coast Salish. These remains are clearly not the entire range of exploited food resources, but they nevertheless are subject to the four types of variation outlined by Suttles. If one accepts his contention that these variations are met by corresponding variations in culture, then it is likely that material culture, as well as kinship, prestige, rank, and population, will also vary in relation to some aspects of the environment. This variation may be temporal, resulting in the changing composition of artifact assemblages through time, or it may be spatial, resulting in differing assemblages according to what activities were being performed at particular sites at particular times of the year.

The spatial and temporal variation of food resource variables was exploited by the Coast Salish by means of a seasonal subsistence round. Despite the loss and differential placement of material cultural items through decay, it is reasonable to argue that the items of material culture found at a food resource procurement site are primarily those that were used, broken, and/or lost during the acquisition, and/or processing, and/or consumption of food resources taken at that site. Thus, within a local group's territory during a yearly round the artifact assemblages at the sites visited should exhibit variation according, in part, to the variation in the food resources dealt with at that site. Many of the Coast Salish annual round activities are described in greater or lesser detail in the ethnographic literature, and specific relationships between artifacts and food resource species are also more or less well described. Because these analogues are available for comparison, the argument for the co-occurence of activity-related artifacts and faunal remains should appear in the archaeological record. The aim of this dissertation is to test this hypothesis.

The benefits to be derived from the testing of this idea are important for Gulf of Georgia prehistory. First, the results of this test should provide further clues as to the uses to which artifact classes were put by associating the artifact classes with specific food resource remains. Second, it should further help establish the extent to which specific portions of the Coast Salish ethnographic literature are applicable to the local archaeological record. This will be done by examining associations between artifact and faunal variables in terms of the ethnographic literature. Third, the results of this examination will provide clues for the possible faunal associations of previously excavated artifact assemblages that have not been associated with faunal assemblages. This type of clue will help to place these artifact assemblages into an annual round context consistent with the sources of food resource variability noted by Suttles. In such a context the difficulties previously noted of assigning artifact assemblages of varying composition to a single phase or culture type and the difficulties in establishing distinctions between phases or culture types may be partially overcome.

The more general contribution to archaeology to be made by this study is twofold. First, it will demonstrate statistically in an archaeological context that specific cultural and environmental variables (artifact classes and food resource species) do covary. Second, it will provide a means by which culture-historical archaeological sequences can be re-appraised in more detailed ecological terms.

The idea will be tested with the aid of quantitative methods. Artifact variables and faunal variables will be analyzed for independence or correlation within a universe of analytical units. Associations of paired artifact and faunal variables that are judged to be reliable will be examined in the light of local ethnographic and ecological data to determine whether satisfactory analogues can be established for the archaeological associations. The analogues so established will serve as a basis for an interpretation of that portion of the annual subsistence round centered at Deep Bay (DiSe 7). This interpretation will test the hypothesis that relationships between artifact and faunal variables reported in the ethnographic literature can successfully be detected in an archaeological context.

Detecting patterns of association between archaeological variables using quantitative techniques is a relatively recent pursuit among archaeologists. Usually quantitative techniques are used to detect relationships among artifacts (Longacre 1970; Freeman 1973; Monks 1973), but rarely are such techniques used to treat faunal, floral, and palynological data as well. One instance in which the latter type of study was undertaken is James Hill's dissertation on Broken K pueblo (Hill 1965). In his work Hill sought to detect functional and stylistic patterns of relationships between artifact and non-artifact variables by means of factor analysis.

Another article (Koyama 1974) is much more similar to the present study in terms of measures of association used and results sought. The correlation of specific artifact classes and faunal species was used to show that, on the basis of Hogup Cave data, at least certain Great Basin subsistence patterns were simple and consistent over the past 8500 years

(Koyama 1974:28). This study and the one undertaken here are similar to the extent that they seek associations between faunal and artifact variables in an archaeological context, they use quantitative methods to find these associations, and they resort to ethnographic analogues of a more or less specific nature to interpret and support archaeological associations.

On the other hand, they are different in more ways than they are similar. The Hogup Cave study deals only with selected artifact classes where the Deep Bay study examines all artifact classes. The Hogup Cave study deals with the faunal data only in terms of minimum numbers of individuals of each species, but this study examines faunal species in terms of presence/absence, percentage of weight of bone, and percentage estimated weight of usable meat within each analytical unit as well.

This study attempts to judge the reliability of variable pair associations not just in terms of statistical significance, but also in terms of whether a given variable pair is found in more than one analysis. That is, if variable pair A is found in both the presence/absence and minimum numbers of individuals analyses then it is thought to be more reliable than if it were found significant in only one of these analyses.

The Hogup Cave study relies only on the statistical significance of correlated variables in a single analysis. The extent or detail of ethnographic analogues used to interpret the Hogup Cave associations are not reported, but it is implied that these analogues are of a general nature. The present study, on the other hand, seeks explicit analogues in the ethnographic literature for each association of variable pairs.

Lastly, the Hogup Cave study uses the Pearson correlation coefficient as the measure of correlation between artifact and faunal variables. One potential shortcoming of this statistic is noted by the author; namely, that the distributions in the data are assumed, not demonstrated, to be normal (Koyama 1974: 23). A second problem arises when the author treats the correlation coefficient as a proximity measure (Koyama 1974: 25). The use of Pearson's r as a measure of taxonomic resemblance has been shown to be faulty (Eades 1965:98-100), and treating r as a proximity measure is in effect the same as treating it as a measure of taxonomic resemblance. Thus, although the results of the Hogup Cave study seem reasonable, it is not clear whether these results are an artifact of the statistical measure used or whether the results accurately reflect cultural patterning in the data.

The potential difficulties in using parametric statistics in general are discussed in Bradley (1968:18). The present study, on the other hand, used non-parametric statistical measures of correlation and independence, Spearman's rank order correlation, and the chi-squared test of independence to analyze the data. The latter test is used in analyzing the presence/absence data, while the former test is used in analyzing the data pertaining to relative frequency and minimum numbers of individuals. Thus, further reliability is added to the results by dealing with observed, rather than assumed, population distributions. In summary, despite the apparent similarity of these studies, the method and results of the present study will be substantially different in both reliability and detail.

The interpretation of associated variable pairs by means of ethnographic analogues will involve a discussion of procurement systems as outlined by Flannery (1972:222-234). One other study on the northwest coast has dealt with this concept as well (Roll 1974), and its relation to the present study should be made clear. Whereas Flannery perceives a procurement system as centering around a specific food resource, Roll contends that each site represents a procurement system (Roll 1974,V). While a definitional argument can be developed around the most reasonable boundary for a procurement system it is thought advisable in this study to examine the smallest unit of analysis first, namely the relationships bwtween individual artifact and faunal variables, before attempting to characterize an entire component or site as a system of any particular sort.

The divergences between the Deep Bay study and Roll's Minard study continue from this point. The latter study relies primarily on subjective assessment of relationships between artifact and faunal variables and on estimates of the relative abundance of faunal species within the site (Roll 1974:205). The basis on which this relative abundance is judged is not made clear. The conclusion is reached that the Minard site, located on a spit at the mouth of Gray's Harbour, into which flows the Chehalis River, represents a river/estuarine procurement system (Roll 1974:277ff). The present study goes beyond Roll's Minard study by establishing which artifact and faunal variables are statistically and reliably associated, by inferring which specific activities occurred at the site, and by showing which specific ethnographic and ecological analogues are relevant to the associations found in the archaeological context. In short, the only real similarity between the two studies lies in a common use of the term "procurement system".

In this study I have made the assumption that the material by-products of specific activities will tend to be deposited together in the archaeological record. Some attention has recently been devoted to this topic with respect to artifacts (Binford 1973; Hayden 1975) and cultural debris in general (Ascher 1968; Schiffer 1972, 1976). Binford argues that technological efficiency--judged by the degree to which artifacts are curated--has increased through time and that in highly curated technologies archaeological artifact assemblages will tend to exhibit little inter-assemblage variability (Binford 1973:249-250). Hayden, arguing that the Nunamiut observed by Binford are atypical hunters and gatherers because they possess technological items of an industrial culture (steel,axes, files, snowmobiles), concludes that artifact curation in a truly aboriginal context may not be nearly as important a factor in inter-assemblage variability as Binford indicates (Hayden 1975:54). I tend to support the latter point of view for two reasons. First, it is thought inappropriate to base models of hunter/gatherer artifact curation behavior on groups whose material culture and behavior has clearly been altered to a considerable extent by products from industrialized society. Consequently, the law-like statements based on Binford's observations are generalizations that cannot legitimately be applied in an aboriginal context.

Cultural remains, however, usually consist of more than just artifacts. Artifacts, faunal remains, structured remains, and assorted debris are all deposited (organized) during a habitation phase, modified (more or less disorganized) during a ghost phase, and observed (interrupted at a point in the process of disorganization) during an archaeological phase (Ascher 1968:46). To make inferences about past cultural behavior, the archaeologist must separate natural and human agencies of disorganization while working backwards from the archaeological phase through the ghost phase to the inhabited phase. This task is impeded by smearing and blending of remains, cycling of serviceable materials, and broadcasting of debris (Ascher 1968:50-51). Ascher contends that the observation of analogous behavior in contemporary communities can aid in reconstructing past habitation phases from present archaeological phases (Ascher 1968:52).

In a more comprehensive treatment of cultural refuse, Schiffer (1972:156-165) defines a systemic context in which potential refuse is circulating within an ongoing behavioral system and an archaeological context which consists of refuse produced and deposited by a behavioral system (Schiffer 1972: 157, 1976:28). Refuse that is output from the systemic context into the archaeological context is deposited by what is known as an S-A formation process. This process is one of four cultural formation processes that affect the eventual deposition of material in the archaeological context. It is the major cultural formation process, although there are archaeological-systemic (A-S), systemic-systemic (S-S), and archaeological-archaeological (A-A) formation processes (Schiffer 1976:28-40). Through S-A formation processes, primary, secondary, and de facto refuse are produced. Primary refuse is discarded at its location of use, secondary refuse is discarded away from its location of use, and de facto refuse is useful material left behind upon site abandonment (Schiffer 1972:160-161; 1976:30-33).

The means by which refuse takes up its position in the archaeological context is regulated by cultural and non-cultural mechanisms. In order to relate patterned deposition of variables in the archaeological record to specific systemic or non-cultural behavior, it is necessary to define principles of deposition that transform systemic behavior into archaeological patterning. These principles may be either statements of fact or hypotheses that seek to account for a specific formation phenomenon. Principles relating to the cultural influence on archaeological deposition are called C-transforms. C-transforms " . . . permit an investigator to specify the ways in which a cultural system outputs the materials that eventually may be observed archaeologically. Application of these laws is necessary to relate the past qualitative, quantitative, spatial, and associational attributes of materials in systemic context to materials deposited by the cultural system" (Schiffer 1976:14). Examples of C-transforms are: as site population, or site size, and intensity of site use increases, a decreasing correspondence will be found between use and discard locations of all elements of activities conducted at the site (Schiffer 1976:15); primary refuse is most likely to be found at limited activity sites (Schiffer 1972:162).

N-transforms are non-cultural formation processes. They permit " . . . the archaeologist to predict the interaction between variables of culturally deposited materials and variables of the noncultural environment in which they are found"

(Schiffer 1976:15-16). An example of an N-transform is the tendency of acid soils to preserve pollen but not bone (Schiffer 1976:15).

Differing patterns of refuse deposition are thought to be the result of outputs from differing behavior within a systemic context. The two examples of C-transforms noted above are important to the following discussion. The first example suggests that the relative amount of secondary refuse increases as occupation intensity and site population or site size increases. The second example suggests the converse of the first; namely, that the relative amount of primary refuse increases as intensity of occupation, and possibly site population or site size, decreases. It is the pattern of refuse deposition at limited activity sites that is presently of concern. Within limited activity sites, the degree to which artifact and faunal by-products of activities tend to be found at their areas of use is inversely related to the population of the site (an indicator of site size) and the length of time the site is occupied (C-transform). Thus, in small, seasonally occupied sites the archaeological record will reveal that there is repeated clustering of artifacts and faunal remains in discrete and overlapping locations (C-transform) (Schiffer 1972:162).

These transforms assume that materials used together will tend to be deposited together under certain specific conditions. Although it is an improvement over previous archaeological practice to designate specific conditions under which the assumption is true, it is nevertheless an assumption. Fortunately, it can be operationalized and tested as an hypothesis, and some investigators are presently engaged in this pursuit. When selected results of R-mode analyses of artifact data from the three components at Glenrose Cannery were associated with appropriate faunal species, the Marpole and St. Mungo Component data indicated that deer and elk remains were negatively associated with artifacts that were likely to have been used for hunting or butchering (Matson 1976:250, 252). There was no association between elk and deer remains and hunting or butchering artifacts in the Old Cordilleran Component (Matson 1976:257). The negative association of variables in the Marpole and St. Mungo Components may result from intensive site occupation (Matson 1976:257), in accordance with the C-transform set forth by Schiffer (1976:15). The lack of any association between artifact and faunal variables in the Old Cordilleran Component is not explained by this C-transform (Matson 1976:257). It should be remembered that much of the material was found at least partially in beach deposits that may have been subject to aquatic disutrbance, that soil chemistry may have been less favorable to bone preservation in the beach gravels, and that the sample size (N=23 levels) was relatively small compared to the Marpole and St. Mungo sample sizes.

The ethnographic pattern of site use on the lower Fraser

River indicates that many large winter villages were located there. Also, large influxes of people during salmon spawning runs would mean that many sites were intensively occupied by large populations. Judging from its dimensions, the Glenrose Cannery site may easily have been such a site if the ethnographic pattern was maintained for a considerable period of time. It may not be surprising, then, to find negative associations between intuitively related artifact and faunal variables given Schiffer's hypothesized relationship between large site population and/or site size, intense occupation, and deposition of secondary refuse. If this relationship holds for a large, intensively occupied site, the converse may also be true for limited activity sites. In the case of these kinds of sites, the assumption that materials used together are thrown away together may not be incorrect.

Limited activity sites consist of such entities as kill sites, quarry sites, and seasonally occupied sites (Schiffer 1972:162). At such sites "curate behavior" is present, but to a lesser extent than at large, intensively occupied sites (Schiffer 1976:56). The site to be examined by this study is in fact a discrete physiographic portion of an extensive habitation area; however, the chronological and spatial relationships between portions of this habitation area are unknown. That portion of the area examined in this study appears to have been used primarily for a seasonally specific, relatively brief, set of purposes. In this sense, occupation intensity of the portion under discussion appears to have been relatively low, at least in terms of duration. For these reasons it is argued that the portion of the habitation area investigated here can be treated as if it were a limited activity site that was occupied at a relatively low level of intensity for a relatively brief period of time.

Apart from the curation of material by-products of cultural activities there are a number of other factors that will tend to obscure relationships among by-products of a behavioral system. First, only a portion of the artifact and faunal remains are usually recovered in an archaeological excavation unless the whole site is dug. Therefore an incomplete record of by-product deposition must be dealt with, although this situation is hardly new. Second, the type of material from which an artifact is made, as well as the use to which it was put, will affect the abundance of certain artifact classes at a site (N-transform). Fragile artifacts are proportionally more likely to be broken and left behind in the archaeological record than are durable artifacts. Third, the material of which cultural by-products consist will affect their relative abundance in the site. At one extreme of decomposability there is stone, at the other extreme vegetable remains. Shell, bone, antler, and wood fall in between. Among these, some shells or bones decay more rapidly than others. Fourth, the use of bone and antler for artifacts has the effect of removing items from the faunal assemblage and adding them to the artifact assemblage (C-transform). Artifacts of bone, antler, tooth, or shell can thus be analyzed as artifacts, modified faunal remains, or both. The research design of the study will determine which of these alternatives is chosen. Fifth, both artifacts and faunal remains may tend not to be found at a site although the site inhabitants dealt commonly with them (C-transform). Examples of such items might be projectile points that were most often used in the pursuit of game away from the site, or trunk bones of larger game animals that were obtained and dismembered away from a site with only certain portions, usually limb bones, being taken back to the site.

No implication is made that material by-products of cultural activity <u>will</u> be found together, only that they will <u>tend</u> to be found together. Clearly, the curation of artifacts and refuse within a site and between sites will take place no matter how many people occupy a site or over what period of time a site is occupied. When a considerable time dimension is added, especially at a seasonally occupied site, it is unreasonable to expect that exactly the same activities will occur in exactly the same location year after year. The deposition of the by-products of these activities will therefore not occur in exactly the same place each year. Over time, however, the deposition of the by-products from a consistent set of activities will nevertheless tend to reflect the relationships between particular by-products.

The foregoing arguments are phrased in terms of tendencies, and this is not without reason. It is in recognition of the virtual absence of absolutes when dealing with archaeological interpretation that the tendency for events to co-occur in time and/or space is stressed. The tentativeness with which archaeology is able to interpret prehistoric behavior patterns has also led to the use of inferential statistics in this study to aid in data analysis. These statistics deal with the likelihood of an event occurring by chance, and as such they lend themselves readily to statements of tendency.

An attempt such as this to detect ethnographic patterns in the archaeological record is confronted with the problem of using variables that correspond to recognizable units in the former cultural system that is being investigated. In the case of faunal remains the difficulties of establishing correspondences between archaeological variables and units in the real world (species) is generally not too difficult. Thus, faunal remains that can be identified as to species can justifiably be thought of as meaningful variables. The reliability with which artifacts can be correspondingly classified is unfortunately not as great. Several generations of debate have taken place concerning the classification of artifacts and what the products of such classifications are meant to signify.

The magnitude of the problem faced by archaeologists is amply illustrated by an examination of Ingalik Material Culture (Osgood 1940). It is clear from this work that no attempt at classification by an archaeologist could succeed in segregating artifacts on the same basis as they are segregated by the people who use them. Failing this, the archaeologist must classify the data as best he can in terms of the purposes of his research while at the same time avoiding doing violence to what he perceives as a reasonably emic classification. This situation in itself is an important factor tending to obscure relationships between material by-products in an archaeological context. In the present study, the basic classification is descriptive although functional aspects of artifact classes are employed secondarily when they can be taken from the relevant ethnographic literature.

CHAPTER II

BACKGROUND TO THE STUDY

Introduction

This chapter serves as a means of connecting the aims presented in Chapter I with the data presented in Chapter III and following. The site from which the data were recovered is described in terms of its morphology and human history. The physical and cultural context of the site is also continued, and a description of the excavation procedures is given.

Site Location and Description

Located at 48°27' north latitude and 123°16' west longitude, the Deep Bay site is designated DiSe 7 in the Borden system (Figure 1). It consists of cultural deposits resting on a spit that projects from the east coast of Vancouver Island into Baynes Sound.

This spit, known as Mapleguard Point, and the curve of the eastern shoreline of Vancouver Island enclose the sheltered body of water called Deep Bay (Figure 2). The protection afforded Deep Bay by the spit and the island is considerable and, as a result, a number of commercial fishing vessels and private craft moor at the government wharf

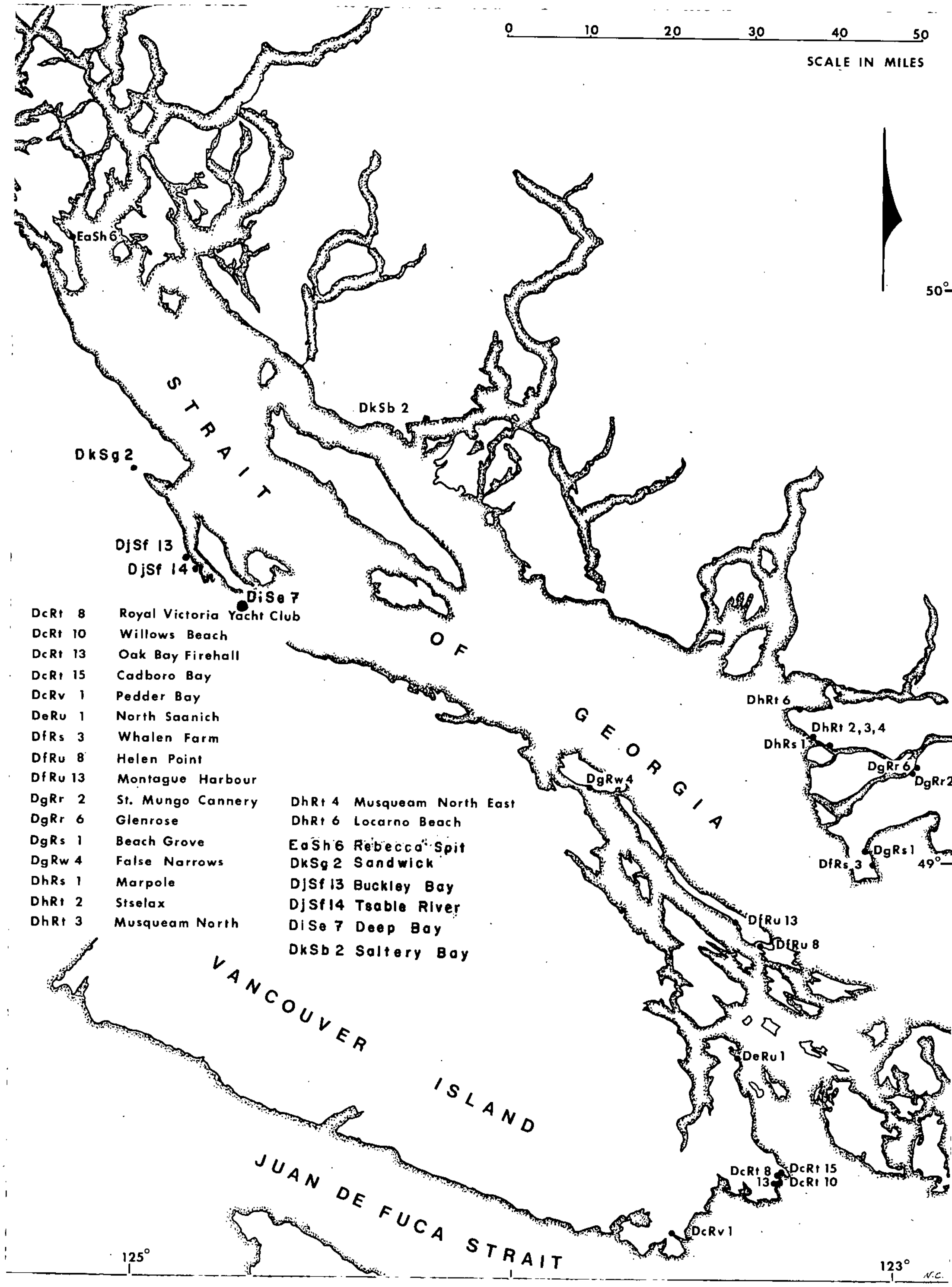


Figure 1. Map of Gulf of Georgia showing Deep Bay in relation to selected archaeological sites.

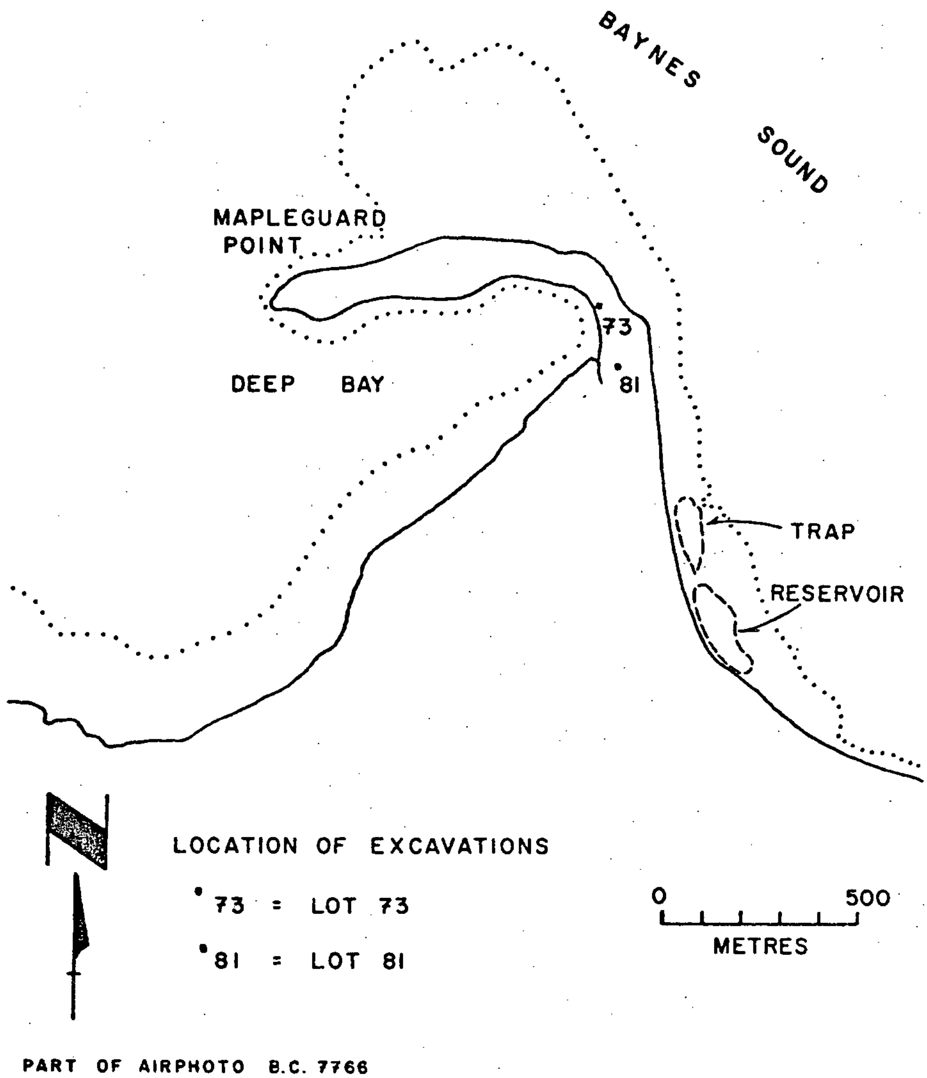


Figure 2. Map of Deep Bay, Baynes Sound, and Mapleguard Point.

throughout the winter. Only on rare occasions does major disturbance occur within the bay. This disturbance takes the form of a violent west wind, called a "Qualicum", that sweeps over the island, presumably via the Alberni Canal and Horne Lake route. On at least one occasion in living memory this wind has caused commercial fish boats to be torn from their moorings and washed ashore against the inside of the spit. Outside the spit is the south end of Baynes Sound, the body of water that separates Vancouver Island from Denman Island.

The spit continues to be built up of sand and gravel carried by the tidal current that flows northwest along the east side of Vancouver Island. The material being carried by the current comes from two sources. One is gravel, sand, and sediment that is carried along the shore in the continuing process of beach build up and decay. The other is the eroding bluffs to the immediate southeast of the spit. Some parts of these bluffs are composed of glacial clays, and other parts are composed of semi-consolidated glacial sands and gravels. These materials belong to the Bowser series of soils (Day, Farstad, and Laird 1959:Qualicum Alberni sheet, Soil Map of Vancouver Island). As these materials erode onto the beach they become part of the material borne by the tidal current.

As the current proceeds along the coast of Vancouver Island it encounters a small headland that forces the current into Baynes Sound. With its direction deflected, the ability of the current to transport material is reduced, thereby causing depositional build up at the tip of the headland. This build up began as a submarine bar and, as the base of the bar came above water, continued as a combined spit and bar. Current direction and velocity and wave direction and velocity have combined over time to produce a spit that has its long axis aligned with the long axis of Baynes Sound (cf. Allen 1968:394ff; Zenkovich 1967:393, 439). It is composed of well sorted sands, gravels, and cobbles along its outer edge.

The beaches that flank the spit are different in composition within the intertidal zone. The beach outside the spit is subjected to far more forces of deposition and erosion than is the beach on the inside. The outer beach also varies more in composition than does the inside beach. The outside beach matrix is coarse, containing many cobbles and much coarse and fine gravel, especially at the base of the spit. Toward the point of the spit, the outside beach is composed of fine sand that lies in flats immediately next to the spit body and cobble ridges that mark the lower edge of the intertidal zone. The inside beach is predominantly fine gravel, sands, and some silt. Relatively little sorting of these materials has occurred except for a small area of steeply sloping fine sand just inside the tip of the spit and several areas of large boulders as one proceeds away from the spit along the shore of the bay.

Vegetation

The present vegetation of the spit is very limited. Only toward the base of the spit are there trees, mostly maples. They constitute the remains of the second growth that followed initial logging activity. Grasses, mosses, and some scrub plants constitute the remaining natural vegetation, the only forms found on the distal two-thirds of the spit. The small headland to which the spit is attached is covered by the usual local second growth regime of fir, hemlock, cedar, maple, blackberry, salal, mosses, and, in the moister areas near the creek, willow, alder, stinging nettle, fern, and cattail.

Resources

At the base of the spit, on the inside of the bay, a small stream debouches. This stream flows year around and thus provides a constant source of fresh water. Additional fresh water is available from Cook Creek about a mile along the shore of the bay.

The food resources available in the immediate vicinity of the site at various times throughout the year are considerable. A variety of molluscs are found in the wide range of beach matrices at the site. Predominant among these are both species of horse clam (Tresus capax and Tresus nuttalli), basket cockle (Clinocardium nuttalli), butter clam (Saxidomus giganteus), little neck clam (Protothaca staminea), edible mussel (Mytilus edülis), and, to a lesser extent, native oyster

(Ostrea lurida), moon snail (Polinices lewisii), and several smaller species of marine snails (Carl 1965). These resources are available all year, as are crabs (Cancer sp.), sea urchins (Strongylocentrotus sp.), cod (Gadus sp.), and rock fish (Sebastodes sp.). Some preferences in the seasonal collection of these resources is noted in the ethnographic literature. Herring (Clupea harengus pallasii) are abundant, especially in early spring, at which time they spawn in large numbers along the beach at the base and to the southeast of the spit. The abundance of this resource can be inferred from the presence of a large stone walled fish trap in the intertidal zone just to the southeast of the base of the spit (see Figure 2). One report mentions a school of herring one to one and a half miles long and twenty to twenty-five fathoms thick, with an estimated weight of over two thousand tons (Tester 1947). This school was observed in late November and early December and would probably winter in the Baynes Sound-Denman Island area, spawning the following March.

Salmon of several species are present in local waters. The Baynes Sound, Chrome Island, Norris Rock area is as abundant in Spring and Coho salmon as any of the better known salmon fishing areas in the Gulf of Georgia, especially in August and September. Also, Mr. Albert Recalma (1975,pers. comm) informed the writer that this area has long been known as one where salmon could always be obtained. Many of the creeks and rivers draining the east coast of Vancouver Island support spawning runs of dog salmon (Oncorhynchus keta) in late October or early November, among them Cook Creek and the small creek at the base of the spit (A. Recalma 1975, pers. comm).

Harbour seals (Phoca vitulina richardii) and northern sea lion (Eumetopias jubata) frequented Deep Bay as predators on the various fish species mentioned above. Dogfish (Squalus suckleyi) were also very abundant in the waters around Deep Bay (Carl 1965). They are easily caught, and were of considerable aboriginal importance as a source of technological materials. Dogfish were sufficiently abundant in the area to warrant the operation of a dogfish liver oil reduction plant at Deep Bay in the second quarter of this century. Coast deer (Odocoileus hemionus columbianus) are common in the forest behind the base of the site. Although no deer were seen while this project was in progress, it can safely be inferred that if the extent of habitation in the area were reduced to a small section of the spit, then the abundance of deer would be more noticeable.

Information on the availability of birds at Deep Bay is meagre. From the writer's observations, bald eagle (Haliaeetus leucocephalus), seagull (Larus sp.), cormorant (Phalacrocoracidae), and heron (Ardea herodias) are present in the summer. A wide range of diving waterfowl are thought to winter at Deep Bay (Guiget 1977,pers. comm). According to the Christmas bird count of 1972-73 reported for the Comox area, the following species were among the total listed: loon (common, arctic, and red-throated), grebe (red-neck, horned, eared, pied-billed, and western), cormorant (double crested, brandt's, and pelagic), heron (great blue), swan (trumpeter), various ducks (mallard, pintail, green-winged teal, American widgeon, shoveller, canvasback, greater scamp, common goldeneye, Barrow's goldeneye, bufflehead, old squaw, and harlequin), scoter (white-winged, surf, and black), merganser (hooded, common, and red-breasted), bald eagle, gull (glaucous-winged and herring), common murre, pigeon guillemot, and marbled murrelet (Arbib 1973:179-180). Canada goose was not present in the 1973 count but was recorded in 1973-74. Among the participants in the 1972-73 count was Mrs. V. Chungranes, a resident of Deep Bay (Arbib 1973:180). Since the count covered 192 miles on foot and by car and involved 56 observer hours of counting, it seems reasonable to assume that many of these species are found at Deep Bay during the winter.

Vegetable foods would have been common at the site, but their former abundance or importance is difficult to assess. A number of species of seaweed are available all year in the intertidal zone, and salmonberries (Rubus spectabilis (Pursh)), huckleberries (Vaccinium sp.), salal berries (Gaultheria shallon (Pursh)), wild blackberries (Rubus sp.), wild raspberries (Rubus sp.), wild strawberries (Fragaria sp.), thimbleberries (Rubus parviflorus (Nutt)), bitter cherry (Prunus sp.), skunk cabbage (Lysichitum americanum (Hultén and St. John)), and fern rhizomes (*Pteridium* and *Polystichum*), can be assumed to have been available in their respective seasons in the past.

Technological resources available near the spit deserve some mention as well. Dogfish skin can be used as an abrasive when dried, as can scouring rushes (Barnett 1975: 111). Nettles (*Urtica sp.*), whose fiber is used to make twine (Barnett 1975:88), are found at the spit, as are rushes that can be used for mats (Barnett 1975:122). Willow, alder, cedar, maple, fir, and hemlock all provide useful wood and/ or bark. Bitter cherry is also available to provide bark for bindings on marine implements (Anderson 1937:73; Barnett 1975:86).

The vast majority of stone artifacts in the Gulf of Georgia are made of either basalt or slate. The writer was told that quantities of slate were available along the west coast of Denman Island (B. Recalma 1975,pers. comm). Basalt occurs in the form of cobbles along the shore of the bay to the northwest of the base of the spit. An examination of the cobbles and boulders strewn on the beach gives the impression that more basalt cobbles have had large flakes removed from them than is the case with the sandstone and granite rocks. In addition, the flakes removed from basalt rocks seem to be more numerous per rock and to be arranged in a more regular pattern vis-à-vis each other than is the case for flakes removed from the other rocks. Undoubtedly, all cobbles and boulders on this beach have been subjected to similar natural forces that remove random spalls, but, unless the basalt rocks break more easily with more regular flake scars as a result of these forces, there may be evidence of non-random cultural selection of raw material on the beach. As has just been mentioned, sandstone is available on this and other local beaches.

Bone and antler for the manufacture of artifacts was supplied as a by-product of the food quest. Since deer are locally available and can supply a substantial amount of bone per individual, there would be no problem acquiring this material. Antler would be less available, however, because males shed their antlers during the late winter and early spring.

Cultural Deposits

In the Gulf of Georgia, it is customary but erroneous to consider the limits of a shell midden deposit to be the limits of a site. The problems arising from this facile equation are pointed out at Deep Bay. First, the midden deposits on the spit are contiguous with, if not part of, midden deposits of varying depth that extend right along the shore of Deep Bay to Cook Creek and beyond. Thus, to call the deposits on the spit "the site" is to arbitrarily give boundaries to an area of midden deposit that is actually just a portion of a much more extensive habitation area. It is not presently known how much of the total midden area seems to be relatively restricted, nor is it known to which time periods the various portions of deposit belong. This potential complexity must be remembered when referring to "the site" that was excavated at Deep Bay. Second, the extent of shell midden is not the extent of habitation deposits, especially on the spit. Cultural remains have been found on and in sand deposits that extend beyond and underneath the midden proper. These findings suggest that the term "site" should encompass surrounding activity areas as well as the main area of cultural deposition. The definition of "the site" under these new terms is relatively easy on a spit where there are practical limits to the potential area for activity, but in situations where such limits do not exist, the task of defining "site" boundaries becomes more difficult. In spite of problems recognized in the use of the term, "the site" will henceforth be taken to refer to the cultural deposits on the spit and on the headland at its base. The reason for this designation is intuitive and pragmatic because that is the area that seems most likely to have been used as a single habitation unit, and because that is the area within which the salvage excavation, on which this report is based, was conducted.

Historic Site Use

Historic use of the site does not seem to have been considerable until this century. During the early part of this century the bay was the site of a fish processing plant and a log dump. The effect of the fish processing plant on the site was minimal, consisting primarily of the construction on the ground surface of accomodations for plant workers. The plant itself stood on cement foundations that rested in the intertidal zone.

The logging activity had a more disturbing effect. Logs were transported by rail, and the road bed for the tracks was cut through Lots 2, 3, 4, 5, and 6 (Figure 3). These tracks ran out onto a trestle from which the logs were dumped. The remains of this trestle are still visible to the north of the present government wharf. Also, a maintenance shop for the railroad was located on Lot 83, and it caused considerable disturbance to the midden there. Another former log dump is evident along the inside edge of the spit on Lots 71, 72, and 73. It is not known whether this was a railroad dump or a truck dump, but the disturbance is quite evident. This disturbance, though, was, if not minor, then at least peripheral to the site.

Recently, however, the spit was purchased by Nanaimo Realty and subdivided into small lots that are now used for permanent homes or summer cabins (Figure 3). The construction of roads, the installation of water mains, the excavation of foundations and septic tank fields, and clearing and levelling of the ground surface have disturbed the site well below the surface in some places. Large mounds of midden

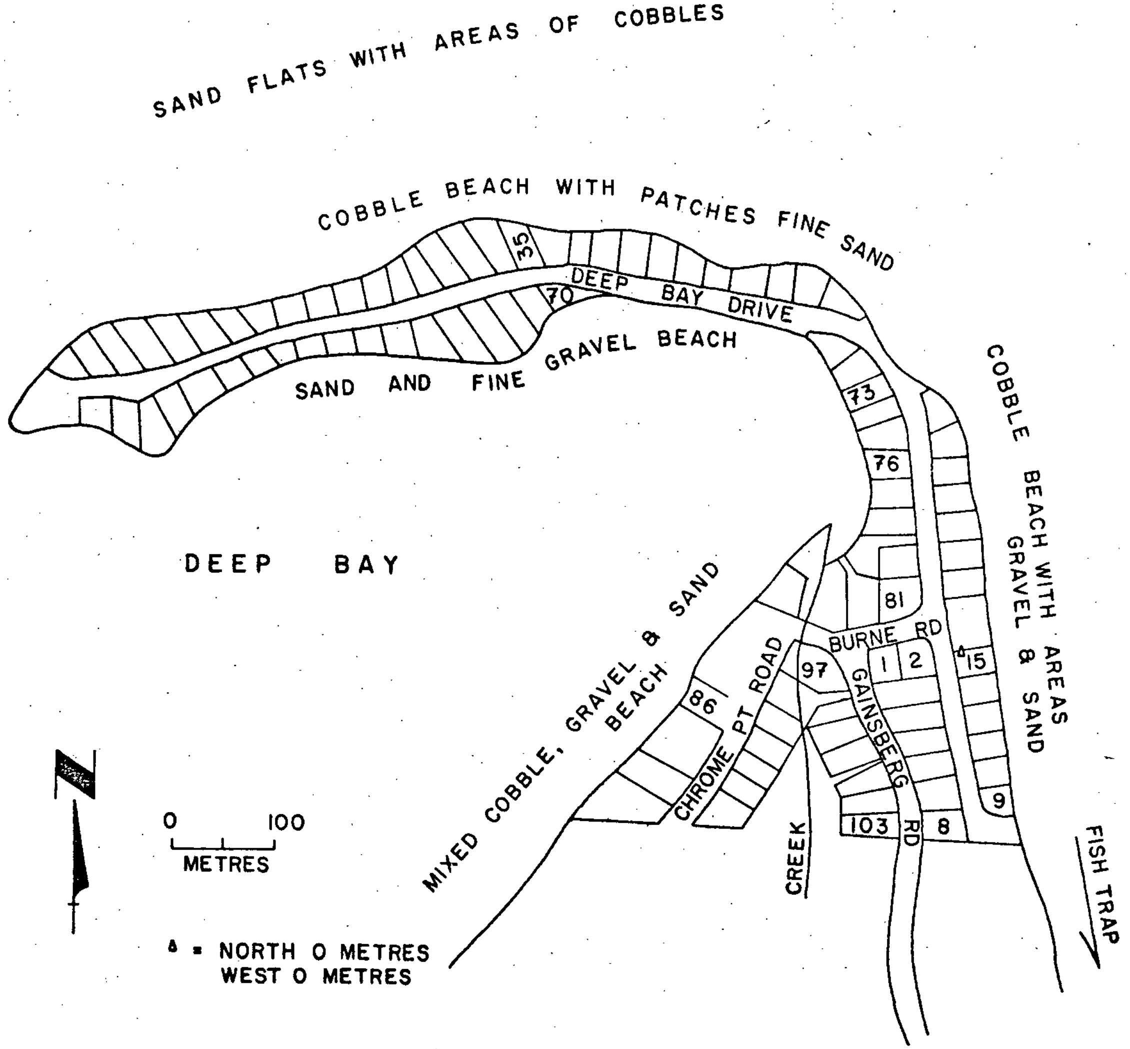


Figure 3. Map of Mapleguard Point subdivision.

and a complex of ditches associated with a fortified position have thus been destroyed.

Little is known ethnographically about the site apart from the mention of a trench embankment there (Barnett 1975:23; Smith 1907:323). It lies within the territory known to have belonged to the S:uckan, a group of Pentlatch (pronounced "puntlitch") speakers, whose territory extended from Union Bay to Deep Bay. This group was flanked to the north by the Pentlatch proper who held the territory from Union Bay to Kye Bay. To the south, the Saa Lam, also Pentlatch speakers, held the territory between Deep Bay and Englishman's River (Barnett 1975:23).

Equally lacking is archaeological information on the site. It has been surface collected for a number of years, and the trench embankment has been discussed by Newcombe (1932:7-8) and Buxton (1969:45). The 1975 excavations constitute the first archaeological examination of the site contents. The site is situated within what has been defined as the northern gulf archaeological area (Mitchell 1971a, Fig.15), an area containing relatively few excavated sites compared to other archaeological areas in the Gulf of Georgia. Other excavated sites in the same area as Deep Bay are: Tsable River Bridge (Whitlam 1974), Buckley Bay (Mitchell 1973), Millard Creek (Capes 1964), Sandwick Midden (Capes 1964), Bliss Landing (Beattie 1971), Rebecca Spit (Mitchell 1968), Little Qualicum River (Bernick 1976), and Saltery Bay (Monks 1971).

Excavation Procedure

The site was chosen for salvage by the Archaeological Sites Advisory Board of British Columbia because of the extensive disturbance that had occurred, or was about to occur, to the midden deposits. Since the writer's research purposes could be achieved at Deep Bay, a proposal was submitted, and an excavation permit was granted. Permission to excavate was requested from all owners of lots in the Nanaimo Realty development, but only the owners of Lots 1, 2, and 73 gave their permission. During the summer the writer obtained permission to examine a portion of Lot 81.

Contour maps of these lots were drawn (Figures 4, 5, 6). No aboriginal sub-surface features were detected although historic disturbance was evident.

To decide on the location of excavation units it was necessary to consider several factors. Because the site was chosen arbitrarily for salvage reasons, and because the lots where permission to dig was obtained were arbitrarily selected, there seemed no point in devising an elaborate and supposedly unbiased means of selecting the location of excavation units. Furthermore, the apparent absence of aboriginal sub-surface features meant that no parts of any of the four lots ought to be selected for or against. For these reasons, excavation units were located using logistic criteria. On Lot 73, the excavation units were laid out so

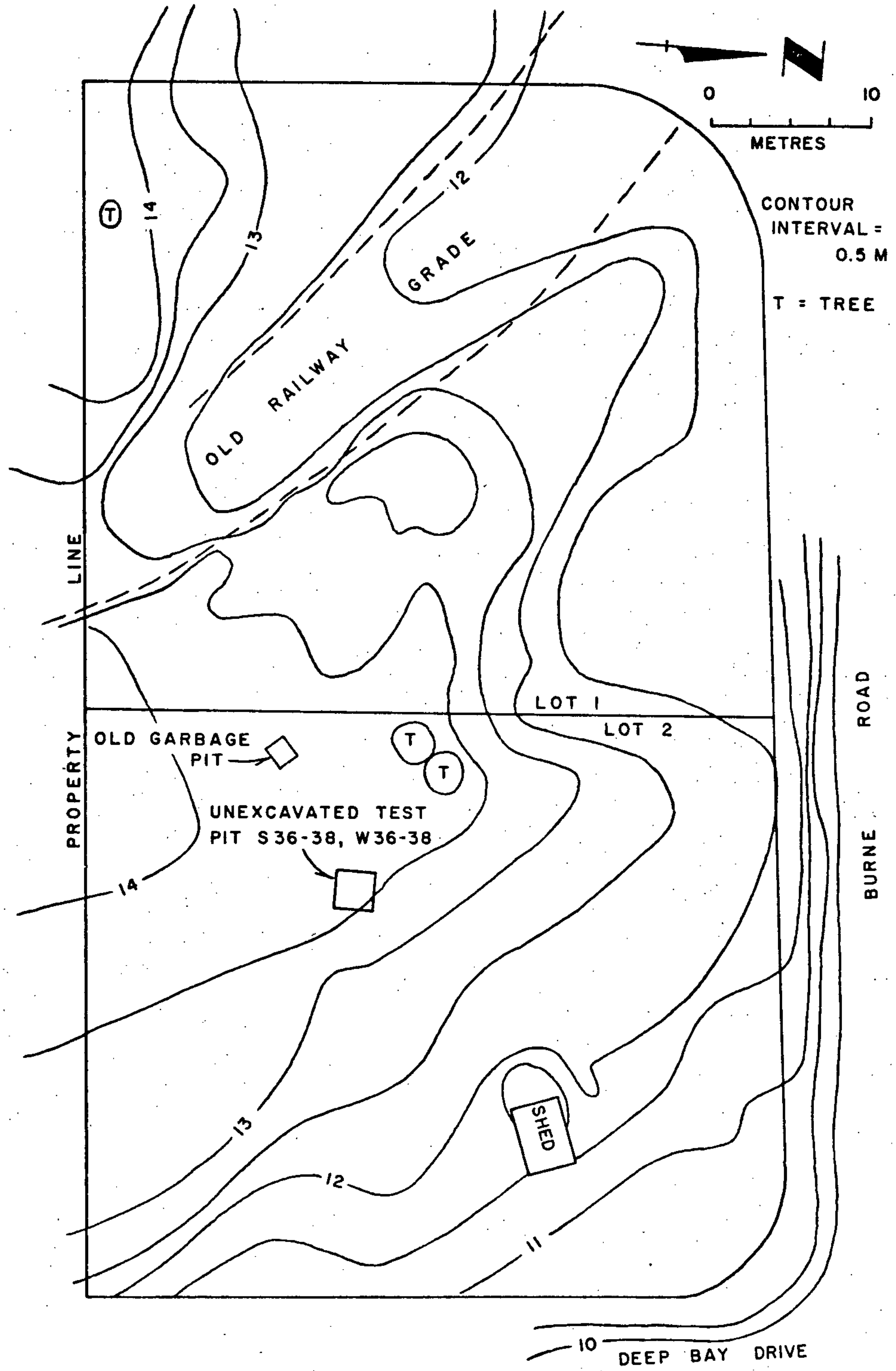


Figure 4. Contour map of Lots 1 and 2, DiSe 7.

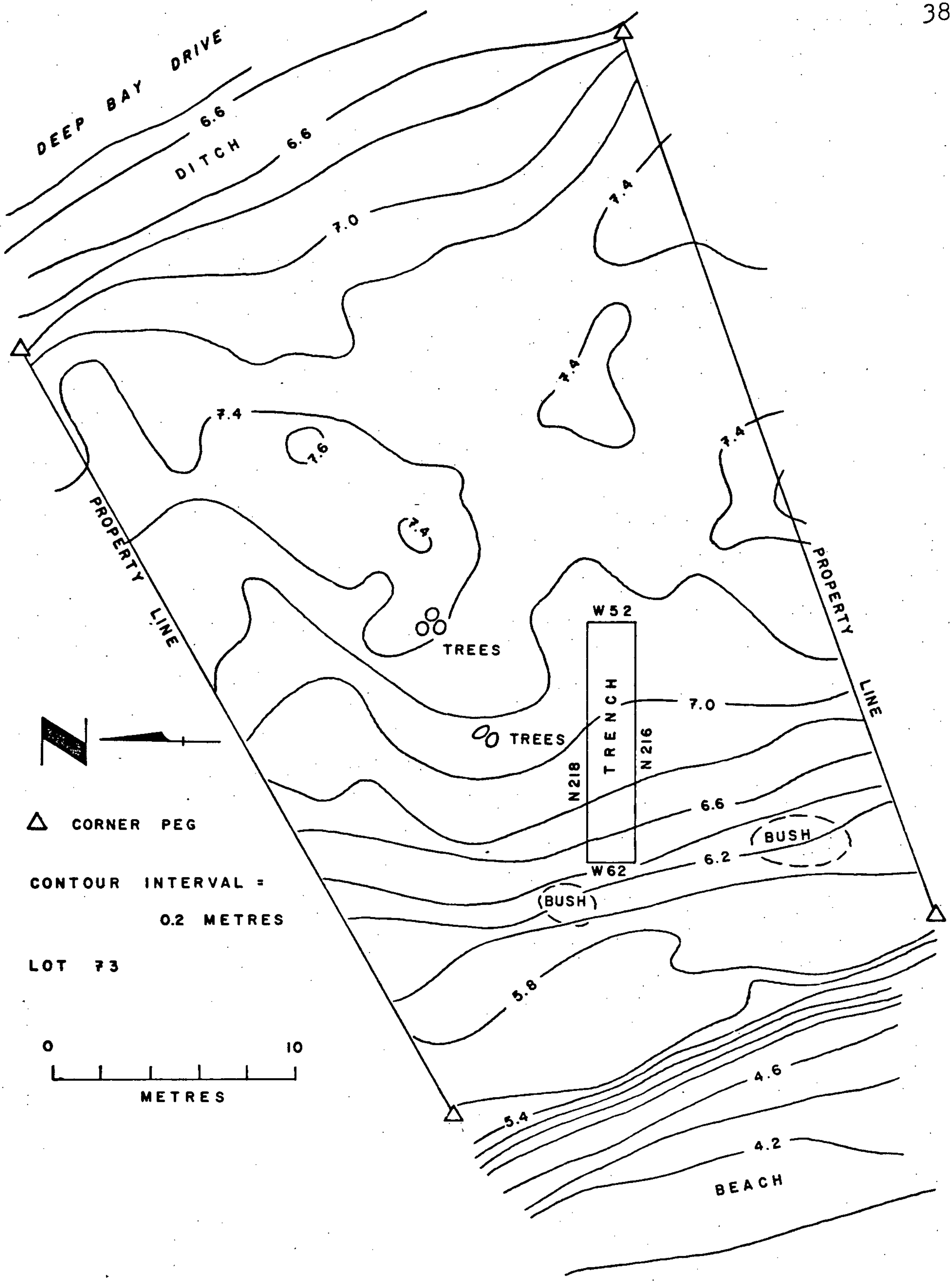


Figure 5. Contour map of Lot 73, DiSe 7.

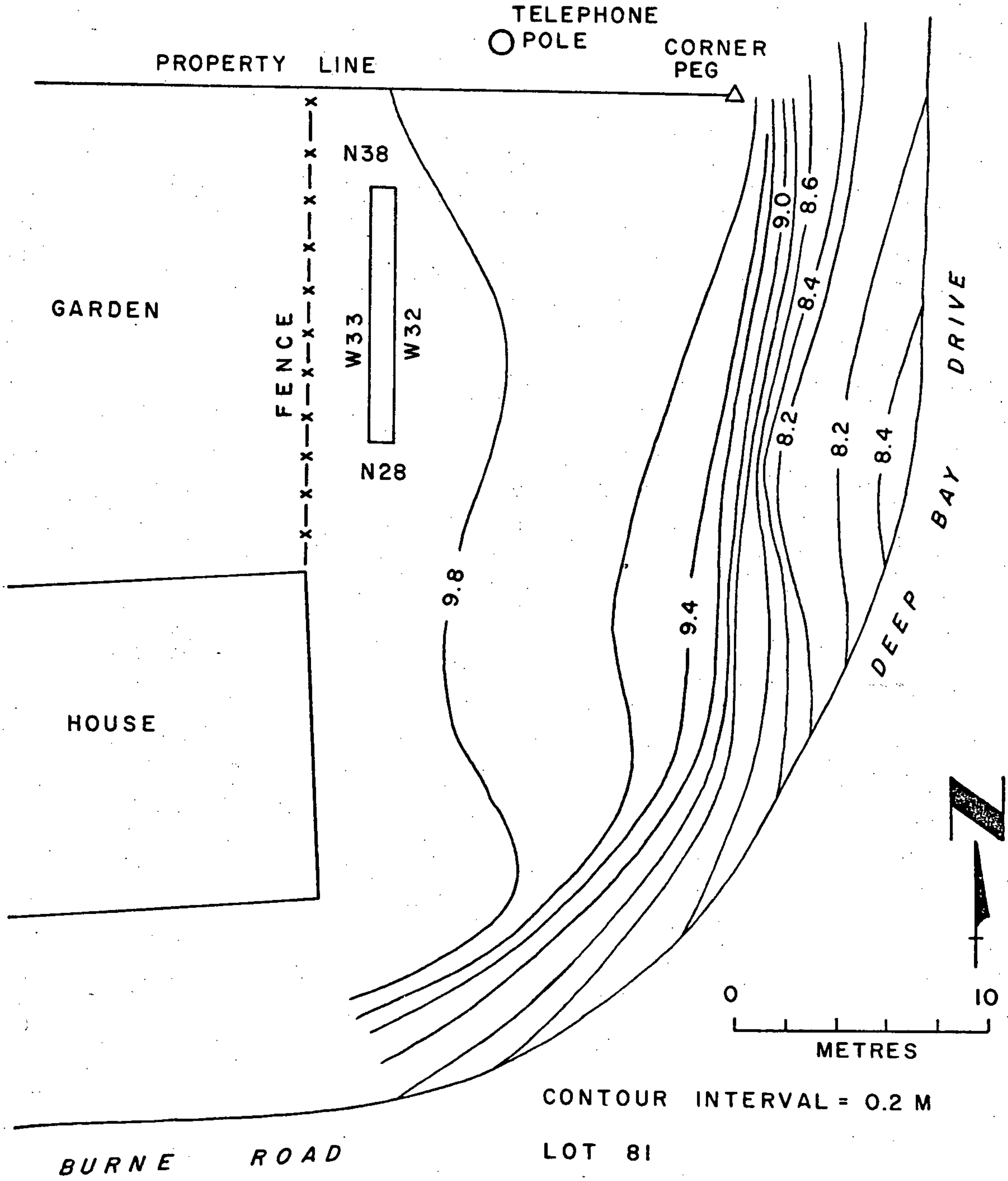


Figure 6. Contour map of Lot 81, DiSe 7.

as to encounter what appeared to be the deepest part of the midden deposits while at the same time avoiding major trees and shrubs. The excavation units on Lot 81 were situated so as to avoid inconvenience to the owner of the lot and so as to have a chance of detecting sub-surface features associated with the fortification that previously existed in the vicinity. Time did not permit excavation to be conducted on Lots 1 or 2.

The five excavation units on Lot 73 were each 2m x 2m located so as to form a 2m x 10m trench, and the four units on Lot 81 were 1m x 2m located end to end. The use of trenches on both lots was thought appropriate because it is the most effective method of controlling complicated stratigraphy such as that evident at this site. Excavation was carried out by means of mason's trowels, the excavated matrix being screened through 1/8" mesh. The matrix was removed according to a combination of 10 cm arbitrary levels and natural strata. Arbitrary levels were numbered according to their distance above datum (zero tide), and natural strata were given letters of the alphabet according to the order in which they were encountered. When an apparent lens of material was found in an already designated natural stratum, the lens was given a hyphenated number to indicate its affiliation with the surrounding stratum (i.e. A-1 is a lens in natural stratum A).

Screening the material was meant not simply as a check for artifacts missed during excavation. All land mammal, sea mammal, fish, bird, lithic, and floral debris was removed and bagged separately, and in addition, large quantities of mollusc remains, especially unbroken or little broken items, were placed in separate level bags. The weight of firecracked rock for each natural stratum in each arbitrary level was recorded. Level notes, including a floor plan, were kept after the removal of each natural stratum of each arbitrary level. Carbon samples were collected and photographs were taken. Soil samples two litres in volume were removed from each natural stratum of each excavation unit at the time the wall profiles were drawn.

CHAPTER III

STRATIGRAPHY AND CHRONOLOGY

Introduction

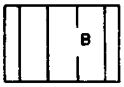
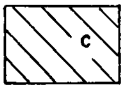
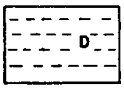
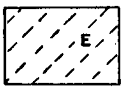
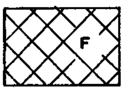
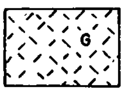
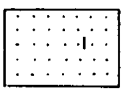
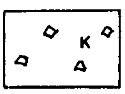
The first of the empirical data are presented here. The stratigraphy and chronology of the site provide a spatial and temporal framework within which the subsequent data can be discussed. The section on stratigraphy contains the results of chemical and physical analyses of natural soil constituents. The details of these analyses are found in Appendix I.

Grouping of Strata

Figure 7 shows the profiles of the trench on Lot 73 and Figure 8 shows those of the trench on Lot 81. The stratigraphy on Lot 81 requires two points of clarification. First, natural stratum A is overburden that has been bulldozed from other parts of the site as a part of land clearing. It is a very hard matrix, having been compacted by the weight of the bulldozer, and it contains a mixture of aboriginal and recent historic material. Second, natural stratum D is markedly different from the other strata because it is compact clay unlike the others which contain sand, gravel, charcoal, rocks, shell, and humus.

On Lot 73, the stratigraphy can subjectively be divided

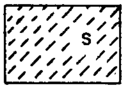
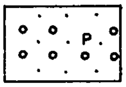
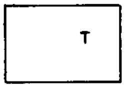
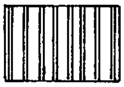
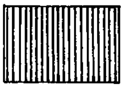
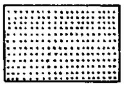
Key to Stratigraphy
Lot 73, DiSe 7.

Code	Description
	Brown sandy humus soil with grass roots, some crushed mollusc shell, and some firecracked rock. Japanese oyster shells are found in this stratum.
	Concentrated crushed clam and mussel shell in a grey sandy matrix; patches of less grey sandy matrix, more pea gravel, more barnacle, and some whole clam valves.
	Whole and crushed mollusc shell, scattered charcoal, and firecracked rock. Some shell is charred, and the soil is grey and sandy with some ash.
	Dark brown compact soil with crushed shell and ash. A lens of orange ash, charred crushed shell, firecracked rock, and flecks of charcoal is found here.
	Concentrated crushed shell and much charred shell in a grey sandy matrix with small, scattered pockets of ash.
	Grey sandy matrix; large quantities of herring remains and quantities of whole and crushed clam, mussel, and barnacle shell.
	Brown sandy soil with little shell or firecracked rock.
	Fine grey sand.
	Black soil and crushed mussel shell with some clam and barnacle shell.
	Coarse grey-yellow sand containing herring remains and some native oyster shell.

Key to Stratigraphy
Lot 73 (continued)

Code	Description
M	Black sandy soil with crushed mussel and clam shell and scattered charcoal.
N	Dark brown to black stained fine sand.
G/O	Dark brown to black compact sandy soil with almost no shell but quantities of firecracked rock.
G/S	Dark brown to black compact sandy soil with dispersed crushed clam shell and firecracked rock. The amount of shell decreases with depth.
D/G	Black compact sandy soil with little shell and some firecracked rock.
G-2	Dark brown sandy soil with large quantities of herring remains and firecracked rock and some crushed shell.
H	A series of discontinuous lenses characterized by whole clam valves and large valve fragments, and loose grey sandy soil with some ash. A fine lens of black soil and crushed mussel shell was also noted.
H-1	A series of discontinuous lenses characterized by compact black greasy soil and crushed mussel shell with several lenses of dark brown sandy soil with crushed clam and mussel shell.
Q	Dark brown coarse sandy soil with some pebbles but no shell.
RS	Loose grey sand with some crushed clam and mussel shell.

Key to Stratigraphy
Lot 73 (continued)

Code	Description
	Black soil and crushed mussel shell.
	Coarse yellow-brown sand with gravel and cobbles.
	Coarse yellow-brown sand.
	Clay and sand floor.
	Ash.
	Sand
	Charcoal

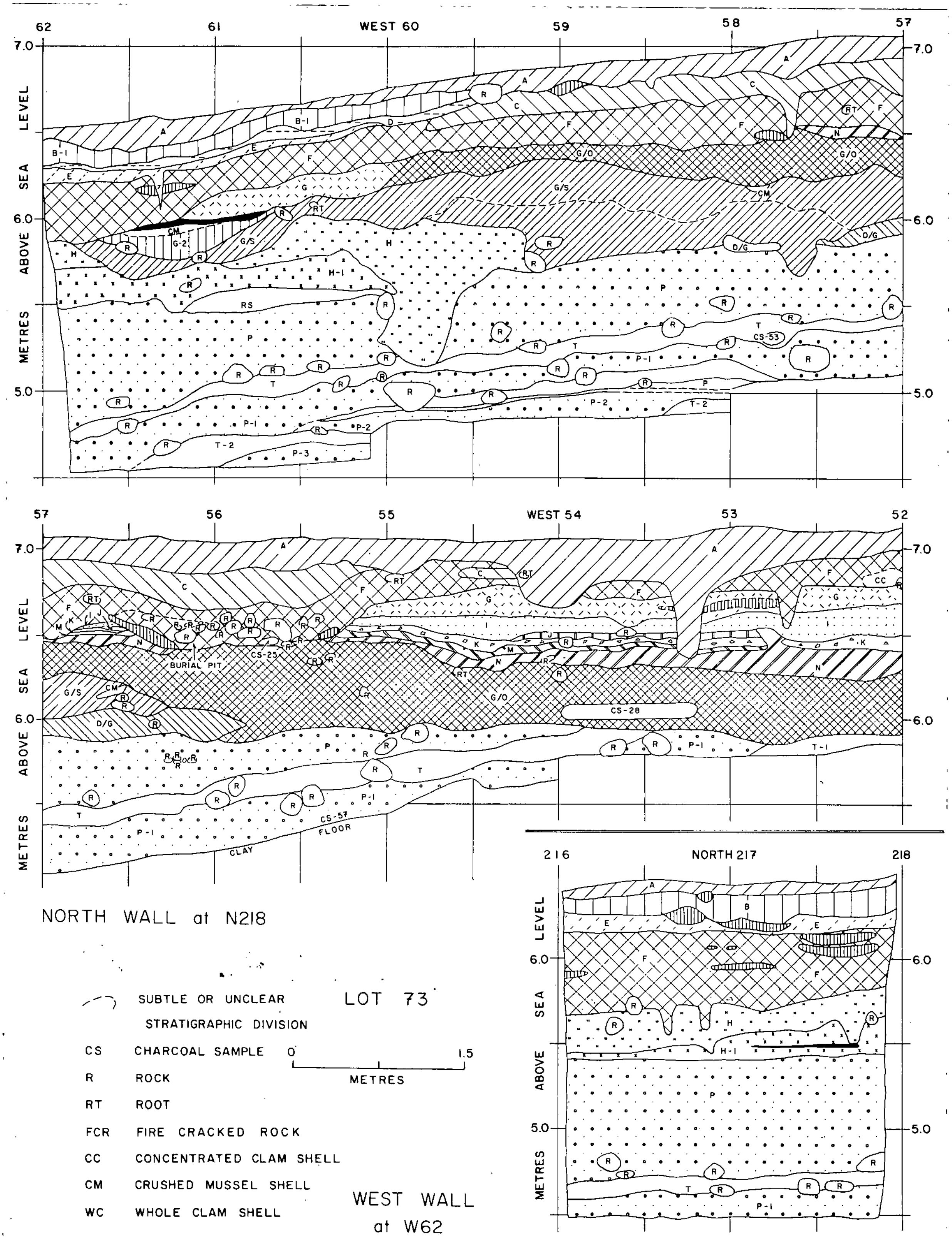


Figure 7(a). Stratigraphic profiles of Lot 73, DiSe 7; N218 wall, W52-62 and N62 wall, N216-218.

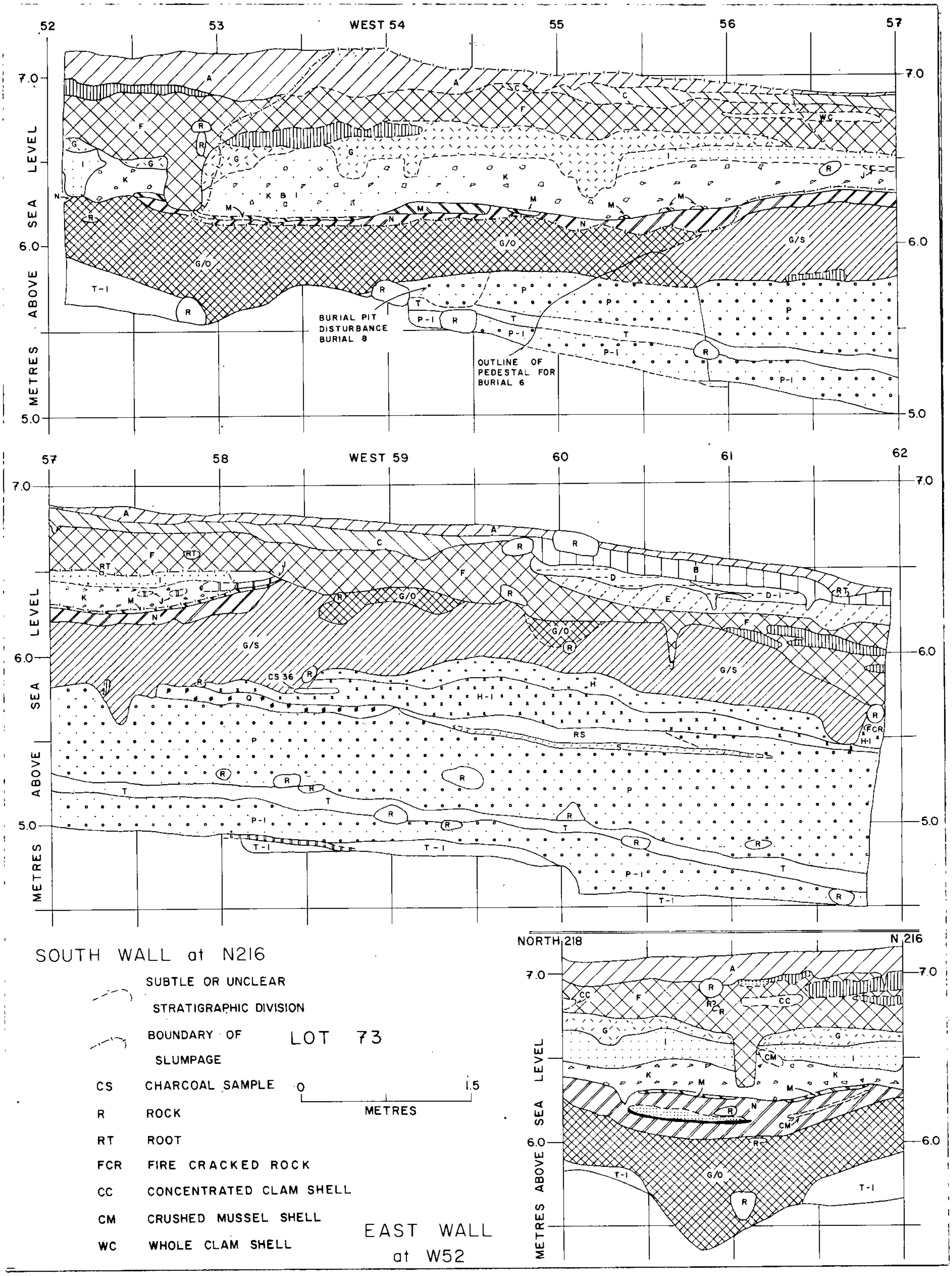


Figure 7(b). Stratigraphic profiles of Lot 73, DiSe 7; N216 wall, W52-62 and W52 wall, N216-218.

Key to Stratigraphy
Lot 81, DiSe 7.

Code	Description
A	Disturbed matrix consisting of compact crushed mollusc shell and soil containing grey ash and sand.
B	Dark brown compact soil with crushed mollusc shell and firecracked rock.
C	Black compact soil and pebbles with very little shell.
C-1	Crushed and charred clam shell and orange ash found as a lens in C.
C-2	Dark brown compact soil and large quantities of pebbles found as a lens in C.
D	Hard yellow-orange clay and fragments of crumbled sandstone.
E	Brown soil with crushed clam shell.
F	Loose black soil with crushed mollusc shell.
F-1	Finely crushed charred shell and dark clay soil.
G	Dark charred soil with no shell.
	Ash
	Sand
	Charcoal

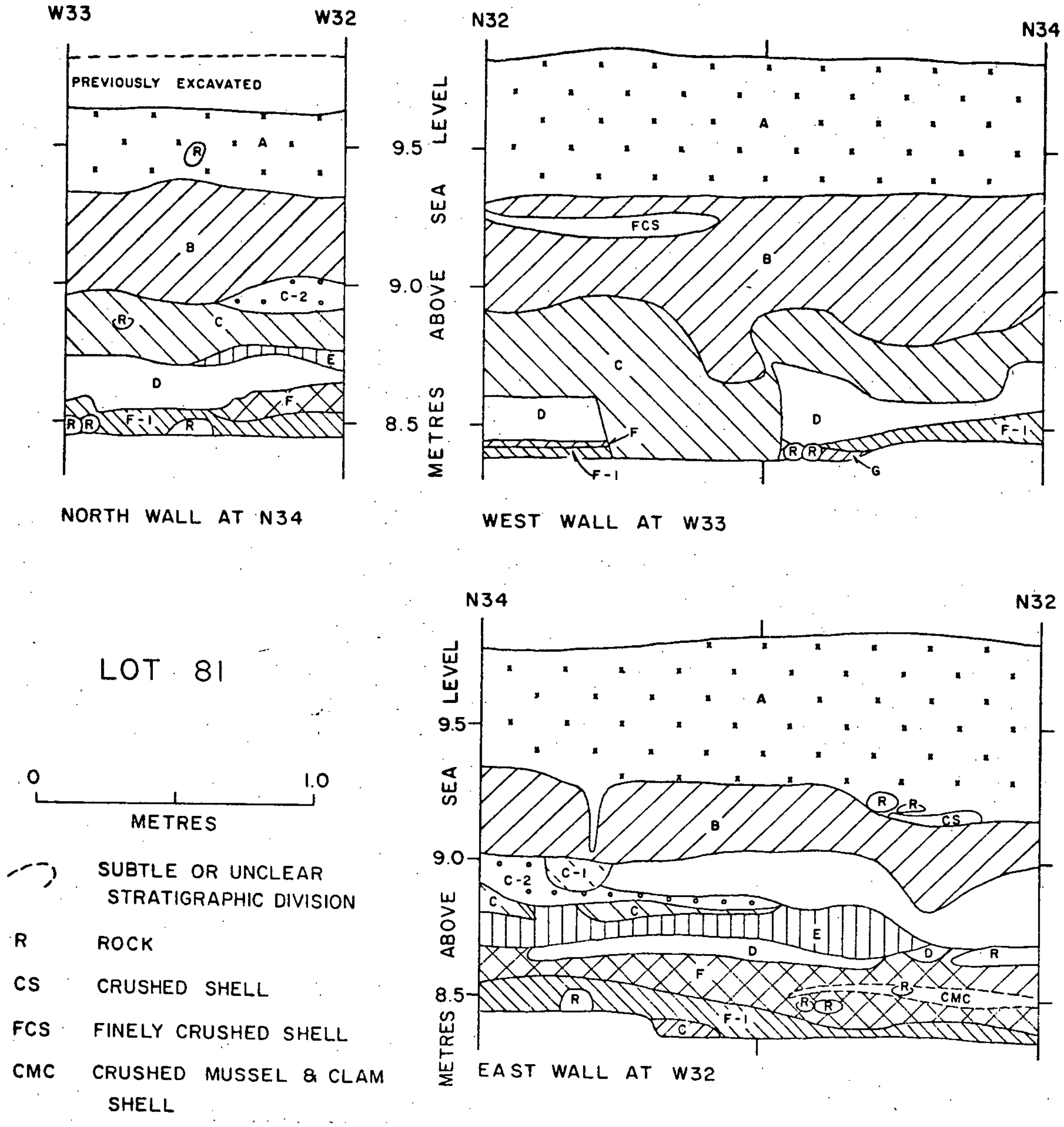


Figure 8. Stratigraphic profiles of Lot 81, DiSe 7; excavation unit 3.

into two zones, the lower zone being composed of strata containing sand, gravel, and cobbles to the virtual exclusion of other materials, and the upper zone, composed basically of sandy humus deposits with considerable but varying amounts of firecracked rock and cultural debris. Within the upper zone there appear, on closer observation, to be two possible stratigraphic subdivisions that might be made. The clearest of these is the division between the upper strata, showing a tendency to contain heavy concentrations of mollusc shell (A, B & B-1, C, D, E, F, "G", I, J, K, M, N), and the lower strata containing relatively less concentrated mollusc remains (G/O, G with shell, G-2, dark G, H, H-1, Q, R, S). Still further examination of the stratigraphy suggests that, within the topmost group of strata there may be yet another subdivision; that is, between A, B & B-1, C, D, E, and F on one hand and "G", I, J, K, M, and N on the other.

The fact that one stratum appears to be different from other strata that flank it, and that groups of strata exhibiting internal similarity can be distinguished suggests that cultural and/or natural constituents of strata may vary over space or through time. The majority of archaeological reports usually examine the most obvious cultural debris and use these observations to separate and group strata into zones. This study moves beyond the subjective assessment of stratigraphic divisions by seeking empirical evidence for such divisions in the pH and grain size characteristics of each natural stratum. The detailed results of these two analyses are presented in Appendix I. The results of these two analyses permit statements to be made concerning the grouping of natural strata and the geological interpretation of soil formation at the site.

The pH data for Lot 73 were useful in establishing that a statistically significant chemical boundary exists in the matrix. This boundary separates natural stratum Q and the complex of P and T strata from the overlying strata (see Appendix I, Figure 30). There is reason to suspect that more sophisticated tests, such as those outlined in Cook and Heizer (1965) and Cornwall (1958), would prove to be even more effective in distinguishing groups of strata.

The analysis of the granulometric data provided tantalizing suggestions about stratigraphic groupings, but it provided no irrefutable division of stratigraphic groups. The scaling analysis provided a clear depiction in two dimensions of the dendrogram results and assisted in identifying granulometric constituents that seem to be important in determining relationships between strata (see Appendix I, Figures 32 and 35). On Lot 73 the major distinction between cluster 1 and cluster 2* generally seems to divide lower

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* Cluster membership, Lot 73:

cluster 1 = natural strata F, G/O, dark G, G-2, H, H-1, K, N, P, Q, R, S, T.

cluster 2a = natural strata A, B & B-1, C, D, E

cluster 2b = natural strata "G", G with shell, I, J, M strata, with relatively little shell, from upper strata containing substantial amounts of shell (see Appendix I, Figure 33). Exceptions to this are strata F and G with shell. The former contains shell but belongs to the lower, less shelly cluster, and the latter is a shelly stratum situated stratigraphically amongst strata containing less shell. Since only granulometric data is under consideration, however, it appears that the abundance of shell in a stratum and the relative proportions of granulometric constituents in that stratum may be related.

Inspection of the weights of sample constituents in clusters 1 and 2 indicates that these two clusters differ most often in terms of .125mm and .063mm sieve constituents, cluster 2 having generally greater weights of them. This finding is supported by the scaling analysis. The subdivision of cluster 2 into two parts appears to be based on the relative amounts of .250mm, .500mm, and 1mm sieve contents. All members of cluster 2a are separated from all other samples on the basis of weight of these constituents. The median weight of constituents for cluster 2a is 29.9 gm, whereas the median weight for all other samples is 84.9 gm. The clustering and scaling analyses of Lot 73 data indicate that in dimension 1 the .125mm and .063mm sieve contents are largely responsible for the division between cluster 1 and cluster 2. In dimension 2 the combined .250mm, .500mm, and 1mm sieve contents is largely responsible for the further division of cluster 2. Cluster 2 members generally contain more of the finer grades of constituents than do cluster 1 members. Within cluster 2 the members of cluster 2a contain less .250mm to 1mm material than do members of cluster 2b.

The granulometric data can also provide information on the processes that have affected the deposition of natural constituents in the site. So far the granulometric data have been referred to only in terms of mesh size. For subsequent interpretation a discussion of these mesh sizes and their descriptive labels is useful. The system of using mesh sizes that are half the aperture of the next largest mesh size is known as the Wentworth scale (Wentworth 1922). The ever decreasing difference between successive mesh sizes is difficult to plot graphically, so another scale, known as the phi scale, was developed from the Wentworth scale. The conversion formula is: $\text{phi} = \log_2 D$ where D is the class boundary (mesh size). The phi scale thus consists of whole numbers that are either positive or negative and that can legitimately be evenly spaced on graph paper. In the following discussion the data will be spaced on the graphs according to phi units, but the mesh size will still be used to label class boundaries in order to provide continuity with the foregoing analyses, and in order to make the grain sizes easy to visualize. The various gradations in grain size have been given descriptive labels, and they are presented below along with the appropriate class boundaries of the Wentworth and phi scales. Although both scales extend farther at both ends than is shown here, the data involved in this study are described by Table I. It will be noted that all the granulometric constituents except pebble gravel and granule gravel were important in the scaling analyses.

Interpretation of Strata

Wind and tide are the most likely natural forces to have transported the granulometric constituents to the site and deposited them there. In the physical description of the site it was suggested that the lowest strata on Lot 73, the P and T complex, represented stages in the tidal build up of the spit, whereas the overlying deposits were heavily influenced by man. The soil pH analysis also noted a division between these two groups of strata. The clustering and scaling analyses did not detect this boundary but it suggested three other divisions in the stratigraphy. It is known that, at a minimum velocity of 15 cm/sec, wind will begin to transport sand grains of .08mm diameter, and that the same minimum velocity of water will transport sand grains of .2mm diameter (King 1971:194). Sand, it will be recalled, is the most common natural constituent in almost all the sampled strata. Comparatively larger sand grains are transported by the same velocity of water flow because the difference between the density of sand and water is less than between sand and air (King 1971:194). It has also been shown that

TABLE I

Wentworth Scale, Phi Scale, and Descriptive Labels of Grain Sizes used in Granulometric Analysis.

Wentworth	phi	label
8mm	-3 and larger	pebble gravel
4	-2	pebble gravel
2	-1	granule gravel
1	0	very coarse sand
.500	1	coarse sand
.250	2	medium sand
.125	3	fine sand
.063	4	very fine sand
pan	5 and smaller	silts and clays

a straight line relationship exists between particle size and critical sheer stress required to initiate particle movement (King 1971:194). It can therefore be expected that water transported sands will contain more particles in the medium and coarse sand ranges than will wind transported sands, where particles in the fine sand range would be expected (Cornwall 1958:186).

The greater velocity achieved by winds at Deep Bay, when compared to tides, is one factor that would tend to mask the expected difference exhibited by these two means of transport. This greater wind velocity would increase the amount of medium sand in the matrix and thereby minimize differences between water and wind transported sands. In fact, 2 phi (.250mm) sand grains are often under represented in samples of beach sands from six to twelve feet of water.

This condition is thought to result from the easy transport of this size by both wind and water. The easy transportation of this grain size, compared to other sizes, means that if particles of this size reach shore they can easily be blown away by wind (King 1971:290).

The graphs in Figure 9 show typical frequency distribution of natural constituents in both wind-laid and water-laid deposits on Lot 73. It can be seen that the P and T samples have the highest percentage of sand in the .500mm sieve, whereas the other strata have the highest percentage of sand in the .250mm sieve. This tends to confirm the field impression that the P and T complex of strata were probably laid down by tidal action as the spit built up. It seems that the different genesis of the material is reflected not only in its grain sizes, but also in its chemistry, the lower matrix being less basic than the overlying deposits. The effect of wind on the deposition of the major sand category in the overlying strata is enlightening for the fact that the spit may still be growing by this means. Indeed, the high positive correlation of fine sands with depth below surface on dimension 1 may support this position. It also suggests that sand lenses predominantly of .250mm grain size may indicate periods of site abandonment.

In cluster 2b (natural strata "G", I, J, K, M, and N), all strata but one exhibit extreme proportions of .250mm sieve contents. The exception to this pattern is natural

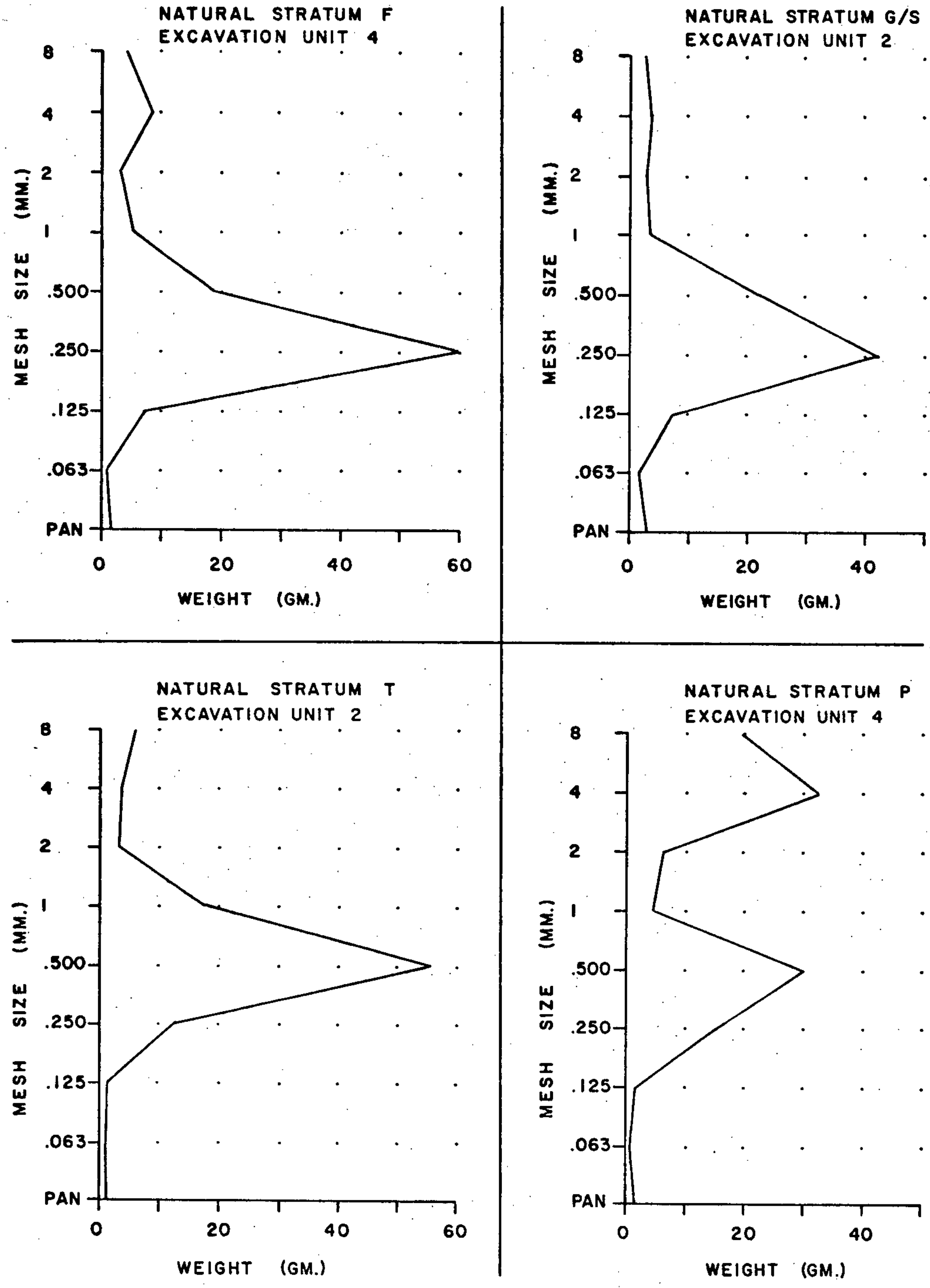

Figure 9. Selected frequency distributions of granulometric constituents, Lot 73, DiSe 7.

stratum K which contains .500mm screen contents in the highest proportions, followed by 1mm contents, then by .250mm contents. There exists the probability, therefore, that the genesis of natural stratum K is more likely to have been due to forces of marine deposition than to forces of wind deposition. Given that these strata are composed almost entirely of sand and that they lie on the slope of the underlying strata that is exposed to wind and waves, and given that they thin out and disappear at the crest of the underlying midden ridge, it seems that they represent accumulations of material that have been little altered by cultural activity. Whether this is due to an absence of human activity at this part of the site or to site abandonment is difficult to determine.

The presence of a stratum that appears to be water deposited must provoke conjecture. A temporary rise in sea level is one hypothesis that comes to mind, but it leaves too many questions unanswered. For example, why are there not similar sandy deposits on the west side of the old midden surface? And where is the evidence for this change from the rest of the coast? Possibly, tidal and weather patterns exceptionally favorable to the build up of a broad sloping beach would enable tidal effects to progress as far west as they have. The apparent absence of habitation debris from this part of the site might also be accounted for by such an alteration in beach morphology. The production of a smoother, flatter beach, however, would suggest relatively calm marine conditions whereas the encroachment of waves practically to the crest of the present spit surface would require exceptionally high tides and violent wave conditions.

As can be seen below, these strata were laid down in a relatively short period of time. The absence of major sea level changes in the last 1000 years in the Gulf of Georgia (Heusser 1960:190; Mathews et al. 1970:693-699), the absence of similar sandy strata from above the western slope of natural stratum G/O, the evidence for a relatively constant climate after about 3000 B.P. (Heusser 1960,Table 6), and the apparently short period of time involved in the deposition of these strata all suggest that they represent the upper limit of wave disturbance during a short period of relatively stormy weather. During this inclement interval, the area of the site represented by these strata, and possibly the whole site, appears to have been infrequently used.

The preceding discussion indicates that the initial occupation of the spit occurred at a time when the spit was still subject to inundation. The virtual absence of bone from the basal water-laid deposits may be related to the relatively low alkalinity of these strata, or it may be related to the activities conducted at the site. This uncertainty is well worth the attention of future investigations. The granulometric analysis indicates that a division may exist within upper, shell bearing strata although the point of division is not clear. Cluster 1 seems to represent undisturbed aboriginal deposits, while clusters 2a and 2b seem to represent disturbed/historic strata and largely non-habitation deposits respectively. The location of cluster 2b between natural strata F and G/O may be important to the delineation of cultural components. The homogeneity of natural constituents in the wind-laid aboriginal deposits indicates that cultural constituents, rather than natural constituents, are what cause one natural stratum to appear different from the next. This suggests either that the site was occupied for a variety of different purposes, or that the purpose remained the same but the location of specific activities varied. It will be seen in chapters VIII and IX that the latter alternative is to be preferred. This finding is consistent with the arguments on site use presented by Schiffer (1975:162).

Chronology

Six samples of wood charcoal were submitted to Gakushuin University for carbon-14 dating, all from Lot 73. Figure 10 shows the reported ages for each of the samples, and it also shows the range of each date to one and two standard deviation units. The Libby half life used for these age determinations was 5570 ± 30 years, and present was defined as 1950. The stratigraphic position of each dated sample is shown on the profiles (Figure 7).

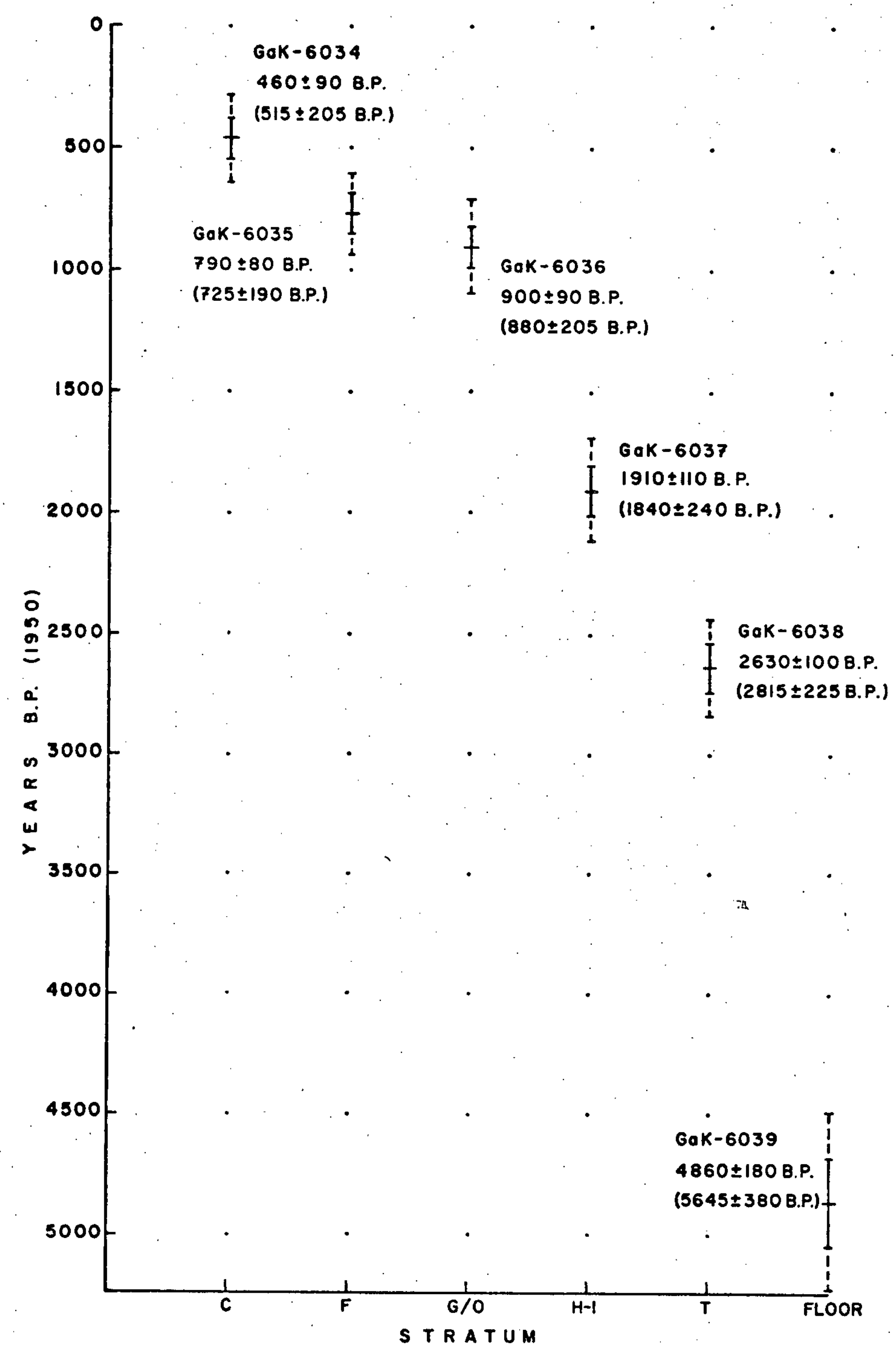

Figure 10. Radiocarbon dates, DiSe 7.
By natural stratum, showing two standard deviation units; based on Libby half life of 5570±30 years. Dates in parentheses are recalibrated according to Clark (1975) by J. Baldwin.

The sample from natural stratum C in excavation unit 3 (GaK-6034) came from the bottom of this stratum and it was collected from an area 33 x 60 x 4 cm. As with all samples, the field sample was cleaned with sterilized tweezers. The resulting sample consisted of small lumps of charcoal weighing 36 gm. During the cleaning of the sample, fine rootlets were noticed and a human hair was found. However, because this sample was taken from a stratum that contained historical material (see Historic Artifacts below), and because the date is youngest of all sample dates (460±90 B.P.)--a finding consistent with its uppermost stratigraphic position --it is thought that contamination has not been severe. One problem lies in the association of this date with obviously recent historic material. At two standard deviation units the youngest possible date for this sample is 280 years B.P., but this date preceeds substantial European contact, not to mention cement, wire, nails, and tin cans. It seems clear that substantial disturbance of the historic strata has occurred. It is not clear whether the historic material has been intruded into aboriginal strata containing appropriate dates, or whether the charcoal material and surrounding matrix has been recently transported from another part of the site. If the latter alternative were the case, then it would appear that young material from another part of the site may have simply been relocated and, in the process, mixed with recent historic material. The physical appearance of this stratum indicated that it was not transported. Rather, it seems to have had historic materials intruded into it as the disturbances shown in the profiles suggest. The aboriginal artifacts associated with this date are thus likely to be more or less correctly dated by this sample, regardless of whether transportation of matrix or in situ additions to the matrix has occurred.

The sample GaK-6035 came from the bottom of natural stratum F in excavation unit 4, immediately behind the cranium of Burial 1. The date of 790±80 B.P. falls well within the period of the Gulf of Georgia Culture Type (Mitchell 1971a,Fig.17, Fig.18), and there is no historic material from natural stratum F. The sample weight was 32.9 gm. It consisted of several large chunks of wood charcoal and was recovered from an area 50 x 50 x 4 cm, with no contamination apparent. The condition of the sample and the consistency between its date and its stratigraphic position, relative to other dates and sample locations, indicates that this date can be accepted with confidence. As will be noted in the discussion of component separation and identification, this date and the cultural materials associated with it are consistent with other findings in the Gulf of Georgia area.

The third sample (GaK-6036) produced a date of 900±90 B.P. It came from an area 80 x 80 x 5 cm, near the bottom of natural stratum G/O in excavation unit 5, and consisted of small pieces of wood charcoal. The cleaned sample weighed

26.5 gm. During cleaning a small, red, synthetic thread was found. The thread and the stratigraphic location of this date are problems. The thread suggests that the reported date may be younger than the real date by an unknown amount. On the other hand, it is not out of order with the other dates in the series, either stratigraphically or chronologically. If contamination has occurred, it does not seem to have been substantial. Possible minor contaminations may account for the relatively large stratigraphic distance between samples GaK-6035 and GaK-6036, but this distance could also be accounted for by a period of relatively rapid matrix deposition. Such deposition could have been extremely rapid in the case of natural strata "G" through N.

It was noted at the end of the granulometric analysis that the group of sandy strata above stratum G/O may have built up quickly as a result of beach encroachment on the site. This would be a relatively fast process, but GaK-6036 came from near the bottom of stratum G/O. It seems unlikely that the remainder of stratum G/O, as well as the overlying group of sandy strata, were deposited in as short a period of time as the GaK-6036 date suggests. It will also be recalled that the granulometric cluster analysis found the samples of G/O to differ substantially between excavation units 2 and 4. It is possible, but unlikely, that what passed in the field for a single homogeneous stratum may actually be two apparently similar strata, one of which was deposited much more quickly than the other. This interpretation would admittedly put a great deal of strain on the data.

The artifacts recovered from natural stratum G/O and underlying strata appear to be different from those above G/O. From natural stratum G with shell, which underlies G/O, a fixed barbed antler point was recovered. Such artifacts are thought to be distinctive of the Marpole Culture Type (Mitchell 1971a:52). From natural stratum K a fixed barbed bone point was recovered, such tools being distinctive of the Gulf of Georgia Culture Type (Mitchell 1971a:48). Although natural stratum G/O is one of two strata separating G with shell from K, and although the appearance of G/O suggests that it is more likely to share a cultural genesis with G with shell than K, the date from stratum G/O should not be rejected automatically even though this date appears to be too young to indicate affiliation with the Marpole Culture Type (Mitchell 1971a:65). Since both F and G/O belong to granulometric cluster 1, however, it is possible that they also belong together culturally despite the similarity in appearance between G/O and G with shell.

As will be suggested later, there may be a greater continuity of artifact classes between these two culture types than is common in some other sites in the Gulf of Georgia. This cultural continuity may be reflected in the granulometric consistency of strata as well. Consequently, the date may be in line with other dates from components of the

Gulf of Georgia Culture Type. Analysis of artifacts must therefore be awaited before a final pronouncement of the validity of the date is made. Even if G/O is found to belong to such a component, the date must still be suspect because of the amount of matrix accumulation separating it from GaK-6035.

The fourth sample, GaK-6037, was collected from an area 4 x 28 x 5 cm in excavation unit 2. The dated sample weighed 31.6 gm and consisted of large chunks of wood charcoal that appeared to be from a single chunk of wood. The reported date was 1910±110 B.P. The field sample was collected from very near Burial 4, but the precise location of the sample and the apparent intrusion of Burial 4 into earlier strata suggests that this sample predates the burial. The burial comes from natural stratum G with shell, whereas the sample was collected from natural stratum H-1. A few fine rootlets were noticed in the field sample. Otherwise, no contamination of the sample is indicated. Since Burial 4 had a number of grave inclusions distinctive to the Marpole Culture Type (Mitchell 1971a:52), and the sample appears to be uncontaminated, with a date falling around the middle of the time period occupied by the Marpole Culture Type (Mitchell 1971a:65), this date can be regarded with confidence.

The fifth sample is composed of small and medium sized pieces of wood charcoal from an area 50 x 75 x 5 cm. The sample (GaK-6038) showed no evidence of contamination and produced a date of 2630±100 B.P. It was collected from natural stratum T in excavation unit 3, one of the strata that was deposited by tidal action, to judge by the results of the granulometric analysis. Two problems are thus encountered. First, is the charcoal in situ, or was it washed in from elsewhere? Certainly the sample was scattered, possibly by water, but it is impossible to tell whether the fire that produced the charcoal was a man made fire on the spit 2630 years ago or whether the charcoal was produced 2630 years ago at some other location and washed onto the site. Second, the effect on dated wood charcoal of what may be repeated and prolonged contact with sea water and its various contents is little known. In Hawaii it is known that movement of ground water can cause bicarbonate carbon-14 to be exchanged with carbon-14 in samples, especially in the case of shell and bone. This factor will produce spurious dates. Dating discrepancies are also known to occur in samples that are frequently or continuously inundated (Emory and Sinoto 1969:4). Also in the Pacific, shell samples that have been in contact with ocean water since deposition should be suspect because of the changes that occur in the O^{18}/O^{16} ratio and the consequent change in the C^{14}/C^{12} ratio (Shutler 1971:25). Since the exact means by which charcoal sample GaK-6038 was deposited in natural stratum T is not known, the presence or absence of contamination through contact with sea water cannot be determined. In light of the findings in

Oceania, however, caution in the use of these dates seems to be the wisest course.

From the tables of artifacts and faunal remains presented below it will be seen that a single piece of unidentifiable land mammal bone is the only item found in this stratum that could possibly be cultural, apart from the charcoal. There are a number of cultural remains in the overlying natural stratum P, and there are a very few cultural remains in the underlying natural stratum P-1. Although it is evident that the site was occupied before and after the deposition of natural stratum T, the virtual absence of cultural remains must leave open the possibility that the charcoal of GaK-6038 does not have a cultural origin. Because GaK-6038 dates the wood but not necessarily natural stratum T, it is thought best to let the date stand as it is, qualifying its acceptance with the acknowledgement that the actual date at which natural stratum T was laid down may diverge considerably from the one reported here.

The sixth sample (GaK-6039) is from the clay floor feature in excavation unit 4 beneath which no cultural remains were recovered. The sample consisted of small pieces of wood charcoal embedded in the sand and clay feature. The dated sample weighed 38.4 gm and was collected over an area of 2m x 1.60m x 2cm. The date produced was 4860$\pm$180 B.P. No contamination was evident, but again no account can be made for the effect of contact with sea water. The problem of cultural versus non-cultural origin of the charcoal and the problem of whether or not the charcoal has been transported again appear. The floor, composed of a 2 cm thick mixture of highly compacted clay, sand, and gravel, is not unquestionably of cultural origin. On the other hand, it is difficult to explain why such a feature exists in the first place and why all cultural materials are found above it. While it may be a natural feature, and while the charcoal may be both non-cultural and transported from elsewhere, it is the writer's opinion that the charcoal is in situ in a feature that is probably cultural. For the reasons outlined for sample GaK-6038 the date is accepted as is with the appropriate qualifications.

CHAPTER IV

DESCRIPTION OF ARTIFACTS

Introduction

This chapter presents descriptions of historic and aboriginal artifacts. Because the historic artifacts, which are presented first, are peripheral to this study, they will be described in much less detail than the aboriginal artifacts. The classes of aboriginal artifacts follow and are described in considerable detail. Variations in the distributions of various artifact classes are discussed as a prelude to the delineation of cultural components in Chapter VII.

Historic Artifacts

A prodigious number of historic artifacts was recovered from the upper strata on Lots 73 and 81. At the outset of excavations on Lot 73 each historic artifact was written up as an artifact, but it quickly became apparent that to do so was much too time consuming. Subsequently, the procedure was adopted of placing all historic artifacts in their own separate level bags. Below the top of natural stratum F all historic artifacts were again recorded for provenience. All historic artifacts on Lot 81 were placed in level bags. Before recording of historic artifacts on Lot 73 was discontinued a total of 1399 artifacts were recovered in approximately three weeks. Table II summarizes the recorded historic artifacts from Lot 73. This table indicates that nails and miscellaneous metal fragments (mostly tin can fragments) compose almost 70% of all historic artifacts. Metal artifacts in general compose 72% of the historic assemblage. Among these artifacts was a 1922 nickel. Glass artifacts comprise another 12.5% of the assemblage with 3% being bottle glass and 9.5% being pane glass. Fragments of cement add another 5% to the assemblage. A further 4.5% is added by the miscellaneous category which consists of asphalt roofing tile fragments, linoleum fragments, and such other items as half of a pair of scissors. The impression received while the excavation of these materials was in progress was that the remains of a small cabin and its associated debris were being excavated. This impression seems to be borne out by the preceding figures. If this impression is correct, such a cabin could have been part of the community associated with the fish processing plant in the 1920's.

On Lot 73 the vast majority of historic artifacts were found in stratum A with lesser numbers found in lower strata. Strata B and B-1, D, and E all contained substantial numbers of historic artifacts and they have the appearance of being well disturbed, if not imported recently from elsewhere. Natural stratum C, as noted in the section on chronology, does not appear to have been well mixed like the overlying

TABLE II

Raw and Relative Frequencies of Recorded Historic Artifacts, Lot 73, DiSe 7.

Artifacts	Frequency Raw	Frequency Relative
Glass		
bottle glass	42	3.0
pane glass	133	9.5
Metal		
nails	335	24.0
sheet metal	3	0.2
bottle caps	11	0.8
tin foil	20	1.4
tin cans	1	0.1
miscellaneous	638	45.6
Cement	70	5.0
Brick	12	0.9
Ceramics	21	1.5
Plastic	21	1.5
Miscellaneous	63	4.5
Wood		
boards	7	0.5
clothes pegs	22	1.6
N	1399	100.00%

strata, but it does contain 57 historic items. This number is not inconsequential, but compared to the hundreds of items recovered from stratum A it represents a marked reduction in frequency of occurrence of these artifacts. Almost all historic materials from this stratum were collected in separate level bags, so it is impossible to note the exact provenience of each artifact. The thinness of the stratum, its consistency, its undisturbed appearance, and the substantially reduced number of historic artifacts it contains all suggest that the presence of these artifacts may be accounted for better by intrusion of materials rather than by a late post-contact deposition of the whole stratum.

Eight historic artifacts were recovered below the surface of natural stratum F. A clear glass fragment (artifact #944) was recorded from natural stratum F of excavation unit 4. The fragment was found in the extreme northeast corner where the profile indicates that natural stratum A has been disturbed into lower strata. A cement nail, reportedly from natural stratum F, was also found in this corner of the pit. It seems likely that they were mistakenly assigned to natural stratum F, when they are in fact from natural stratum A which intrudes into natural stratum F in this particular location. An unidentified rusty metal fragment was reported from natural stratum K in excavation unit 5. No provenience is available for this artifact, however examination of the north 218 m profile shows a post mold of natural stratum A intruding down through natural stratum K. It is probable that such a disturbance could account for the recovery of a metal artifact in natural stratum K. A clear glass fragment was also reported from natural stratum "G" in excavation unit 4. Although complete provenience is not available for this artifact, the depth below surface measurement indicates that it could have come from the disturbance in the northeast corner where the two artifacts reportedly from natural stratum F were recovered. A rusty nail (artifact #1026) was also reportedly from natural stratum "G" in excavation unit 4. The depth below surface measurement indicates that it also could be from the disturbance in the northeast corner of the excavation unit. Three more rusty nails (artifact #973, 974, and 1020) were reported from natural stratum "G" in excavation unit 5. The depth below surface proveniences available for these artifacts indicate that they are likely to have been found in the post mold visible in the north wall profile. Given that so few historic artifacts were recovered below the surface of natural stratum F, that they are, or are potentially, associated with obvious intrusions of historic strata into prehistoric strata, and that these eight artifacts are reportedly from strata that are as old or older than 790 ± 80 years B.P., there is little reason not to consider them definitely to be intrusions.

The top of stratum F therefore marks the historic horizon, strictly speaking. But the definite possibility of historic material being intruded into stratum C, the "in situ" appearance of this stratum, and the date obtained from the bottom of it all suggest that this horizon and the extent of aboriginal deposits do not coincide. Instead, aboriginal deposits and the historic horizon overlap, the former being at the top of stratum C and the latter being at the bottom. It seems most reasonable to emphasize aboriginal deposits rather than historic horizons, especially since the material may be intruded, and to define the top of stratum C or F, whichever is uppermost, as the boundary between aboriginal and historic occupation.

Aboriginal Artifacts

The following artifact descriptions are based largely on the nomenclature presented by Mitchell (1971a:89-216). The presence of artifact classes at Deep Bay that are not present at Montague Harbour, and the variation in members of a given artifact class between these two sites will require that appropriate modifications be made to the descriptive terminology and that appropriate references be cited. The format of the artifact classification will also be the same as Mitchell (1971a:89-216). The actual format for artifact description will emphasize the class rather than the particular artifacts (cf. Matson 1973:10-22; 1974:110) because the central purpose of this study involves the analysis of classes of tools, not individual tools. Because subsequent analyses will require the grouping of artifacts in differing combinations of classes, the most detailed breakdown of these classes is given in the artifact descriptions and Table III. It is thought wiser to present the smallest possible analytic units first, then, when these units are combined for specific analyses, the exact contents of each new unit is known. The range of dimensions and weights of artifact class members will be given along with references or justification for distinguishing the particular class. Dimensions will be presented in the following format: range of lengths x range of widths x range of thicknesses. Measurements were made to within .1 cm, therefore variations of less than this amount are recorded as a single measurement. Mitchell's (1971a) Archaeology of the Gulf of Georgia area, a natural region and its culture types will be used as the primary reference because the present classification follows his and because his synthesis of references for each artifact class at Montague Harbour is excellent, leading the reader to the range of literature dealing with many specific artifact classes.

TABLE III

Artifact Classes by Excavation Unit and Natural Stratum, Lot 73, DiSe 7.

CHIPPED STONE

Excavation Unit	Natural Stratum	HEAVY DUTY UTILIZED FLAKE	MEDIUM DUTY UTILIZED FLAKE	LIGHT DUTY UTILIZED FLAKE	MICROBLADE	OBSIDIAN FLAKE	QUARTZ CRYSTAL FLAKE	HEAVY DUTY UNIFACIALLY RETOUCHED FLAKE	MEDIUM DUTY UNIFACIALLY RETOUCHED FLAKE	MEDIUM DUTY BIFACIALLY RETOUCHED FLAKE	LIGHT DUTY BIFACIALLY RETOUCHED FLAKE	RETOUCHED SLATE	LIGHT DUTY BIFACE	HEAVY DUTY BIFACE	COBBLE/FLAKE CORE	MICROCORE	UNILATERALLY SHOULDERED POINT BASE FRAG.	BILATERALLY SHOULDERED POINT BASE FRAG.	SIDE NOTCHED POINT BASE FRAG.	FLAT BASE & CONVERGING EDGE POINT BASE FRAG.	POINT TIP FRAG.	BROAD LEAF-SHAPED POINT	PARALLEL EDGE POINT	ASYMMETRIC LEAF-SHAPED POINT	TRIANGULAR STEMMED POINT	TRIANGULAR UNSTEMMED POINT	UNIFACIAL CHOPPER	BIFACIAL CHOPPER
A	1									1																		
A	2																1											
A	3	1												1														
A	4																											
A	5																											
B	1																											
B	2																											
D	1																											
D	2														1													
E	1																											
E	2																											
C	2																											
C	3																											
C	4																											
F	1									1																		
F	2																											
F	3											1			1													
F	4																											
F	5																											
GX	4																											
GX	5																											
I	3											1														1		
I	4																										1	
I	5																											
J	4																											
J	5																											
K	3																											
K	4																										1	
K	5						1																					
M	3																											
M	4																											
M	5																											
N	3														1													
N	4																											
N	5																											
GO	1					1						1																1
GO	2																											
GO	3		1	1		1	2																					
GO	4					3		1	5																			
GO	5					2					1				2													
GS	1											2													1			
GS	2																				1							1
GS	3						3		1	2				1											1			
G2	1															1		1								1		
GD	3																											
H	1																											
H	2	1																										
HI	1																											
HI	2					1	1																					
Q	2														1													
R	1																											
R	2																											
S	2																											
P	1			1		2	5	1	1				1	1	1													
P	2	1	3	3		3	7		2						4		1			1	1		1	1				
P	3			4	1	4	6	2					1						1	2	3		1	1				1
P	4		1			2	1		4	1				2						2		1						
T	2																											
T	4																											
PI	1																											
PI	4						1																					
TI	2																											
P2	2																											

GROUND STONE

Excavation Unit	Natural Stratum	FINE TEXTURE ABRASIVE STONE	MEDIUM TEXTURE ABRASIVE STONE	COARSE TEXTURE ABRASIVE STONE	ABRASIVE STONE/SAW	ABRASIVE STONE/CHIPPED EDGE	SLATE POINT TIPS	SLATE POINT BASE	SLATE POINT MEDIAL FRAG	THIN TRIANGULAR SLATE POINT	THIN CORNER NOTCHED SLATE POINT	THIN BASAL NOTCHED SLATE POINT	THICK SLATE POINT	MEDIUM THICK SLATE KNIFE	THIN SLATE KNIFE	BIFACIALLY BEVELLED SLATE FRAG
A	1															
A	2															
A	3															
A	4			1											1	
A	5															
B	1															
B	2															
D	1	1		1												
D	2	1		1												
E	1															
E	2															
C	2	1														
C	3															
C	4															
F	1	1	1		1										1	
F	2	1														
F	3		1				2									
F	4											1				1
F	5								1							
GX	4														1	
GX	5															
I	3													1		
I	4															
I	5															
J	4															
J	5															
K	3															
K	4	1														
K	5															
M	3															
M	4															
M	5		1													
N	3															
N	4										1					
N	5	1														1
GO	1	1														
GO	2									1						
GO	3			1												1
GO	4										1					
GO	5	1					1									
GS	1							1								
GS	2	1	1	1	1		1						1		1	
GS	3	2					1			1	1					
G2	1															
GD	3									1						
H	1					1										
H	2							1								
HI	1															
HI	2															
Q	2															
R	1															
R	2															
S	2															
P	1		1													
P	2															
P	3															
P	4			1												
T	2															
T	4															
PI	1															
PI	4															
TI	2															
P2	2															

TABLE III (continued)

		GROUND STONE							INCISED STONE	BONE														ANTLER										SHELL					MINERAL		WOOD	COPPER
EXCAVATION UNIT	NATURAL STRATUM	UNIFACIALLY BEVELLED SLATE FRAG.	BIFACIALLY ABRADED SLATE FRAG.	UNIFACIALLY ABRADED SLATE FRAG.	CELT	SAW	PENDANT	SLATE DISC BEAD	INCISED SLATE	SPLIT BONE AWL	HEAVY DUTY BONE POINT	WEDGE BASE BONE POINT	UNILATERALLY BARBED FIXED BONE POINT	ULNA TOOL	BIRD BONE WHISTLE	BONE BIPOINT	WORKED MAMMAL TOOTH	PENDANT	BEAD	CHISEL/WEDGE/GOUGE	WORKED BONE FRAG.	LIGHT DUTY BONE POINT	SEA MAMMAL BONE IMPLEMENT	UNILATERALLY BARBED FIXED ANTLER POINT	ANTLER POINT	ANTLER RING	ANTLER WEDGE	ANTLER FORESHAFT	COMPLETE TINE FLAKER	TOGGLING HARPOON VALVE	ADZED FRAGS.	ABRADED FRAGS.	INCISED FRAGS.	SHELL DISC BEAD	PECTEN SHELL	DENTALIUM SHELL	SHELL RING	*MYTILIS CALIFORNIANUS* CHISEL/GOUGE	OCHRE	MICA	WOOD FRAG.	NATIVE COPPER BEAD
A	1																					1									1		1			1			2			
	2																					3																	1			
	3	1														1											1								1				1			
	4			1							1					4				2	6	5								1									7			
	5															4					2	2					1												5			
B	1									1											2																					
	2															2																							1			
D	1															1														2												
	2																																									
E	1										1					1																										
	2																																									
C	2															2						3				1													2			
	3																				2																					
	4																				1																					
F	1										1			1		4					3	5					1	1			1							1	3			
	2															1					2	1							2										3			
	3				1		1									1						1																	2			
	4		2							2		1				1					1	2				1										1						
	5													1							2	1																				
GX	4			1																	1																					
	5									1																																
I	3																																									
	4																																									
	5									1											1																		1			
J	4																																									
	5																					1	1																1			
K	3																								1												1		1			
	4																																						1			
	5									1			1																		1	1							1			
M	3																				1																					
	4																														1											
	5																														1											
N	3																				1																		1			
	4							1									1			1											1											
	5																																						1			
GO	1									1		1																				1										
	2								1	1										1	4	3								1									1			
	3							1				1									7				1		1												1			
	4				1						1					1					4	1			2		1			2				1					1			
	5								1											1	1																		2			
GS	1															2			1		5	1														1						
	2	1	1		1			2		3	4					3		1			2	2		1										48		12			2	1	1	1
	3	1									1					1				2	1						1			2									2			
G2	1																					1																				
GD	3											1										1																				
H	1												1																										1		1	
	2															1																							1			
HI	1																																									
	2														1																											
Q	2										1																															
R	1										1																															
	2																																									
S	2																																									
P	1																				1																					
	2																																									
	3							1																																		
	4																																									
T	2																																									
	4																																									
P1	1																																									
	4																																									
T1	2																																									
P2	2																																									

TABLE IV

Artifact Classes by Excavation Unit and Natural Stratum, Lot 81, DiSe 7.

NATURAL STRATUM	EXCAVATION UNITS	CHIPPED STONE			GROUND STONE														PECKED STONE	BONE									TEETH		ANTLER				SHELL		MINERAL
		OBSIDIAN FLAKE	QUARTZ CRYSTAL FLAKE	COBBLE/FLAKE CORE	FINE ABRASIVE STONE	CHIPPED ABRASIVE STONE	GROUND SLATE POINT TIP	GROUND SLATE MEDIAL FRAG.	THIN TRIANGULAR GROUND SLATE POINT	CORNER NOTCHED GROUND SLATE POINT	THIN GROUND SLATE KNIFE	UNIFACIALLY BEVELLED GROUND SLATE FRAG.	CELT	PIPE	PENDANT	BEAD	MEDIUM ABRASIVE STONE	COARSE ABRASIVE STONE	BOWL	BIRD BONE AWL	SPLIT BONE AWL	HEAVY DUTY AWL	WEDGE	ULNA BASE BONE POINT	BONE TOOL	BONE BIPOINT	WORKED BEAD	LIGHT DUTY BONE POINT	BEAVER INCISOR	WORKED TOOTH	ANTLER TINE FLAKER	ANTLER COMPOSITE TOGGLING HARPOON VALVE	ADZED ANTLER FRAGS.	ABRADED ANTLER FRAGS.	SHELL DISC BEADS	DENTALIUM	OCHRE
A	1																			1		1	1		4		2	3					1	1			
A	2					1					1	1	1			1	1								4		9	4				2	1			1	2
A	3		1	1			1												1		1		1	1	1	1	5	1				1				1	2
A	4																								1			1							1	1	
B	2								1					1												1	3										
B	3							1			1														2		1				1						
C	2				1																						2		1								
C	3	1	1		1					1					1			1			1							1	1								1
C1	3																																				
C2	3																										1										
D	3																																				
E	3								1								1											1				1					
F	3																	1							1												
F1	3																																				
G	3																																				

STONE

Chipped Stone

A) Bifaces

1. Heavy duty bifaces (Figure 11g-i)

These artifacts are characterized by crude bifacial flaking and a broad lanceolate outline. Flake scars are large and few in relation to surface area. No edge retouch is evident, flakes having the appearance of being removed by percussion. The five class members from Deep Bay are all fragmentary, ranging in weight from 16.6 to 28.6 gm and in dimensions from 4.7 to 8.1 x 2.3 to 3.6 x .9 to 1.3 cm (Mitchell 1971a,Fig.31m).

2. Light duty bifaces (Figure 11j-k)

These are much smaller than heavy duty bifaces but exhibit the same outline, crudeness of flaking, and lack of edge retouch. There are two fragments in this class weighing 3.4 to 4.8 gm and measuring 2.5 to 2.9 x 1.1 to 2.3 x .7 to .9 cm. They appear similar to, but slightly smaller than, the point shown by Mitchell (1971a,Fig.31n). Application of the term "point", "biface", or "knife" to artifacts of this size and shape often depends on criteria selected by the investigator. It is maintained here that "point" and "knife" can imply an undemonstrated function to the class, and, since "knives" and "points" are special bifacial tools, the term "biface" is preferable. Crudeness

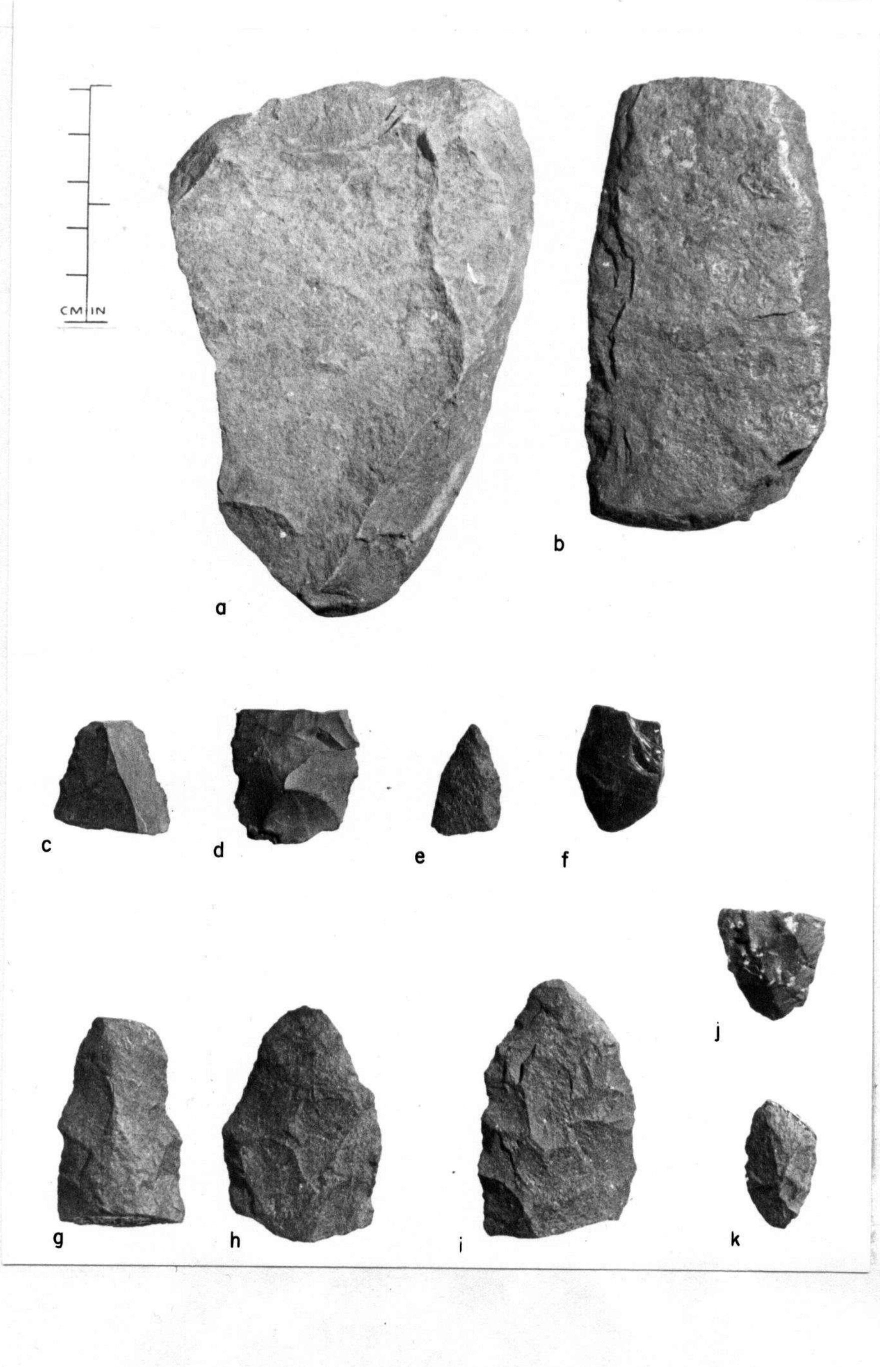

Figure 11. Chipped stone, DiSe 7.
a. heavy duty bifacially retouched flake;
b. heavy duty unifacially retouched flake;
c-d. light duty unifacially retouched flake;
e-f. light duty bifacially retouched flake;
g-i. heavy duty biface;
j-k. light duty biface.

of manufacture should also be a criterion on which to set apart "bifaces" and the potentially more refined "knives" and "points".

B) Points

As just suggested, the finish of these items is more sophisticated than is the case for bifaces. There are more flake scars per surface area than is the case for bifaces, and edge retouch is common. The general shape of points may be similar to bifaces or more elaborate.

1. Base fragments with unilateral shoulder (Figure 12 l-m)

These fragments have a rounded base with a small shoulder apparent on one edge. The two specimens from Deep Bay measure 2.0 x 1.8 x .7 cm and 2.2 x 1.9 x .8 cm and weigh 2.6 gm and 3.6 gm respectively. These specimens most closely resemble Figure 6a in Mitchell (1971b).

2. Base fragments with bilateral shoulder (Figure 12n)

The shoulders are very weakly developed but give the abrupt base a slightly pointed appearance. The specimen from Deep Bay is 2.7 x 2.9 x .8 cm and it weighs 6.2 gm. No satisfactory reference can be made to other similar items.

3. Base fragment, side notched (Figure 12o)

One item of this shape was found. It is similar to the base of a point pictured by Borden (1970,Fig.32v). The Deep Bay specimen measures 2.5 x 2.5 x .7 cm and weighs 5.4 gm.

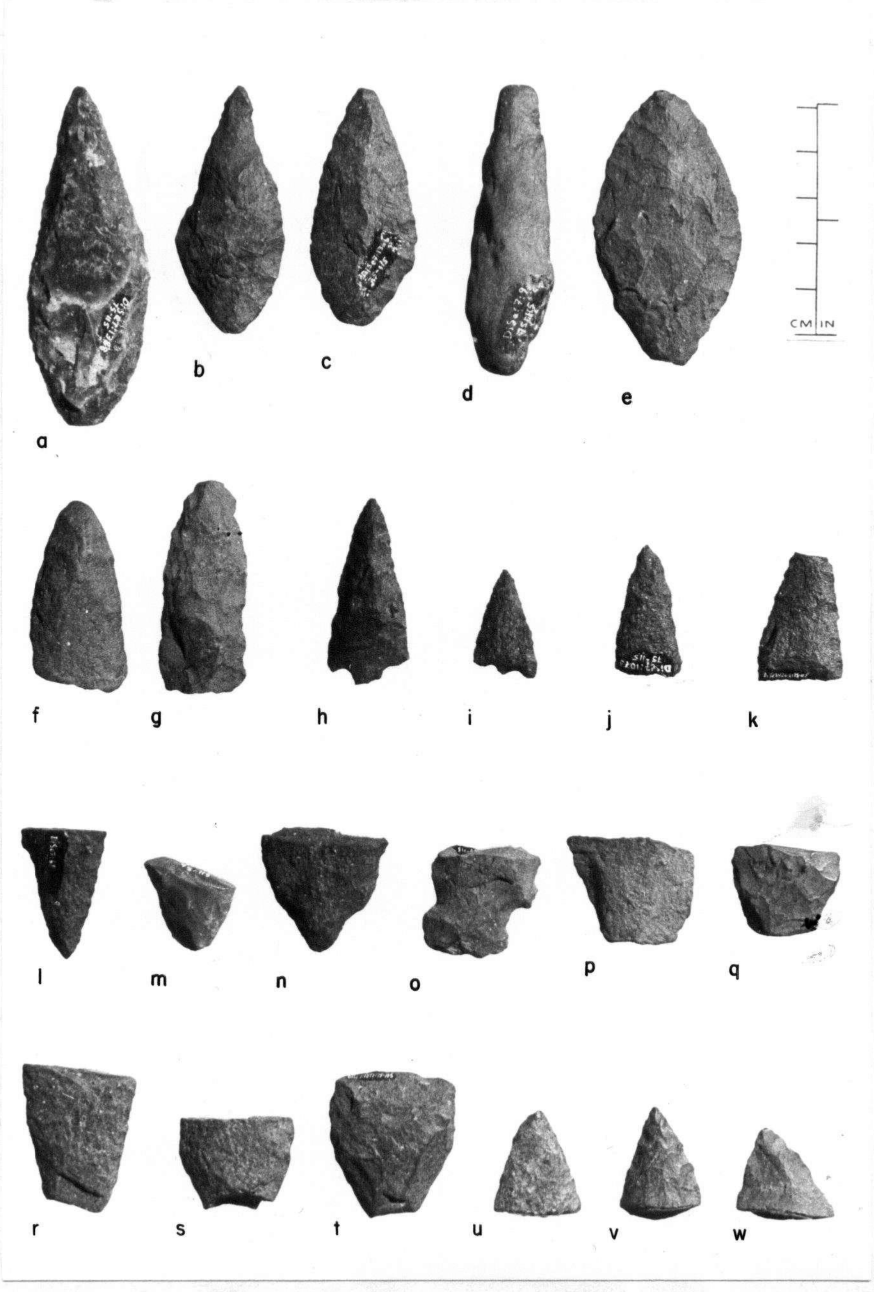

Figure 12. Chipped stone points, DiSe 7.
a-d. leaf-shaped asymmetric;
e. broad leaf-shaped symmetric;
f-g. parallel edged;
h-i. triangular stemmed;
j-k. triangular unstemmed;
l-m. unilaterally shouldered base;
n. bilaterally shouldered base;
o. side-notched;
p-t. flat base;
u-w. tips.

4. <u>Base fragments, flat base with contracting sides</u> (Figure 12p-t)

There are five such items at Deep Bay, ranging in dimensions from 2.1 to 3.2 x 2.4 to 2.9 x .7 to .9 cm and in weight from 4.3 to 9.5 gm. These fragments appear to belong to points with gently excurvate sides and leaf shaped outline. The base is flat and thick, unlike a straight base which has been thinned. Calvert (1970,Fig.19a) pictures an artifact, the base of which appears similar to those described here.

5. <u>Tip fragments</u> (Figure 12u-w)

All items appear to be fragments of well made points of lenticular cross section. The sides of the points appear to have been gently excurvate. Five items from DiSe7 belong to this category. They measure 2.1 to 3.2 x 1.2 to 3.3 x .3 to .9 cm and they weigh 1.0 to 6.7 gm. Tips of the points pictured by Mitchell (1971a,Fig.32a-d,g,l) are similar to the Deep Bay specimens.

6. <u>Points with parallel edges</u> (Figure 12f-g)

These points are narrow relative to their length. Their edges are parallel for a large portion of the length of the point. The bases are rounded. Two specimens, both with tip missing, come from DiSe7. They could have been classed as light duty bifaces, except that there is retouch on both surfaces and along the edges, in contrast to the items classed as bifaces. Similar looking artifacts are shown by Mitchell (1971a,Fig.31o; 1971b,Fig.5o; 1971c,Fig.9e). The point in Figure 5e is much cruder, however, than those described here. Dimensions are 4.0 to 4.7 x 2.0 to 2.1 x .9 cm, weight is 7.7 to 8.7 gm.

7. Leaf shaped points, symmetric with excurvate edges (Figure 12e)

This class of artifact is very broad in relation to its length and the edges are smooth and evenly excurvate with the widest part of the artifact at the midpoint of the long axis. The one speciman from Deep Bay is 6.1 x 3.3 x .9 cm and weighs 18.4 gm. No highly similar point is found in the literature, but if the point shown by Calvert (1970, Fig.19h) were as broad as that shown in Figure 19k (Calvert 1970), a close approximation would be reached.

8. Leaf shaped points, asymmetric edges (Figure 12a-d)

This class of point reaches its maximum width approximately one third of its length from the base. In this regard, the class is similar to that described by Kidd (1969:44). The edges are curved at the proximal end and from the maximum width to the tip they may be either straight or gently excurvate. Four members of this class were found at DiSe7. They measure 5.2 to 7.4 x 2.0 to 2.8 x .8 to 1.0 cm and weigh 9.2 to 20.4 gm. Examples of this class of point are given in Mitchell (1971a,Fig.31g; 1971b,Fig.5h), and McMillan and Ste. Claire (1975,Fig.3a-c).

TABLE V

Dimensions (cm) and Weights (gm) of Leaf Shaped Points with Asymmetric Edges, DiSe 7. Column D presents the distance along the long axis from the base to the point of maximum width.

artifact number	length	width	thickness	weight	D
9	6.4	2.0	0.8	11.6	2.2
1165	5.5	2.5	0.9	9.8	2.2
1361	5.2	2.4	0.8	9.2	1.9
1388	7.4	2.8	1.0	20.4	3.3

9. Triangular points, stemmed (Figure 12h-i)

These points are small and triangular in outline. The edges are straight but the base has a weakly developed projection that can be called a stem although the term is barely justified. The stem may be emphasized by the removal of several small flakes from the junction of the stem and the base, otherwise the base tends to be straight across. The point shown in McMillan and Ste. Claire (Fig.3g) is of the type described here. There were two such points in the Deep Bay collection. They measure 2.3 to 4.1 x 1.4 to 1.5 x 0.5 to 1.0 cm and weigh 1.4 to 4.3 gm.

10. Triangular points, unstemmed (Figure 12j-k)

These points are well described by the artifact class label. They are small, usually with straight edges but the edges can also be slightly excurvate. The base is straight or slightly concave, and it is usually bifacially thinned. Two such points come from DiSe7. They measure 2.8 to 2.9 x 1.5 to 1.9 x .5 cm and weigh 2.0 to 3.3 gm. This class of point is pictured in Mitchell (1971a,Fig.76a-c; Fig.104 a-e), McMillan and Ste. Claire (1975,Fig.3h,i), and Carlson (1970,Fig.35c).

C) Chopping tools

These tools are usually classified as cobble tools, but since several of them are not made on cobbles, the present term was chosen.

1. Unifacial chopping tools (Figure 13a,c)

Unifacial chopping tools are made on beach cobbles that retain a great deal of the original cortex and that are fashioned by the unifacial removal of a few large flakes to form a working edge. Five such artifacts are in the DiSe7 collection. They weigh 509.7 to 1866.1 gm and measure 9.0 to 14.4 x 9.4 to 15.3 x 3.8 to 6.7 cm. The largest specimen (artifact #2) has been heavily pecked on both sides and may also have been used as an anvil. Since it was found on the beach where pecking could be historic, it seems safer to classify this artifact as a chopper than as an anvil. Matson (1973:16) distinguishes this class of tool from other classes of cobble tool, but no pictures are available.

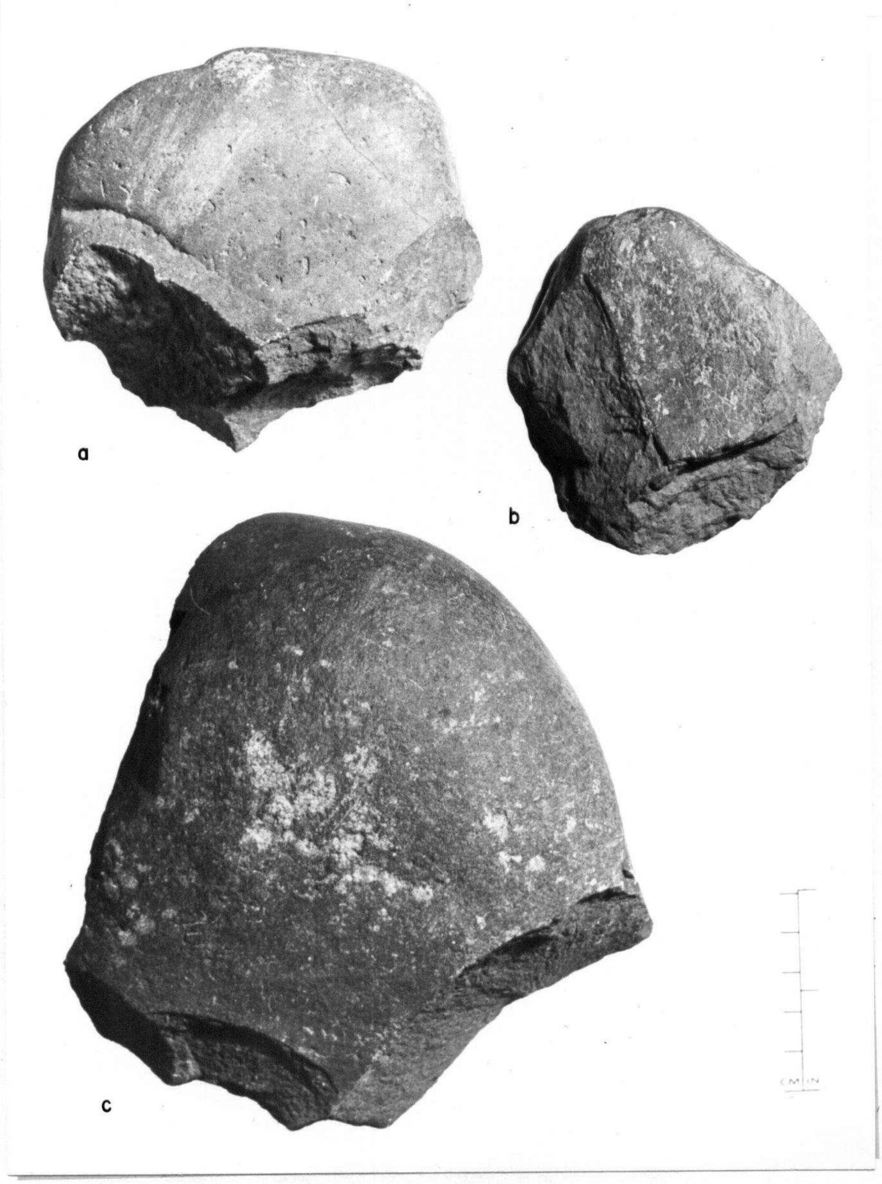

Figure 13. Chopping tools, DiSe 7.
a. unifacial chopper;
b. bifacial chopper;
c. unifacial chopper and anvil.

TABLE VI

Dimensions (cm) and Weights (gm) of Unifacial Chopping Tools, DiSe7. Length = maximum dimension parallel to cutting edge
Width = maximum dimension at right angles to length

artifact number	length	width	thickness	weight
1	10.8	9.4	5.3	712.8
2	14.4	15.3	6.7	1866.1
44	10.1	9.5	4.7	582.1
1063	9.0	12.2	3.8	638.0
1079	11.9	10.7	4.5	509.7

2. Bifacial chopping tools (Figure 13b)

Bifacial chopping tools are also made on cobbles, although heavy flakes can also be members of this class. A few flakes are removed bifacially to produce a working edge. Again, most of the original cortex of the rock remains. Five such tools come from DiSe7. They measure 6.8 to 14.6 x 6.7 to 12.0 x 2.4 to 6.3 cm and weigh 117.2 to 1312.2 gm. Similar implements are described as cobble core implements (Mitchell 1971a:106).

TABLE VII

Dimensions (cm) and Weights (gm) of Bifacial Chopping Tools, DiSe7. Length and width defined as in Table VI.

artifact number	length	width	thickness	weight
4	8.8	12.0	3.1	485.3
133	9.8	8.0	6.0	670.4
961	14.6	10.8	6.3	1312.1
1126	6.8	6.7	2.4	117.2
1421	8.2	8.4	3.7	320.0

D) Cores (Figure 17a,p)

Cores exhibit scars where flakes have been removed. They also show one or more striking platforms that are either natural or prepared. They do not exhibit a working edge in terms of cutting, scraping, or piercing. Fifteen cores that could be called pebble or cobble cores were found at Deep Bay. They range in weight from 22.1 gm to greater than 5 kg and they measure 4.2 to 22.1 x 2.6 to 16.0 x 1.2 to 15.8 cm. Three cores, not included in the above description, deserve special mention. The first is an obsidian core showing the removal of long, uneven flakes using a bipolar technique. The striking platform is at one end of the long axis, and the width and thickness are similar, but considerably less than, the length (2.2 x 1.5 x 1.2 cm, weight 3.5 gm). This core may represent an attempt to prepare a microblade core, given its size, shape, and material, but the flake scars cannot be attributed to the removal of blades. The second core is of quartz crystal measuring 3.2 x 2.0 x 1.6 cm and weighing 9.2 gm. The flake scars on this core are irregular. Probably the quartz crystal flakes described below were removed from cores such as this. The third core is in two fragments that together measure 1.1 x 1.0 x .5 cm and weigh .6 gm. This core is a microblade core with characteristic scars where two small blades have been removed by bipolar flaking. Such cores were also recovered from Argyle Lagoon and Cattle Point East Bluff (Carlson 1960:572, 574).

E) Retouched flakes

Retouched flakes exhibit a varying number of flake scars on their dorsal surface, but the ventral surface is a single flake scar except where edge retouch has occurred. These flakes can be sorted on the basis of whether edge retouch has been unifacial or bifacial. This distinction is made by Matson (1973:12-15), and it is also made, in part, by Fladmark (1970:24-28, 31) who chooses to group bifacially retouched flakes with bifaces. The former author treats retouched flakes on the basis of flake size and edge angle; the latter author places primary emphasis on the shape of the retouched edge. For the present purposes, the longest dimension of the flake has been used to group retouched flakes

TABLE VIII

Dimensions (cm) and Weights (gm) of Cores, DiSe7. Length = maximum dimension; width = right angle to length on the same plane.

artifact number	length	width	thickness	weight
6	6.6	4.9	2.4	142.2
41	5.3	2.4	3.2	61.2
118	10.0	5.9	3.3	353.7
122	10.2	8.0	5.4	702.3
128	9.0	7.6	6.4	714.5
134	9.3	9.0	7.3	1078.3
955	20.8	13.2	7.0	1746.8
999	4.2	2.7	1.2	22.1
1139	8.3	4.5	3.5	190.6
1175	2.3	1.5	1.2	3.5
1197	4.3	4.0	2.6	49.1
1258	1.1	1.0	0.5	0.6
1318	8.2	2.6	1.9	95.2
1357	11.9	10.0	6.7	896.6
1376	3.2	2.0	1.6	9.2
1389	13.1	10.0	6.0	1128.6
1426	14.2	11.6	9.4	2426.3
1429	13.9	8.6	7.6	1442.1
1441	22.1	16.0	15.8	>5000.0

into heavy duty, medium duty, and light duty classes. The class boundaries are: heavy duty, greater than 5 cm; medium duty, less than 5 cm but greater than 2 cm; light duty, smaller than 2 cm. These boundaries quite closely reflect breaks in the frequency distribution of long axes of these flakes from Deep Bay. While thickness could also be a measure of how heavy or light duty a flake was, a case could also be made for developing some index to express more of the length, width, thickness, and weight of each flake. Unfortunately, such indices are difficult to relate to a three-dimensional object. Because the object of this paper is to establish reasonable analytic units rather than establish the superiority of one method of classification, the use of the largest dimension of a flake to establish whether it is a member of one class or not seems justified. Retouched slate flakes are included with basalt flakes even though slate may be less "heavy duty" than basalt for any given size. It seems more sensible to include the slate flakes than to set up a separate class for them only on the basis of material.

1. Unifacially retouched flakes

Heavy duty (Figure 11b)

There are four members of this class from DiSe7. They measure 5.6 to 10.0 x 5.4 to 7.4 x 1.2 to 2.4 cm and weigh 76.8 to 203.3 gm. The working edges vary in form from concave to convex, but extreme curvature is not present.

Medium duty

Sixteen members of this class come from Deep Bay and the shape of their cutting edge varies considerably. They measure 2.4 to 4.6 x 1.3 to 3.7 x .2 to 1.2 cm and weigh .8 to 19.5 gm. One of these flakes (artifact #1169) is quartz crystal. The rest are basalt.

2. Bifacially retouched flakes

Heavy duty (Figure 11a)

One basalt flake measuring 11.9 x 8.1 x 1.4 cm and weighing 181.2 gm and one slate flake measuring 6.5 x 3.1 x .3 cm and weighing 7.1 gm belong to this class. On both implements the cutting edge is straight.

Medium duty

Nine flakes belong to this class. Their edges vary from straight to convex, their measurements are 2.7 to 4.8 x 1.3 to 3.4 x .3 to .8 cm and their weight is 1.1 to 11.0 gm. Four flakes are basalt, one is waterworn obsidian, and four are slate.

Light duty (Figure 11e-f)

One flake (artifact #1242) belongs to this class. It is 1.8 x 1.2 x .4 cm, weighs .7 gm, and is made of basalt.

TABLE IX

Dimensions (cm) and Weights (gm) of Medium Duty Unifacially Retouched Flakes, DiSe7. Length = maximum dimension; width = right angle to maximum dimension.

artifact number	length	width	thickness	weight
40	2.5	2.5	0.2	5.1
50	2.9	2.6	1.2	14.3
1118	4.1	3.5	1.1	16.5
1121	3.0	1.3	0.3	0.8
1169	2.6	1.5	0.3	0.9
1179	3.2	3.2	0.8	9.2
1182	3.2	1.9	0.5	3.3
1189	3.1	2.3	0.6	3.1
1293	2.4	2.2	0.9	5.6
1297	3.4	1.8	0.5	2.5
1323	4.2	3.7	1.2	19.5
1335	2.9	2.8	0.9	6.3
1394	4.6	3.0	0.9	19.1
1371	2.9	1.5	0.3	1.2
1401	3.7	2.5	0.6	5.3
1422	2.4	1.3	0.3	0.8

TABLE X

Dimensions (cm) and Weights (gm) of Medium Duty Bifacially Retouched Flakes, DiSe7. Length = maximum dimension.

artifact number	length	width	thickness	weight
947	2.4	1.5	0.5	1.7
1233	2.5	1.3	0.4	1.1
1256	2.5	2.3	0.5	8.6
1292	2.6	2.0	0.6	3.2
1306	4.1	1.6	0.8	7.1

F) Utilized flakes

These flakes show evidence of use through the removal of very small flakes along an edge that is naturally thin. The flakes removed from the presumed working edge do not exhibit the same pattern of removal as purposeful retouch. Instead, they appear more random in terms of their location and the side from which they are removed. The heavy duty, medium duty, and light duty criterion is applied here as well.

Heavy duty

One such flake was found. Made of basalt, it weighs 176.0 gm and measures 7.7 x 6.9 x 2.7 cm. It was found on the beach in a waterworn condition.

Medium duty

Of the six artifacts in this class, four are basalt and two are obsidian. They measure 2.1 to 4.3 x 1.1 to 3.3

x .4 to 1.0 cm and weigh 1.0 to 10.2 gm. Use is evident only on one edge of these artifacts. Their edges tend to be straight or slightly convex.

TABLE XI

Dimensions (cm) and Weights (gm) of Medium Duty Utilized Flakes, DiSe7. Length = maximum dimension.

artifact number	length	width	thickness	weight
39	3.9	2.5	0.1	4.3
1164	4.4	3.3	1.0	10.2
1291	3.2	3.1	0.5	5.1
1360	2.1	1.5	0.8	1.4
1372	2.4	1.1	0.4	1.0
1415	3.4	2.4	0.6	5.5

Light duty

All nine artifacts in this class are obsidian. Their cutting edges tend to be straight or slightly convex. The thinness of these flakes makes it possible for more than one utilized edge to appear on a single flake. They measure .7 to 1.6 x .4 to 1.1 x .1 to .4 cm and they weigh .1 to .4 gm.

TABLE XII

Dimensions (cm) and Weights (gm) of Light Duty Utilized Flakes, DiSe7. Length = maximum dimension.

artifact number	length	width	thickness	weight
1298	1.3	1.1	0.2	0.1
1332	1.2	0.4	0.4	0.4
1344	1.2	0.5	0.4	0.2
1345	1.6	0.8	0.3	0.2
1349	1.4	1.0	0.3	0.2
1350	0.8	0.7	0.2	0.1
1386	1.0	0.6	0.4	0.1
1396	1.5	0.4	0.4	0.3
1427	1.5	0.4	0.2	0.2

G) Microblades

One medial fragment of what appears to be an obsidian microblade was found. It measures 1.0 x .6 x .2 cm and weighs .1 gm. It exhibits the customary trapezoidal cross section and parallel edges of microblades, but the ridges on the dorsal surface appear to converge gently toward what would be the distal end. Given its appearance and raw material, the classification of this artifact as a microblade seems warranted. The distribution of microblades is discussed by Mitchell (1968b, 1971a:97, 99).

H) Obsidian flakes

Twenty irregular, small flakes showing no evidence of utilization belong to this class. They are designated as artifacts because the raw material is not readily available at Deep Bay. This suggests importation from a more distant location. These flakes measure .5 to 2.7 x .2 to 1.7 x .1 to .7 cm and weigh less than .1 to 2.2 gm.

I) Quartz crystal flakes

The description of this artifact is the same as that for obsidian flakes and has been included for the same reason. There are twenty-nine of these flakes, measuring .9 to 2.8 x .4 to 2.2 x .1 to 1.3 cm and weighing less than .1 to 5.2 gm. Large quantities of obsidian and quartz crystal detritus are also reported at Shoemaker Bay (McMillan and Ste. Claire 1975:40) and from Cattle Point (Carlson 1960: 574).

Ground Stone

A) Abrasive stones

Abrasive stones are characterized by an area, on at least one surface, that is relatively smoother than the surrounding surface or that otherwise indicates use by abrasion. These artifacts are almost always of sandstone, the texture of which shows considerable variation. A stylistic classification of such artifacts is presented by Mitchell (1971a,Table XVI), but, since the emphasis of this study is directed more toward function than toward style, grain texture of the rock will be used to classify abrasive stones. This approach has been implied in Matson (1973:20). Estimation of grain texture is subjective and is only in relation to other abrasive stones in the DiSe7 collection. Although intensity of use may affect the evaluation of grain texture, nevertheless, the finer the grain the smoother the working surface. The abrasive stones have been grouped into coarse, medium, and fine texture classes. (See Table XIII).

1. Coarse texture abrasive stones

These artifacts have a grain texture that retains each piece of sand as a physically separate entity, the whole being cemented together by finer material that is often abraded more quickly than the sand grains. This texture of abrasive stone would leave distinct, deep striations in an abraded implement. There are eight such items from Deep Bay, measuring 5.5 to 39.1 x 3.5 to 22.9 x 1.4 to 8.8 cm and weighing 39.4 gm to more than 5 kg. The form of these artifacts varies, most appearing to be fragmentary. The largest abrasive stone is an egg shaped sandstone cobble with a utilized dorsal surface.

TABLE XIII

Dimensions (cm) and Weights (gm) of Apparently Complete Abrasive Stones, DiSe7. Length = maximum dimension.

artifact number	length	width	thickness	weight
coarse				
956	12.4	5.8	2.7	237.6
1038	13.0	8.6	1.8	345.4
1114	18.1	5.7	3.2	607.7
1474	39.5	23.0	8.5	5000.0
medium				
132	14.4	7.3	5.4	928.8
943	10.4	9.2	2.1	293.9
1049	13.8	9.5	1.9	397.3
1423	9.1	6.9	7.9	89.8
1458	12.0	11.4	2.0	358.6
fine				
46	22.0	16.5	2.3	1149.8
998	15.1	7.9	2.4	472.1
1076	4.9	4.4	0.6	19.3
1515	13.7	8.1	2.1	363.0

2. Medium texture abrasive stones

The texture of these artifacts is finer than that of the first group. The grains are smaller and more closely spaced, although they still retain the appearance of being individual sand grains. The faster removal of cementing material is not evident in this class. Objects abraded on this class of stone would exhibit fine, closely spaced striations. There are ten such artifacts at Deep Bay, measuring 4.0 to 17.5 x 2.5 to 13.0 x .7 to 7.8 cm and weighing 10.2 to 928.8 gm. Several of these artifacts show bifacial abrasion, and several also exhibit slight edge wear.

3. Fine texture abrasive stones (Figure 14b)

The largest number of abrasive stones, seventeen, falls into this class. The texture results from fine sand grains that are very compacted. The working surface is extremely smooth, and an artifact abraded on such a stone would show a flattened surface whose striations would be invisible to the naked eye. Within this class, fall the grooved and shaped abrasive stones. The Deep Bay artifacts in this class measure 2.4 to 15.8 x 1.4 to 16.0 x .6 to 6.0 cm and weigh 19.3 to 1600.2 gm.

B) Abrasive stone/saw (Figure 14a)

Three artifacts belong to this class. They show characteristic abrasive stone usage on one or both surfaces, but in addition they show bifacial abrasion along a sharp, straight edge that contracts evenly from both sides. These artifacts measure 9.0 to 19.5 x 7.8 to 10.2 x 1.1 to 5.6 cm and weigh 104.8 to 1268.2 gm. The largest is coarse textured. The other two are medium textured. This class of artifact is also known from Shoemaker Bay (McMillan and Ste. Claire 1975:44).

C) Abrasive stone with edge retouch (Figure 14c-d)

These artifacts are classed as sandstone knives and grouped with chipped slate artifacts by Mitchell (1971a,

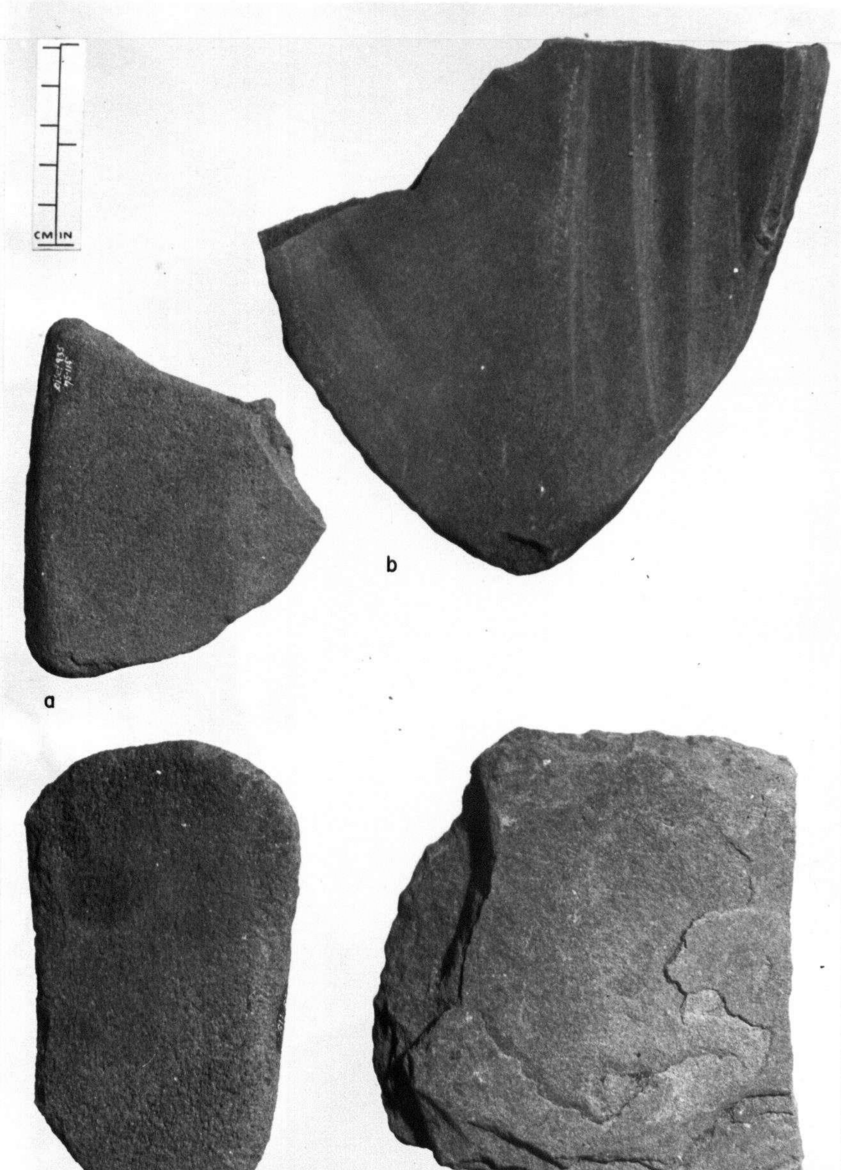

Figure 14. Abrasive stones, DiSe 7.
a. abrasive stone/saw;
b. fine textured abrasive stone;
c-d. edge retouched abrasive stone.

Table XVI). They are discussed separately here because it is clear that the Montague Harbour sandstone items are not abraded on either surface (Mitchell 1971a:102), and because the chipped and ground slate items from Deep Bay were clearly not used for the same purposes as the edge retouched abrasive stones. Two artifacts of this class were found, measuring 11.8 to 12.2 x 7.2 to 10.9 x 1.6 to 1.7 cm and weighing 185.7 to 320.7 gm. On one implement the retouch is unifacial and is confined to one straight edge; the other implement is bifacially retouched on three out of four edges.

D) Chipped and ground stone

These two fragments are difficult to classify on a functional basis. One (artifact #119) is a basalt chunk abraded roughly on one surface and bifacially retouched on a convex edge. It is unlike an abrasive stone with edge retouch because of the different material and because it is abraded rather than abrasive. It could be part of a heavy duty bifacially retouched flake that has been abraded on both sides. It weighs 69.2 gm and measures 5.2 x 4.4 x 1.9 cm. The other member of this class is made of slate. It is thin and it has bifacial retouch on four edges. Both sides are abraded, and one side also has a fine incision diagonally across it as if it had been sawn. It weighs 3.6 gm and measures 4.1 x 2.3 x .3 cm.

E) Points

In the Deep Bay collection ground stone points are all of slate. The classification of these points closely follows Mitchell (1971a), although fragments of such points will be treated differently. It is customary simply to group fragments together in a "miscellaneous point fragments" class, but information on thickness, edge shape, and base form is lost this way. The procedure followed in this study is to separate tip, medial, and base fragments from points that are sufficiently whole so as to be treated as entire.

1. Tip fragments (Figure 15n-q,s)

These class members consist of distal fragments of thin ground slate points. They exhibit the characteristic thin, flat cross section with bifacially bevelled edges. Because of the short edge presented on these fragments and because the base is lacking, they cannot be assigned to a specific class of point. There are seven such fragments, measuring 2.1 to 4.5 x .8 to 2.4 x .1 to .3 cm and weighing .3 to 2.8 gm.

2. Medial fragments (Figure 15r)

These fragments lack proximal or distal ends. All are of the thin ground slate point configuration with straight or slightly convex edges. There are three of these fragments, measuring 3.4 to 3.9 x 1.4 to 2.9 x .2 to .3 cm and weighing 1.8 to 4.5 gm.

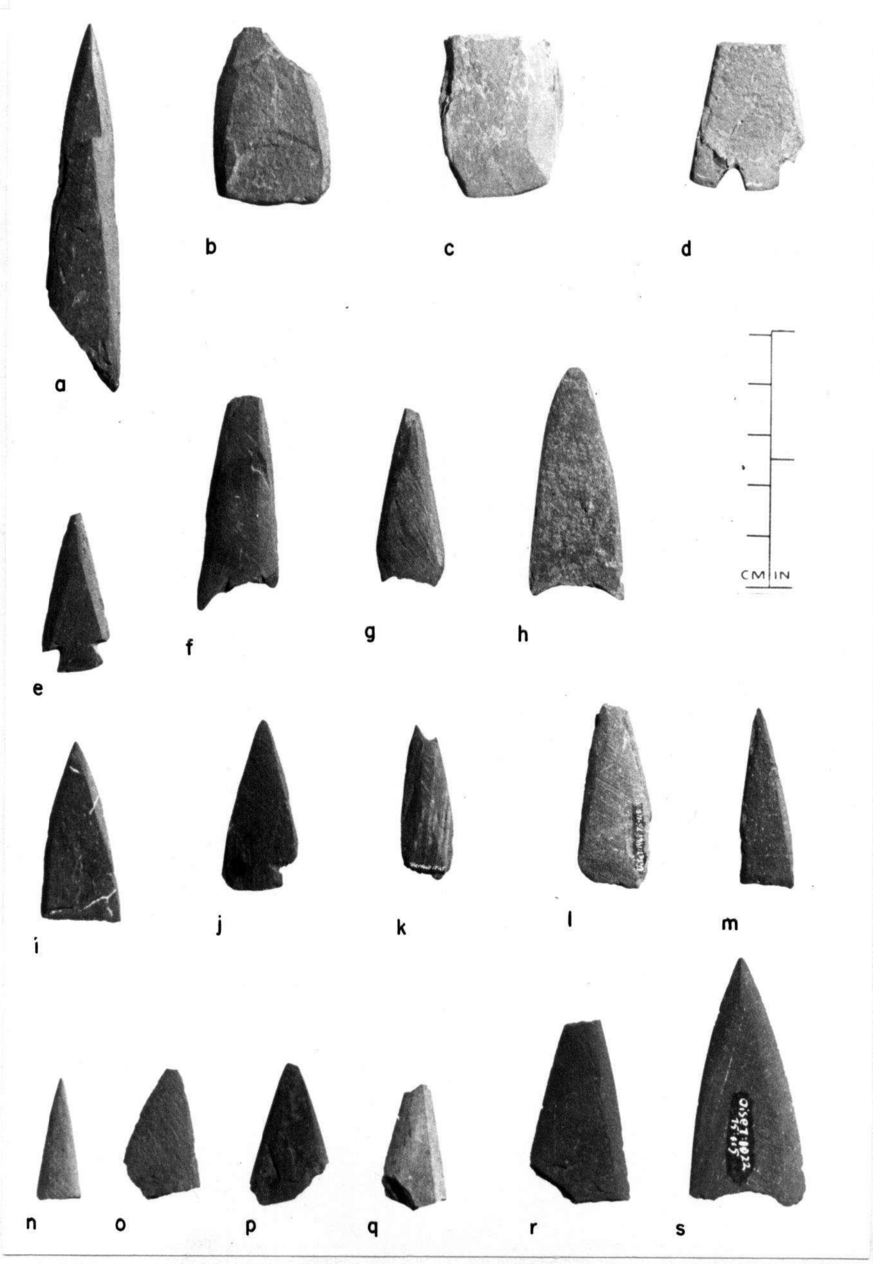

Figure 15. Ground stone points, DiSe 7.
a. thick;
b-c. thick basal fragments;
d. basal notched;
e-h. corner notched;
i-m. thin triangular;
n-q,s. tip fragments;
r. medial fragment.

3. Basal fragments (Figure 15b-c)

This class exhibits little of the edge of the former artifact and nothing of the tip. The base form of the two members of this class is unfinished in one case and bifacially bevelled in the other. Both fragments are from large points that were thicker than the previously described fragments and that appear to have been more parallel sided than the thinner fragments. The bases in question measure 3.3 to 3.6 x 2.4 to 2.6 x .3 to .5 cm and weigh 3.7 to 5.9 gm. No satisfactory picture or description of these points can be found in the literature, although these basal fragments are approximated in Mitchell (1971a,Fig.91) and Borden (1970,Fig.30ii) and are probably parts of thick ground slate points.

4. Triangular ground slate points (Figure 15i-m)

These points are short and relatively broad with a thin, flat cross section and bifacially bevelled edges. Often the base is thinned more or less abruptly. Bases and edges are usually straight. Five members of this class are found at Deep Bay. They measure 3.1 to 3.7 x 1.1 to 1.7 x .1 to .3 cm and weigh 1.1 to 2.7 gm. Such artifacts are described by Mitchell (1971a:189).

TABLE XIV

Dimensions (cm) and Weights (gm) of Triangular Ground Slate Points, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
1054	3.7	1.1	0.2	1.0
1263	3.4	1.6	0.1	1.2
1267	(3.1)	1.1	0.2	1.1
1411	3.6	1.7	0.2	1.6
1468	3.7	(1.5)	0.3	2.7

5. Corner notched ground slate points (Figure 15e-h)

This class is characterized by an elongated triangular shape with straight to slightly convex edges, a thin, flat cross section, and a bifacial bevel on the edges. An acute angled notch has been abraded into the corners of these points, producing an acute angled shoulder and an expanding base. The narrowness of the base where it joins the body of the point weakens the point, often resulting in breakage. Many of these points are found without bases. Four of these artifacts were found at Deep Bay, measuring 3.1 to 4.6 x 1.4 to 1.9 x 0.2 to 0.3 cm and weighing 1.3 to 2.6 gm. Similar points are described by Mitchell (1971b,Fig.9j), McMillan and Ste. Claire (1975,Fig.5d), and Smith (1907,Fig.102b), and were recovered at Saltery Bay (Monks, in preparation). Points similar to these, but side notched instead of corner notched, are reported from Belcarra Park (Charlton 1972,

Fig.50c), Buckley Bay (Mitchell 1973,Fig.21f), and Helen Point (Carlson 1970,Fig.36o).

TABLE XV

Dimensions (cm) and Weights (gm) of Corner Notched Ground Slate Points, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
1155	3.1	1.4	0.2	1.3
1163	(3.5)	1.4	0.3	1.7
1239	(4.4)	1.6	0.2	2.3
1404	(4.6)	2.0	0.2	2.6

6. Basally notched ground slate points (Figure 15d)

There is one such point with a missing tip. The point is broad and thin with flat surfaces and bifacially bevelled edges. The overall form appears to have been triangular. The semi-circular notches abraded into the base isolate a stem that is roughly flush with the shoulders. The specimen measures 3.0 x 2.2 x 0.2 cm and weighs 2.2 gm. Illustrations or descriptions of similar points are not found in the local literature.

7. Thick ground slate point fragments (Figure 15a)

This class of point is well known in the Gulf of Georgia (Borden 1970:98, Fig.30hh-jj; Mitchell 1971a:57). Edge and base form varies within the class (Mitchell 1971a:109, Fig.45d, e,g,k,l,m) but the thick hexagonal faceted cross section is distinctive. The artifact from Deep Bay is very narrow, relative to its length, and is only slightly convex along the edges. The base is missing. It measures 7.3 x 1.6 x .4 cm and weighs 4.6 gm.

F) Ground slate knives

This class of artifact is also well known in the Gulf of Georgia area. Members of the class have a working edge that is straight to convex and that has been sharpened by abrasion. The converging sides can be either convex or bevelled in cross section. Variations in thickness of these knives may indicate temporal distinction, as may the amount of abrasion on both surfaces (Mitchell 1971a:48, 52, 57).

1. Thick ground slate knives (Figure 16f)

These two fragments are .6 to .7 cm thick and both are completely abraded on both surfaces. Their length and width vary from 3.9 to 8.9 x 2.3 to 6.8 cm and their weights are 6.7 to 42.6 gm. These two items are thicker and more completely abraded than that described by Mitchell (1971a:113).

2. Thin ground slate knives (Figure 16d,g-h)

This class is the commoner one at Deep Bay. Its eleven members are .3 to .4 cm thick and they have parallel surfaces. All but one are abraded over their entire surface and nine are fragmentary. They measure 3.6 to 12.0 x 2.2 to 7.3 cm and

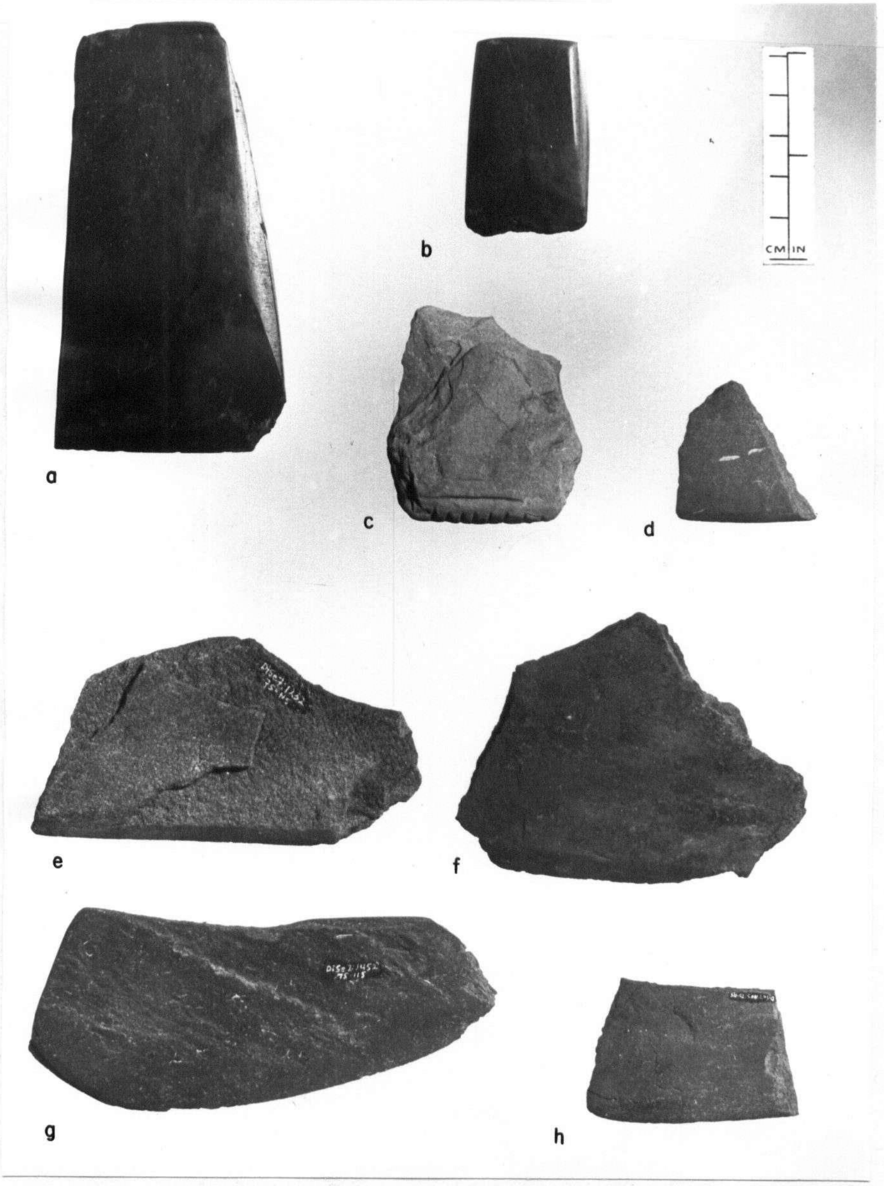

Figure 16. Ground slate knives and celts, DiSe 7.
a-b. celt;
c. decorated slate;
d,g-h. thin ground slate knife fragment;
e. saw;
f. medium thick ground slate knife.

weigh 2.0 to 32.6 gm. Mitchell (1971a:191, Table XLII, Fig.108) describes this class, and Barnett (1975:62) indicates that members of this class were used as fish knives. The two complete members of this class, artifacts #8 and #1452, measure 11.3 x 5.4 x 0.4 cm and 12.0 x 4.9 x 0.4 cm and weigh 32.6 gm and 31.8 gm respectively.

G) Ground slate fragments

It is customary to class all ground slate fragments together under "miscellaneous ground slate" if they are not subsumed in a point fragment or knife fragment class, but here they are subdivided so as to use more of the information they can provide. In examining ground slate fragments that are not clearly members of any specific artifact class, four attributes always exist, separately or together, that can be used to subdivide them.

1. Bifacially bevelled ground slate fragments

These fragments are abruptly bevelled at an edge, they are thin, and they have parallel sides. The sides are usually completely worked, and the fragments are usually thin. These fragments could be from either thin knives or points, but their smallness makes their assignment to either class impossible. There are five fragments of this class from Deep Bay. They measure 1.2 to 2.7 x 1.2 to 2.0 x 0.1 to 0.3 cm and weigh 0.2 to 2.4 gm.

2. Unifacially bevelled ground slate fragments

These fragments are also thin with parallel surfaces but the bevel is only unifacial. Both surfaces are usually abraded. There are five of these artifacts at DiSe7, measuring 1.4 to 4.2 x .8 to 2.5 x .1 to .3 cm and weighing .3 to 4.8 gm.

3. Bifacially abraded ground slate fragments

This class of artifact shows no edge abrasion but is ground on both surfaces. These surfaces are parallel and the fragments are thin. Two are from Deep Bay; they measure 3.8 to 3.9 x 2.2 to 2.4 x .2 to .3 cm. These fragments, like the bifacially bevelled fragments, are probably parts of thin ground slate points or knives but no diagnostic features allow them to be placed in either category.

4. Unifacially abraded ground slate fragments

No edge abrasion is evident on this class of artifact either and, in addition, only one surface has been abraded. Although there are only three artifacts in this class from Deep Bay, they appear to be slightly thinner than the thin ground slate artifacts and bifacially abraded fragments. This, coupled with the lack of surficial abrasion on the three members of this class, suggests that they may have been parts of the surface of other ground slate tools at one time. They measure 2.3 to 3.0 x 1.4 to 2.3 x .1 to .2 cm and weigh .4 to 2.0 gm.

H) Miscellaneous ground slate (Figure 16c)

This fragment is ground on both surfaces, and the surface along one edge has been worked to produce a longitudinal incision from which shorter incisions produce an edge that gives the appearance of having broad serrations on it. The fragment is of silver slate. It measures 5.3 x 4.9 x .8 cm and it weighs 30.0 gm.

I) Celt (Figure 16a-b)

This class of artifact is characterized by having a poll that is usually flat and rectangular to sub-rectangular in transverse cross section, a bit that is usually straight and that may converge symmetrically or asymmetrically from each surface, and edges and surfaces that can be partly or completely polished. Members of this class are usually made of jade or nephrite, and one edge often shows where the artifact has been sawn from a larger piece of rock. The size, shape, and cross section of celts varies considerably, but since only three are represented from Deep Bay, no attempt will be made to subdivide them.

Of the three specimens one is represented only by a fragment, but the other two are complete. The fragment is of coarse grained nephrite with polish on part of a surface and an edge. It measures 4.7 x 2.8 x .9 cm and weighs 15.4 gm. One of the complete celts is small, rectangular in cross section, and quite thick. It is made of nephrite. The surfaces converge symmetrically to the bit, which is damaged. It measures 4.8 x 3.1 x 1.3 cm and weighs 39.7 gm. It is similar in plan view and in dimensions to the one described by Mitchell (1971a:113, Fig.45a, Fig.46a) but in longitudinal cross section the Deep Bay specimen has parallel surfaces and more even convergence at the bit. It was found associated with Burial 5. The third celt is also made of nephrite and is quite large, measuring 10.6 x 5.7 x 1.3 cm and weighing 149.6 gm. It has a flattened, sub-rectangular transverse cross section, the edges diverge from the poll to the bit, and the surfaces converge asymmetrically to the bit. A similar celt is pictured by Borden (1970,Fig.33dd). This celt was associated with Burial 4.

J) Saw (Figure 16e)

This class of tool is characterized by a straight edge that has a convex or bifacially bevelled cross section. The edge is slightly dulled, and, along with the convex or bevelled area adjacent to the edge, is formed by longitudinal abrasion. Usually the other surfaces of such artifacts are not abraded. They are often made of sandstone. Two fragments of this class were found at Deep Bay. In both instances the surfaces of the artifacts are roughly parallel and the artifacts are not unusually thick, considering that they are made of sandstone. They measure 8.2 to 9.9 x 4.3 to 5.1 x .7

to .9 cm and they weigh 32.6 to 60.4 gm. Artifacts recognizable as being only saws are made on slabs that are recognizable as abrasive stones (Mitchell 1971a:196, Fig. 115b; McMillan and Ste. Claire 1975:44).

K) Stone disc beads (Figure 17i-l)

These beads are small, flat, and circular with a perforation that has been biconically drilled from each surface. They can be made using a variety of stone types, but the ones from DiSe7 appear to be of fine grained sandstone and schist. They are of similar size and shape as shell disc beads. There are eight specimens from Deep Bay. They measure .5 to .6 cm in diameter and .1 to .3 cm in thickness and they weigh .1 gm or less.

L) Pendant (Figure 17b-c)

This class of artifact is any ground stone object that appears to have been suspended as decoration. Two such items were found. One is highly polished and convex longitudinally as well as transversely, but the thickness is relatively constant throughout. It is roughly triangular with a rounded knob at the top. It was found with Burial 1 and it appears to be made of black nephrite or steatite. It measures 3.6 x 1.7 x .4 cm and it weighs 2.3 gm. A pendant similar only in outline was recovered from the Grant Anchorage Site (Simonsen 1973:42). The pendant described by McMillan and

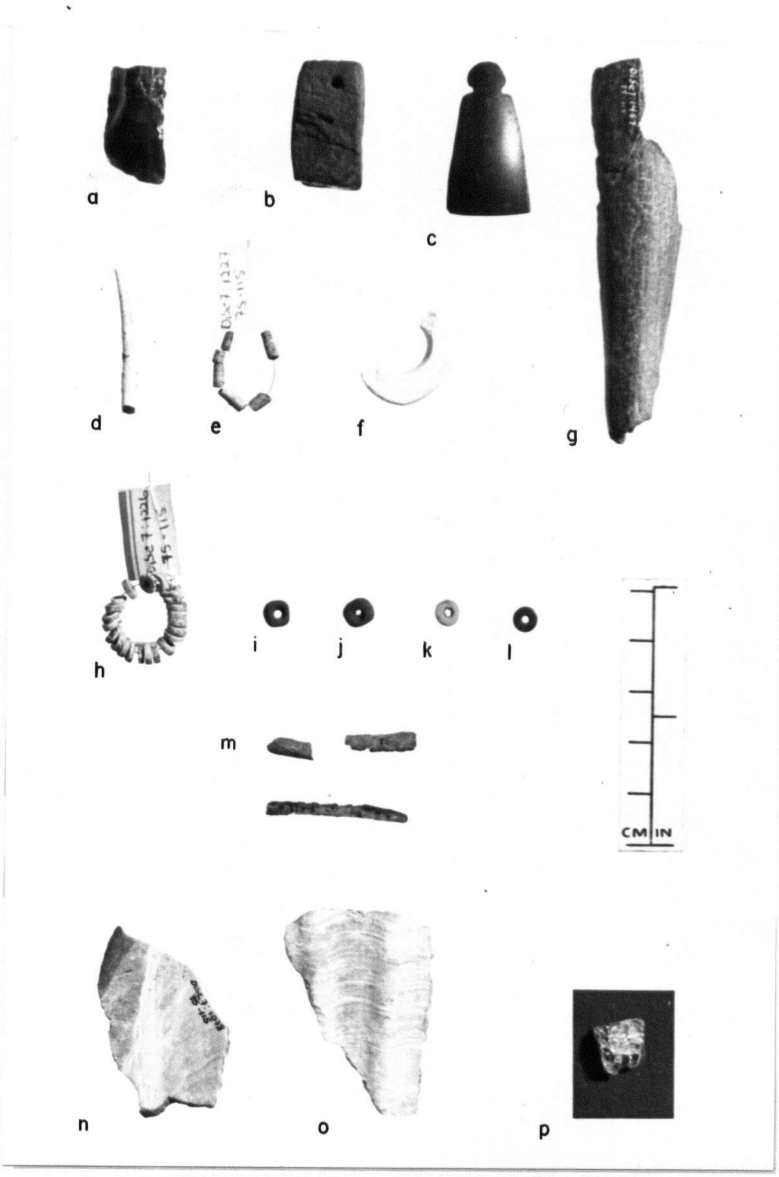

Figure 17. Miscellaneous artifacts, DiSe 7.
a. obsidian core;
b-c. stone pendant;
d-e. dentalia shells;
f. shell ring fragment;
g. stone pipe fragment;
h. shell disc beads;
i-l. stone disc beads;
m. copper fragments;
n. <u>Mytilus californianus</u> shell celt;
o. pecten shell fragment;
p. quartz crystal microblade core fragments.

Ste. Claire (1975:43) also sounds similar to the Deep Bay specimen. The other pendant is rectangular in plan, elevation, and cross section. Two perforations at right angles to one another near the junction of one end and a side of the artifact were probably intended to meet and form the means by which this object could be suspended. The object is crudely abraded and gives the appearance of being unfinished. It is made of coal, measures 2.4 x 1.4 x .4 cm, and weighs 4.4 gm. Gulf Island Complex items of lignite are reported from Montague Harbour (Mitchell 1971a:115, 117) and coal artifacts are also reported from Buckley Bay (Mitchell 1973:91), and from Shoemaker Bay (McMillan and Ste. Claire 1975:43-44).

M) Pipe (Figure 17g)

This class of artifact is an elongated conical piece of stone that is perforated longitudinally and that has an expansion of the perforation at the base of the cone to accomodate the material being smoked. Two fragments of a pipe were found at DiSe7. It is made of silver slate that is coarsely abraded on the exterior surface. It measures 7.4 x 1.7 x .8 cm and weighs 8.5 gm. Few pipes are reported in the literature. An elbow pipe from the proto-historic period is pictured by Borden (1970,Fig.33s); a decorated stone pipe bowl was surface collected at False Narrows from deposits likely to contain material of the Marpole Culture Type. One fragment is also reported from disturbed deposits at Glenrose (Percy 1971:174).

Pecked Stone

A) Hammerstone

Hammerstones exhibit pecking and/or pitting of varying degrees of coarseness in at least one place on an edge, an end, or a surface. They are usually of a size and weight such that they can be effectively used with one hand. One such artifact is from Deep Bay, but it was found on the beach. It exhibits all the above characteristics, fine pecking being evident on one corner. The shape of the artifact is that of a long rectangle with all corners well rounded. Its regularity is reminiscent of ballast weights for sailing ships or even sash weights, and the fact that it was found on the beach leaves this possibility open. The pecking evident on one corner, to the exclusion of evidence of utilization anywhere else, argues for its inclusion as an aboriginal artifact.

B) Stone bowl

This object is made of coarse, hard sandstone. It is elliptical in plan with a shallow depression. The ventral surface is smoothly curved in two dimensions, suggesting that it is the natural exterior of the parent rock. Pecking or grinding are not obvious in its manufacture. It may be naturally formed, as it was found in the disturbed stratum on Lot 81. But, its form is sufficiently bowl-like to include here.

Incised Stone

Two artifacts fall into this class, both with incisions on one surface that are of cultural origin. The first artifact is a chunk of siltstone that has random straight lines incised on one surface. Unfortunately, the person who excavated this artifact added several thumbnail incisions to the same surface to test the hardness of the stone. It is not possible at present to distinguish the original lines from the recent ones. This artifact measures 16.7 x 11.0 x 3.4 cm and it weighs 649.7 gm. The second artifact is a flat sandstone slab that has a series of geometric incisions on one surface. The incisions consist of two motifs that are closely spaced. There are two rows of short straight lines, one below the other, set side by side at one end of the incised surface. The remainder of the surface shows the other motif, a herring bone pattern, that is presented in columns. The artifact measures 9.4 x 4.1 x 1.0 cm and weighs 79.7 gm. Geometric motifs are thought to be more common in the Gulf of Georgia Culture Type than in the Marpole Culture Type (Mitchell 1971a:54).

BONE

A) Barbed bone point (Figure 18e'-f')

This class of point is widely known and is thought to be distinctive of the Gulf of Georgia Culture Type (Mitchell

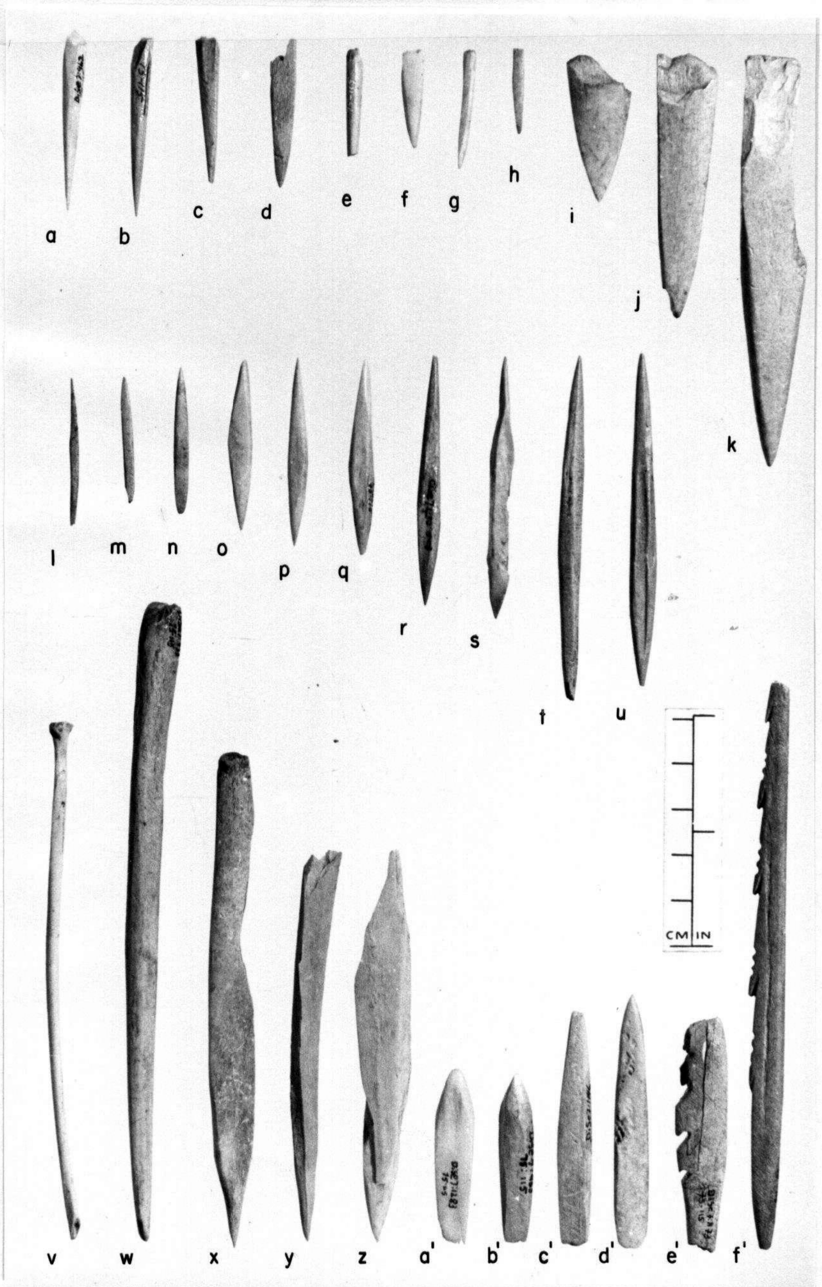

Figure 18. Bone points and awls, DiSe 7.
a-f. light duty bone points;
g-h. light duty bird bone points;
i-k. heavy duty bone points;
l-n. bird bone bipoints;
o-u. bone bipoints;
v. bird bone awl;
w. polished bone awl;
x-z. split bone awl;
a'-d'. wedge base bone points;
e'-f'. unilaterally barbed bone *points*.

1971a:48). The predominance of this artifact class in the southern Gulf of Georgia (Mitchell 1971a:198) may simply be a function of the number of sites excavated in the southern Gulf, as opposed to the northern Gulf. Unilaterally barbed bone points are found at Rebecca Spit, Sandwick Midden and Courtenay River (Mitchell 1971a:198-9), Bliss Landing (Beattie 1971:28), and Comox (Smith 1907,Fig.104), as well as the two that have been found at Deep Bay. Thus, it seems that such points are not uncommon in the northern Gulf relative to the number of reports available. The two specimens from Deep Bay are quite different from one another. The first is a heavily made artifact of mammal bone. The barbs are crude and they are low and enclosed. The artifact appears to have been broken transversely at half its former length, and an attempt to refashion the distal end has been made. The base is slightly tapered but is still thick. It measures 5.2 x 1.2 x .5 cm and weighs 3.7 gm. The second specimen is more finely made. It is long and slender with a thinned base and low enclosed barbs. The edge of each barb has been serrated to form two or three smaller barbs in the same manner as that described by Smith (1907:310). It measures 12.6 x .8 x .5 cm and it weighs 5.2 gm.

B) <u>Bipoints</u> (Figure 181-u)

These artifacts are characterized by sharp points at each end and a slender, elongated, diamond shaped profile.

They are usually well finished over their entire surface, and they are more or less circular in transverse cross section. Their greatest width is usually toward the mid-point of the long axis, although this varies somewhat. They are most often made of split mammal bone, but bird bone bipoints are also common. Thirty-five mammal bone bipoints and seven bird bone bipoints were found at Deep Bay. None of these artifacts showed the removal of medial flakes to form fish gorges (see Mitchell 1971a:202). There are two further artifacts classified as bipoints for lack of a more appropriate grouping. They are both thick, made of mammal bone, and come to blunt points at either end. One of them (artifact #1113) may have been a pendant as there is a slight constriction at one end where a break has occurred. The other (artifact #832) was surface collected from the inside beach. They measure 6.8 x 1.1 x .8 cm and 6.8 x 1.0 x .8 cm and weigh 5.1 gm and 4.1 gm respectively. The following two tables present the measurements for the bird bone and mammal bone bipoints.

TABLE XVI

Dimensions (cm) and Weights (gm) of Bird Bone Bipoints, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
430	3.1	0.2	0.1	0.1
983	(1.6)	0.2	0.1	0.1
1090	2.8	0.2	0.2	0.1
1166	3.2	0.3	0.2	0.2
1187	3.2	0.2	0.2	0.1
1331	4.1	0.3	0.2	0.2
1484	3.0	0.4	0.1	0.3

The six complete specimens indicate a range in length from 2.8 to 4.1 cm, in width from 0.2 to 0.3 cm, and in thickness from 0.1 to 0.2 cm. Weights vary from 0.1 to 0.3 gm.

TABLE XVII

Dimensions (cm) and Weights (gm) of Mammal Bone Bipoints, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
495	(3.3)	0.6	0.4	1.1
625	(2.5)	0.7	0.6	0.7
792	(2.1)	0.4	0.2	0.4
810	(6.6)	0.6	0.1	2.2
840	7.3	0.6	0.5	2.1

TABLE XVII (continued)

855	5.1	0.5	0.4	0.7
946	3.6	0.6	0.4	0.5
969	(4.8)	0.6	0.4	1.0
988-A	(2.9)	0.5	0.2	0.7
997	(4.0)	0.4	0.2	0.5
1003	5.7	0.5	0.4	1.3
1004	4.4	0.7	0.4	0.7
1008	7.5	0.7	0.4	1.6
1012	5.6	0.7	0.5	1.2
1014	4.1	0.5	0.5	0.7
1030	(4.8)	0.7	0.4	1.8
1058	(2.8)	0.7	0.5	0.7
1074	3.7	0.6	0.4	0.6
1089	7.5	0.5	0.4	1.5
1096	(5.4)	0.6	0.4	1.4
1219	3.6	0.5	0.4	0.4
1267	(5.5)	0.6	0.6	1.6
1276	3.7	0.6	0.4	1.1
1280	5.4	0.5	0.4	1.2
1282	7.0	0.5	0.5	1.5
1290	(3.3)	0.5	0.5	0.7
1301	4.1	0.6	0.4	0.8
1307	4.3	0.6	0.4	0.9
1309	4.1	0.5	0.4	0.5

TABLE XVII (continued)

1310	(4.4)	0.6	0.4	1.6
1373	4.6	0.8	0.6	1.0
1374	(2.8)	0.7	0.4	0.6
1380	(4.0)	0.5	0.5	0.8
1398	4.0	0.6	0.4	0.4
1460	6.0	0.5	0.4	1.6

The twenty complete specimens indicate a range in length from 3.6 to 7.5 cm, in width from 0.5 to 0.8 cm, and in thickness from 0.4 to 0.6 cm. Weights of complete specimens range from 0.4 to 1.6 gm.

C) Awl

Awls are a class of hand held artifact used for piercing. The working point is slender and of roughly circular transverse cross section. The remainder of the implement may show varying degrees of finishing. Most awls are made of split mammal bone (usually deer metatarsal), although awls made of unsplit bird bone do occur. Awls are usually large compared to other pointed bone implements with slender points.

1. Mammal bone awl

This class includes polished bone awls and split bone awls. There is one polished bone awl and fourteen split bone awls. The polished bone awl (artifact #933) is made of split deer metatarsal polished over the entire surface. From a flat butt it tapers gently to the point. This artifact measures 14.1 x 1.0 x .8 cm and weighs 6.6 gm (Figure 18w).

The split bone awls are of much cruder manufacture, being ground to a slender point only at the tip. The remainder of the artifact is unworked. Measurements and weights for these fourteen artifacts are given in Table XVIII (Figure 18x-z).

2. Bird bone awl (Figure 18v)

Two of these awls were recovered at Deep Bay. The complete one (artifact #1466) is made on the radius of an unidentifiable bird. The point is made by abrading across the bone at an acute angle to the long axis. It measures 11.6 x .6 x .4 cm and weighs 1.1 gm. The second awl (artifact #1502) is a distal fragment made on the ulna of an unidentifiable species. It measures 6.3 x .7 x .5 cm and weighs 1.2 gm. Similar artifacts are reported in Mitchell (1971a:133, 172, 202).

TABLE XVIII

Dimensions (cm) and Weights (gm) of Split Bone Awls, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
32	13.9	1.7	0.4	5.3
884	(5.0)	1.0	0.4	1.3
967	(4.2)	0.8	0.4	0.8
994	8.6	0.9	0.5	3.2
1037	8.8	1.3	0.1	5.2
1039	(6.0)	0.2	0.4	1.5
1065	(4.0)	0.7	0.4	1.4
1069	(4.5)	0.7	0.1	1.4
1084	11.0	1.1	0.7	6.3
1102	5.7	0.7	0.4	1.8
1141	(7.9)	0.6	0.4	2.1
1383	(3.9)	0.4	0.6	0.7
1437	(5.4)	1.0	0.5	1.7
1499	7.2	1.1	0.5	2.7

Many of the points of these artifacts show wear polish. The complete specimens show considerable variation in size and shape. Awls in this class are pictured in Mitchell (1971a, Fig.18cc-hh).

D) Wedge base bone points (Figure 18a'-d')

This class consists of well finished bone points that are pointed at one end and thinned at the other. The specimens from Deep Bay appear to be of two types. One is abruptly pointed with the remainder of the body tapering gradually to a very thin, relatively broad base (class A). The other type has a more gradual point, tapers over a lesser portion of the long axis, is not as thin at the base as the previously described type, and is often longer than the former type (class B). The same two types are found in the Montague Harbour III assemblage (Mitchell 1971a,Fig.117a-f, 1968,Fig. 7p,t). It is my impression, despite the small sample size, that the two forms of these points may be temporally distinct, the abrupt pointed ones being more recent. There are six wedge based points from Deep Bay. Their measurements are given in Table XIX.

TABLE XIX

Dimensions (cm) and Weights (gm) of Wedge Base Bone Points, DiSe 7.

artifact number	length	width	thickness	weight
Class A				
965	3.8	0.8	0.6	1.1
1285	3.9	0.9	0.4	1.5
Class B				
1146	5.2	0.8	0.4	1.5
1158	6.7	1.0	0.5	3.1
1299	5.6	0.8	0.4	2.1
1465	6.2	0.6	0.3	1.8

E) Bone points

This class of artifact includes fragments of bone that were obviously parts of points. Only one pointed end can be attributed to this class, unlike bone bipoints, and their size is usually small, unlike awls. They are subdivided for descriptive purposes into heavy duty and light duty categories. Heavy duty points have abruptly converging edges and are made of thick pieces of mammal bone. Light duty points are small, often circular in transverse cross section, and gently tapered to the point.

1. Heavy duty points (Figure 18i-k)

There are eleven of these points and fragments, all on thick pieces of bone. Abrasion is not common away from the tip. They differ from awls in being abruptly pointed. They measure 2.8 to 9.1 x .2 to 1.5 x .1 to .9 cm and weigh .8 to 10.2 gm.

2. Light duty points

This class of artifact can be further divided into mammal bone and bird bone points.

Mammal bone (Figure 18a-f)

There are forty-three artifacts in this class. They all appear to be fragmentary, although it is difficult to judge their original sizes. They range in finish from roughly abraded to highly polished, and they are relatively slender in proportion to their length. Mitchell (1971a:204, Fig.118 w-bb) classifies such artifacts as small, single-pointed bone objects. The Deep Bay specimens measure 1.0 to 4.7 x 0.3 to 0.6 x 0.1 to 0.6 cm and weigh 0.1 to 1.5 gm.

Bird bone (Figure 18g-h)

Three bird bone point fragments were found. All are made on small pieces of split long bone, and two appear to be fragmentary. Measurements for this class are given in Table XX.

TABLE XX

Dimensions (cm) and Weights (gm) of Bird Bone Points, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
1177	(1.9)	0.3	0.1	0.1
1268	2.6	0.3	0.2	0.1
1475	(1.9)	0.5	0.2	0.1

F) Ulna tool (Figure 19l-m)

This class of artifact is usually made on deer ulnae, although wapiti ulna tools are not uncommon. The distal end is worked to a point or a wedge shape; sometimes the anterior distal edge is bifacially ground to produce a knife edge. Distal ends are frequently broken off, leaving the proximal ends to be classified simply as "tools" rather than "awls"

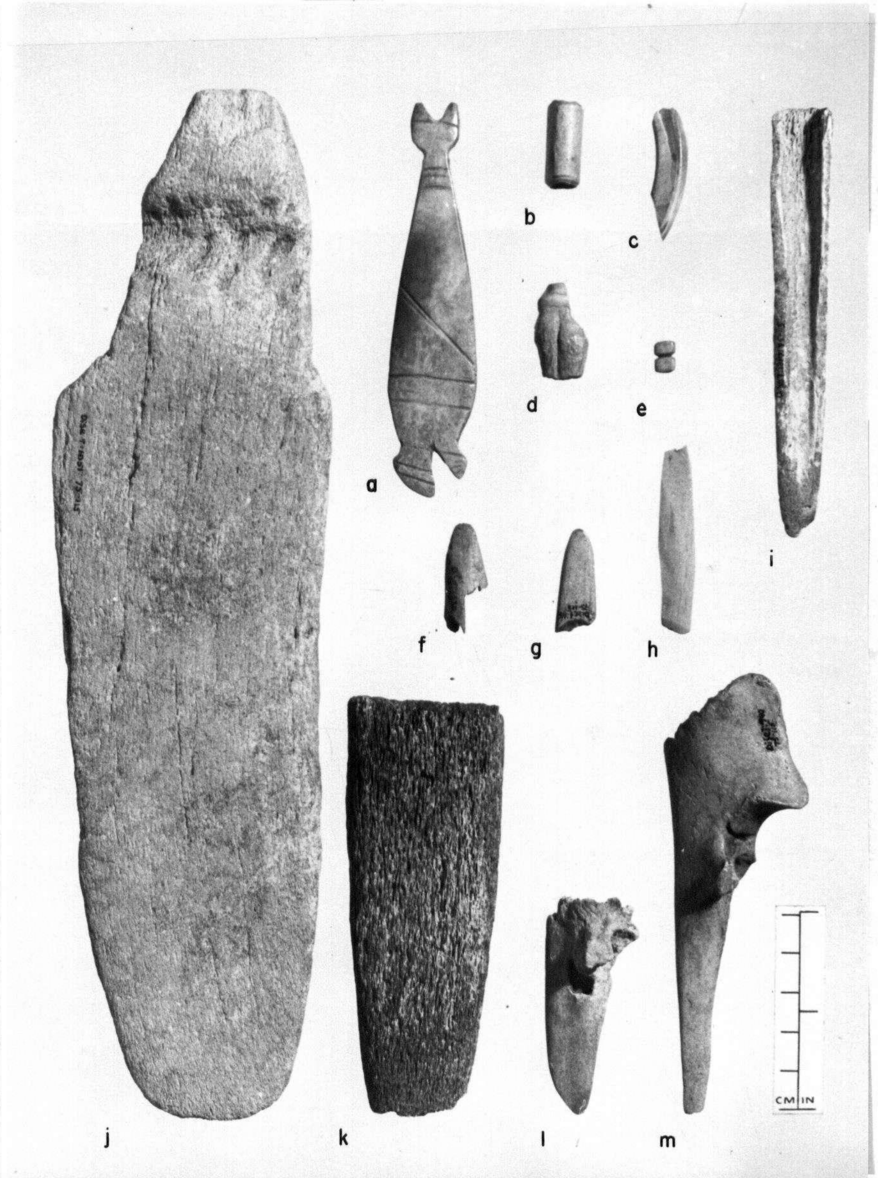

Figure 19. Miscellaneous bone artifacts, DiSe 7.
a. zoomorphic pendant;
b. bird bone tube bead;
c. beaver incisor tool;
d. sea mammal tooth;
e. girdled bone bead;
f-i. bone chisel/wedge;
j. sea mammal bone implement;
k. sea mammal bone wedge;
l-m. deer ulna tool.

or "knife". Three artifacts from this class were found at Deep Bay. Two are proximal fragments and one is a distal fragment. One proximal fragment is abruptly pointed only a short distance from the condyles, the other is missing the distal end but it is a much longer, more gently tapered artifact. The distal fragment has been abraded to a wedge shape. Similar artifacts are described by Mitchell (1971a, Fig.63g, Fig.93, Fig.118q,r).

G) Bird bone whistle

This class of artifact is described by Mitchell (1971a: 136). Its members are made on the long bones of birds approximately the size of seagulls. One or more V-shaped notches are abraded transversely across the surface of the bone to form apertures from which air can escape. The specimen from Deep Bay is broken at the center of the only visible notch. The exterior of the bone is in its natural state except for several coarse transverse incisions at the opposite end of the fragment. It measures 3.8 x .8 x .7 cm and it weighs .7 gm. A similarly fashioned artifact is pictured by Mitchell (1971a,Fig.64a).

H) Bone wedge/chisel (Figure 19f-i,k)

Tools of this class are made of mammal bone that is usually split longitudinally and abraded to a broad, thin distal end that is often rounded. Variation within the class exists in terms of size, raw material, and degree of finish of the artifacts, but their general form suggests that they may have been used as chisels or wedges. There are seven whole and fragmentary members of this class from Deep Bay. One is a large wedge of sea mammal bone with the bit, and possibly the poll, missing. It measures 10.7 x 4.1 x .3 cm and it weighs 38.2 gm. The remaining specimens are made of land mammal bone. Of these, two small ones are made on the ends of bone splinters. The bits are narrow and bifacially bevelled on both specimens. They weigh 1.2 to 1.7 gm and they measure 3.7 to 4.8 x 1.0 to 1.2 x .4 cm. The remaining four wedges are made of split long bone, presumably deer, and they come to narrow, rounded bits that are unifacially bevelled from the interior of the bone. Three are bit fragments, measuring 1.5 to 2.8 x 1.0 to 1.1 x .2 to .5 cm and weighing .3 to .6 gm. The fourth is more complete, measuring 10.9 x 1.0 x .8 cm and weighing 7.1 gm. This class of artifact is described by Mitchell (1971a:133).

I) Beaver incisor tool (Figure 19c)

Mitchell (1971a:137, 207) describes this artifact class. The natural sharpening of the distal end of the tooth is utilized and often reground at a similar angle. These artifacts are reported to be used as incising tools for woodwork (Barnett 1975:109). One such artifact comes from DiSe7. It is abraded at an acute angle at the distal end and broken at the proximal end. It measures 3.4 x 0.9 x 0.7 cm and weighs 1.3 gm.

J) Modified sea mammal tooth (Figure 19d)

Two such artifacts were found. One is a male northern sea lion canine showing several small incisions at the proximal end for possible suspension as a pendant. It measures 8.8 x 2.9 x 2.7 cm and it weighs 60.2 gm. A similarly modified tooth was recovered from the Marpole site. The second specimen is a northern sea lion lower premolar. On this specimen the distal posterior section has been removed by abrasion to form a notch. No decorative or utilitarian purpose can be suggested for this artifact. It measures 2.7 x 1.4 x 0.9 cm and weighs 2.3 gm. No comparable artifacts from other sites are presently known.

K) Bone pendant (Figure 19a)

Many forms of artifacts belong to this class. Their purpose is presumably decorative, and they all indicate that they were meant to be suspended. The artifact from Deep Bay belonging to this category is zoomorphic. It has the outline of a sea mammal, and it was probably suspended from the constriction where the hind flippers or flukes meet the body. It has two lines incised at right angles to the long axis just behind the head, and a third incision runs diagonally across the same surface from the animal's throat to its back.

The artifact was associated with Burial 4. It weighs 8.4 gm and measures 9.9 x 2.3 x .8 cm. A green stain on its dorsal area has resulted from its proximity to the copper bead fragments described below. Stone fish effigies are listed as distinctive of the Marpole Culture Type (Mitchell 1971a: 52). The pendant described here does not clearly represent a fish nor is it made of stone, however, fish effigies could also be called zoomorphic effigies.

L) Bone beads (Figure 19b-e)

These three beads are of a tubular variety, the tubes being of varying lengths. Two beads are made of mammal bone and are about as long as they are wide. They are small, and one is divided into two segments. With this latter specimen, it is not clear whether the segments were meant to be separated or whether it is one bead with a deeply incised girdle. The girdled bead measures .8 x .5 x .4 cm, and the plain one .7 x .6 x .6 cm. They each weigh .2 gm. The third bead is a short bird bone segment. It is made from the long bone of a large bird, and it is unworked on the surface. It measures 2.1 x .9 x .9 cm and weighs 1.1 gm. A fragment of this kind of bird bone is described in Mitchell (1971a:136, Fig.61b), and a shorter bead of this sort is described in McMillan and Ste. Claire (1975:52).

M) Sea mammal bone implement (Figure 19j)

This artifact is made from a large piece of sea mammal bone, possibly a rib. The proximal end is narrower than the body, and there is a constriction from the dorsal surface 3 to 5 cm from the proximal end. This portion of the implement has been adzed to shape. The broad, flat body of the artifact thins and tapers to the distal end which is gently convex. The distal end could have been used as an axe or wedge, and the proximal end may have been hafted like an axe. No conclusive use can be found for this implement, although it has an appearance similar to "slave killers". It measures 25.5 x 7.2 x 2.0 cm and weighs 197.4 gm.

N) Slender polished bone objects

Three fragments fall into this class. They are characterized by an extremely polished surface, a circular transverse cross section, and an almost imperceptible taper. One specimen appears to be a proximal fragment that has been finished by a slight constriction and transverse polishing. These artifacts may have been awls or arrow points, but their finish and delicacy implies a less rigorous function. Use as blanket pins or needles seems more probable. These items measure 4.5 to 9.2 x .5 to .6 x .5 cm and weigh 1.2 to 3.4 gm.

O) Miscellaneous worked bone fragment

This class of artifact consists of pieces of bone that show evidence of having been modified. Some may have been parts of larger, broken artifacts. In their present condition these fragments can not reliably be assigned to any specific artifact class. Generally small, there are seventy of these artifacts from Deep Bay. All are of mammal bone. Four have been incised randomly, one has been adzed or whittled, and the remaining sixty-five have been abraded and/or polished. Sixteen of these specimens are end fragments, and fifty-four are medial fragments.

ANTLER

A) Barbed antler point (Figure 20s)

This class of point is thought to be distinctive of the Marpole Component in the Gulf of Georgia (Mitchell 1971a:52). The form is similar to that of barbed bone points and overall size is approximately the same. The specimen from Deep Bay has a roughly circular transverse cross section with low barbs that are well separated. The base is conically tapered rather than thinned. It measures 15.2 x 1.0 x .7 cm and weighs 8.1 gm. This point is unlike those pictured by Mitchell (1971a, Fig.95d,e); it is more similar in form to the bone point shown in McMillan and Ste. Claire (1975,Fig.8c).

B) Antler point (Figure 20l-m)

These artifacts are similar in shape and size to bone

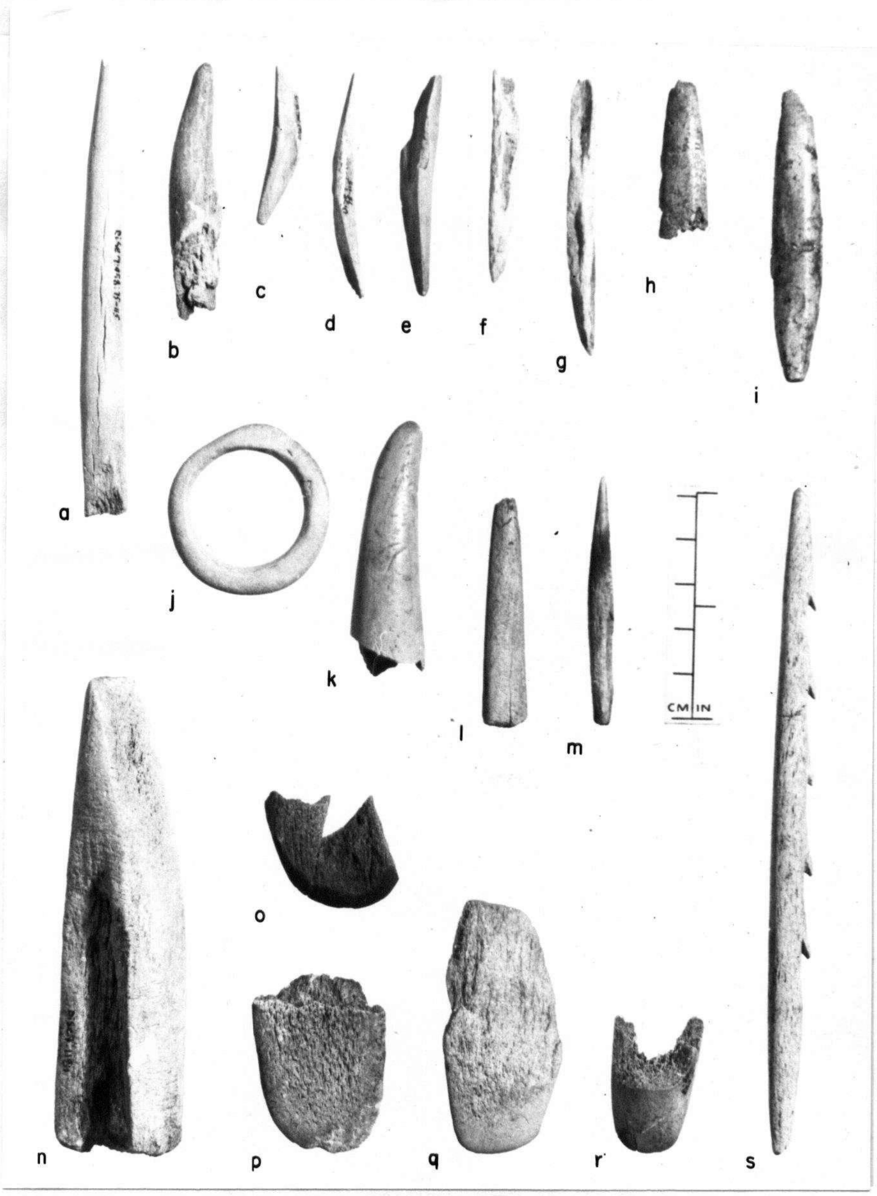

Figure 20. Antler artifacts, DiSe 7.
a. foreshaft;
b. tine flaker;
c-i. composite toggling harpoon valves;
j. ring;
k. incised tine;
l-m. point;
n-r. wedge;
s. barbed point.

points, and it is possible that they were used interchangeably. One of these artifacts is heavy duty. It is a distal fragment of a well finished point, measuring 5.2 x 1.1 x 0.6 cm and weighing 3.1 gm. The other two artifacts can be described as light duty; both are distal fragments. The tips in each case would be roughly conical, and the taper is gentle. The whole specimen measures 5.6 x 0.6 x 0.6 cm and weighs 1.6 gm, while the fragment weighs 0.4 gm and measures 1.8 x 0.8 x 0.4 cm.

C) Antler ring (Figure 20j)

This kind of artifact is rare, although bone rings are known from St. Mungo (Calvert 1970:61), Saltery Bay (Monks, n.d. a), and they are exhibited in Marpole and Stselax Phase displays in the U.B.C. archaeology laboratory. Shell rings are known from Deep Bay (described below), and one is exhibited in the Marpole Phase collection in the U.B.C. archaeology laboratory. The antler ring artifacts from Deep Bay consist of a whole ring and two fragments of another ring. The whole specimen is well finished, but it is slightly irregular in thickness. It measures 3.9 x 3.8 x 0.5 cm and it weighs 3.2 gm. The two fragments appear to be in an earlier state of manufacture. They are roughly square in cross section, and they indicate that the center part of a disc has been removed by bifacial incising to produce a ring. They measure 1.9 x 0.8 x 0.9 cm and weigh 1.6 gm. Suttles (1951:106) describes an antler ring as part of the composite toggling sea mammal harpoon apparatus.

D) Antler wedge (Figure 20n-r)

These artifacts are common in the Gulf of Georgia. Both beam wedges and tine wedges are found at Deep Bay; however, the small numbers of each and their fragmentary state preclude this subdivision. All but one of the artifacts is a bit fragment. There are eight of these artifacts from Deep Bay. The one complete specimen measures 10.8 x 2.9 x 2.3 cm and weighs 32.5 gm. It is made on a thick antler tine, probably wapiti. The bit is square and unifacially bevelled. The seven remaining bit fragments, also showing unifacial bevel and slightly convex working edges, measure 2.7 to 5.8 x 1.6 to 3.1 x 0.3 to 2.3 cm and weigh 1.1 to 8.3 gm. Antler wedges are described by Mitchell (1971a:212).

E) Antler foreshaft (Figure 20 a)

This artifact is admittedly dubious for several reasons. First, it was found just below the disturbed historic zone and, second, the base is only roughly adzed or carved to shape despite the degree of finish on the shaft of the artifact. Antler foreshafts are listed as distinctive of the Locarno Beach Culture Type (Mitchell 1971a:57). However, because the Deep Bay specimen was found in natural stratum F, and because of its indistinct form, it may not be a foreshaft.

F) <u>Antler tine flaker</u> (Figure 20b)

These artifacts are the distal fragments of antlers. They show coarse wear at the tip of the implement, suggesting that they may have been used to pressure flake lithic material. It is also conceivable that they were used as punches for indirect percussion. There are three of these artifacts at Deep Bay, measuring 5.8 to 6.9 x 1.2 to 1.6 x 0.9 to 1.2 cm and weighing 3.6 to 6.9 gm.

G) <u>Composite toggling harpoon valves</u>

These artifacts exist in a variety of forms in the Gulf of Georgia. They can be plain or have lashing grooves on the exterior, and the distal interior end may be channelled or slotted to hold a piercing point. They all have flaring proximal ends with an interior channel to receive a fore-shaft. Mitchell (1971a:48, 57) lists these valves among the distinctive archaeological features of both the Locarno Beach and Gulf of Georgia Culture Types.

The fifteen valves and fragments from Deep Bay (Figure 20 c-e) can be divided into three groups. Their dimensions and weights are presented in Table XXI. The largest group consists of eleven fragmentary valves. They have plain exterior surfaces and shallow channels on the distal interior surfaces. The channel at the distal end of these artifacts suggests that the arming point was most likely to have been a wedge base bone point. Similar artifacts are pictured by Mitchell (1971a,

Fig.121a) and Capes (1964,Fig.20A-3).

The second group (Figure 20h-i) consists of two notched valves that are much larger and more robust than the previous specimens. They are much longer and broader than members of the first group, although the exteriors are also plain and the arming channels are also shallow. If relative size is any indicator, these valves were probably used in the acquisition of larger animals than was the case for members of the preceding class. A similar pair of valves is pictured by Borden (1970,Fig.33e).

The third group consists of another matched pair of valves. They are as long as those in the second group, but are more slender than those in the first group. The distal interior ends are deeply channelled to receive an arming point of circular transverse cross section. These two valves and three members of the first group were recovered from natural stratum G/O. This natural stratum also yielded a fixed barbed antler point; this class of artifact is thought to be distinctive of the Marpole Culture Type (Mitchell 1971a: 52). No pictures or diagrams of this type of valve could be found (Figure 20f-g).

TABLE XXI

Dimensions (cm) and Weights (gm) of Antler Composite Toggling Harpoon Valves, DiSe 7. ( ) = incomplete dimension.

artifact number	length	width	thickness	weight
group 1				
590	(2.9)	1.0	0.4	0.8
1072	5.0	1.0	0.6	2.1
1115	(2.2)	0.9	0.6	0.7
1193	(1.6)	0.8	0.4	0.3
1278	(2.3)	1.1	0.5	0.6
1456	5.2	0.8	0.5	1.4
1461	(2.9)	0.8	0.5	0.8
1462	(3.5)	0.8	0.5	0.9
1479	(2.6)	1.0	0.6	1.0
1480	(2.0)	0.8	0.5	0.4
1503	(2.7)	1.0	0.5	0.4
group 2				
505	6.8	1.2	0.7	2.5
513	(3.6)	1.2	0.4	0.7
group 3				
1319a	6.2	0.7	0.6	1.5
1319b	(4.8)	0.7	0.6	1.0

H) Incised antler tine (Figure 20k)

This distal tine fragment has a longitudinal incision that bisects the tine. It is possible that this artifact represents an initial stage of manufacture of composite toggling harpoon valves. It measures 5.8 x 1.7 x 1.6 cm and weighs 9.2 gm.

I) Miscellaneous worked antler

There are four abraded antler fragments. They show relatively little abrasion and no form that suggests membership in a specific artifact class. There are many fragments of adzed antler and one adzed antler tine. Over one hundred fragments were found in a concentration in excavation unit 4 on Lot 73 at the top of natural stratum M. Eight additional fragments are from excavation unit 5, natural stratum K on the same lot. One fragment was also found in natural stratum N in unit 4. Two fragments were found on Lot 81, both in the disturbed zone.

SHELL

A) Shell disc beads (Figure 17h)

These artifacts are small, flat, biconically perforated circles of clam shell. They are common in the Gulf of Georgia and are thought to be distinctive of the Marpole Culture Type (Mitchell 1971a:52). There are 51 such beads from Deep Bay, 48 of which were associated with Burial 4. These artifacts are too light to weigh individually, although 22 of them and a label tag weigh 0.8 gm. They measure approximately 0.4 to 0.5 cm in diameter and 0.1 to 0.2 cm in thickness.

B) Dentalia (Figure 17d-e)

Whole and fragmentary dentalia are often found in Gulf of Georgia sites. Similar items were recovered from Montague Harbour III (Mitchell 1971a:213, 215). They are listed as inclusions in midden burials distinctive of the Marpole Culture Type (Mitchell 1971a:52). They were probably imported from the west coast of the island. There are 18 from Deep Bay, 12 of which were associated with Burial 4. Most of these artifacts are too light to weigh accurately to the nearest tenth of one gram. The longest specimen recovered was 3 cm, and most shells are 0.4 cm or less in diameter.

C) Shell ring fragment (Figure 17f)

This artifact is flat and represents only half of the original artifact. As mentioned above, a similar but larger shell ring is exhibited in the Marpole Phase collection in the U.B.C. archaeology laboratory. The DiSe 7 specimen is 2.0 x 1.3 x 0.3 cm and weighs 0.5 gm. This artifact may be part of a nose ring such as the one pictured in Kew and Goddard (1974:48, 87).

D) Sea mussel tool (Figure 17n)

This artifact is made of *Mytilus californianus*. The surface of the shell has been ground smooth, and the cutting edge is unifacially bevelled. The fragment weighs 4.1 gm and measures 3.3 x 2.4 x 0.3 cm. Artifact #319 from Montague

Harbour III (Mitchell 1971a:178) is also unifacially bevelled and abraded on part of the exterior. The Deep Bay artifact may have been used for scraping, gouging, or cutting.

E) Pecten shell (Figure 170)

One fragment of unmodified pecten shell was found. Rattles made of pecten shell were used by the Coast Salish (Barnett 1975:177). Pecten shell has been recovered from the Stselax Phase, according to the artifact exhibit in the U.B.C. archaeology laboratory, and a pecten shell was also found in San Juan Phase deposits at Helen Point (Carlson 1970,Fig.36e).

MINERAL

A) Ochre

Ochre is usually found in small particles and is most often rusty red in colour, although different colours are known. It smears easily on skin, distinguishing it from stones with iron oxide in them. Fifty-seven pieces were found at Deep Bay, of which two were orange, one was white, and the remainder were red. The uses of red ochre are noted in Mitchell (1971a:198) and Barnett (1975:74, 89, 91, 105).

B) Mica

One mica flake was found. It is clear at its thinnest portions and slightly irridescent at its thicker portions. No use can be attributed to the artifact, but it may have served as decoration (cf. Mitchell 1971a:198). It measures 2.3 x 1.6 x 0.1 cm and weighs 0.1 gm.

METAL

A) Native copper (Figure 17m)

The remains of two slender tubes of copper were found in association with Burial 4. The fragments were too fragile to measure or weigh. Similar beads, but larger with solid wooden centers, were found at Prince Rupert Harbour (G. MacDonald 1976,pers. comm). The stain from these fragments is found on the zoomorphic bone pendant.

WOOD

Two samples of wood were recovered. One came from stratum F in excavation unit 1 of Lot 73. It consists of highly decomposed cedar fragments. The age of natural stratum F is such that wood preservation from a point some 800 years B.P. is unlikely. Since the soil pH is the same in this stratum as in most others, and since no similar fragments of wood were recovered from other strata, except as noted below, it seems likely that this artifact was intruded into natural stratum F.

The second sample consists of bark that was found wrapped around some shell disc beads, dentalia beads, and the copper bead fragments associated with Burial 4. The copper salts probably helped preserve the bark (Matson 1975,pers. comm). This artifact is extremely fragile and is now stored in carbowax.

Variations in the Artifact Inventory

Table IV presents the artifacts from Lot 81 by excavation unit and natural stratum and Table III presents the same material for Lot 73. The portion of a natural stratum in an excavation unit is hereafter referred to as an analytical unit. Analytical units from which no artifacts and no faunal remains were recovered were discarded from subsequent discussion. The data are presented in their most detailed form in order that subsequent recombinations of artifact classes will be explicit in terms of their contents.

A) Lot 81

Table IV indicates that 98 artifacts were recovered from Lot 81 and that 66 of them, or 2/3, were found in the disturbed historic stratum. Of the remaining 32 artifacts, none was found below natural stratum F, and most were found in natural strata B and C. The most numerous artifacts, 16 in total, are made of bone. This figure represents half of the undisturbed artifact assemblage. There are five abraded bone fragments, four light duty bone points, and three bone bipoints. There is also one split bone awl, beaver incisor tool, worked mammal tooth, and bone bead. Ground stone is the next most common category with 12 artifacts present. Five of these are abrasive stones, four are thin ground slate points and fragments, and thin ground slate knife, pipe, and pendant are each represented once. The total number of chipped stone artifacts was two, one quartz crystal flake and one obsidian flake. Likewise, two antler artifacts were found, an antler tine flaker and a composite toggling harpoon valve. No shell or mineral artifacts were found in undisturbed deposits.

The cultural affiliation of the undisturbed assemblage is difficult to judge because of the small sample size and the lack of radiocarbon dates. Bearing in mind the small sample size, it is still interesting to note that chipped stone accounts for approximately 6% of the assemblage, ground stone for about 37.5%, bone for about 50%, and antler for another 6%. The preponderance of bone and ground stone artifacts, especially the relative abundance of bone bipoints, light duty bone points, and thin ground slate artifacts, suggests that the undisturbed assemblage could belong to the Gulf of Georgia Culture Type. The presence of an antler composite toggling harpoon valve and the relative scarcity of chipped stone support this suggestion. The percentages of chipped stone and bone also suggest this (Mitchell 1971a:

47). The type of chipped stone, namely quartz crystal and obsidian, suggests on the other hand that an earlier culture type may be represented. Without dates the issue cannot be resolved, but the weight of evidence appears to fall on the side of the first of these two interpretations.

The undisturbed assemblage is almost equally divided into stone and non-stone artifacts, there being 14 of the former artifacts and 18 of the latter. However, there is a massive disparity between ground and chipped artifacts, there being 29 of the former and two of the latter. Of the ground artifacts, 5 are abrasive stones and 24 are abraded. The antler tine flaker may have been used to assist in the manufacture of chipped stone artifacts such as the obsidian and quartz crystal flakers.

B) Lot 73

There were 518 artifacts recovered from excavations on Lot 73. Of these, 91 were from the disturbed historic deposits (including natural stratum C). Only one artifact is found below natural stratum P. It is a quartz crystal found in natural stratum P-1. No artifacts were found in natural stratum T. As mentioned in the section on chronology, the oldest radiocarbon date was produced by a sample collected from the clay and sand floor underlying natural stratum P-1 in most places.

Of the 427 artifacts from definitely aboriginal deposits, 135 are chipped stone, 62 are ground stone, 110 are bone, 25 are antler, 65 are shell, 27 are mineral, 2 are wood, and 1 is metal.

The distribution of these broad categories, and of some specific artifact classes, suggests that assemblages representing three components can be recognized. Chipped stone artifacts are found throughout the deposits, although they are considerably more common in strata G/O, G with shell, and P. Among the chipped stone artifacts are several classes thought to be distinctive of specific culture types in the Gulf of Georgia area. Microblades, and by inference microblade cores, are reportedly distinctive of the Marpole and Locarno Beach Culture Types (Mitchell 1971a:52, 57). The microblade found at Deep Bay came from natural stratum P, while the microblade core came from natural stratum G-2. Leaf shaped chipped stone points are thought to be distinctive of the Locarno Beach Culture Type (Mitchell 1971a:57). A variety of these artifacts, including leaf shaped points and numbering 14, were found at Deep Bay. One was found in natural stratum A, one was found in natural stratum G-2, one in G/O, and the remaining 11 in natural stratum P. Cobble tools are also distinctive of the Locarno Beach Culture Type (Mitchell 1971a:57). The unifacial and bifacial chopping tools from DiSe 7 correspond to this artifact class. Four of these artifacts were found in strata I, M, G/O, and G with shell. Small, triangular chipped basalt points are listed as being distinctive of the Gulf of Georgia Culture Type (Mitchell 1971a:48). Three such artifacts were found at Deep Bay, all symmetrical. Two are stemmed and one is unstemmed. The two stemmed specimens were found in natural stratum G with shell, and the unstemmed specimen was found in natural stratum G-2. It should be noted that the stem on each of these points is very weakly developed. For analytical purposes they could be grouped with the unstemmed specimen.

There were 72 ground stone artifacts recovered from excavations on Lot 73. Of these, 10 were found above the surface of natural stratum F, leaving 62 in definitely aboriginal deposits. With the exception of two abrasive stones and a stone disc bead found in natural stratum P, ground stone artifacts are not found below natural stratum H-1. Although this category of artifact is present in natural strata dark G, H, and H-1, only four artifacts are found in these strata. Combined with the three artifacts from natural stratum P, the total number of artifacts in aboriginal deposits below natural stratum G with shell is only seven (11%).

Natural strata F, G/O, and G with shell contain 15, 12, and 19 artifacts respectively, for a total of 46 artifacts representing 74% of all artifacts from aboriginal deposits. These deposits contain 20 abrasive stones, 17 ground slate points, of which two bases and one point are relatively thick and the rest are thin, 4 ground slate knives, 9 abraded slate fragments, 2 celts, 2 saws, 5 disc beads, 2 incised fragments, and 1 pendant.

Thin triangular ground slate points are reported to be distinctive of the Gulf of Georgia Culture Type (Mitchell 1971a:48). Three specimens were recovered from Lot 73, one from natural stratum G/O, one from G with shell, and one from dark G. Other thin ground slate points and fragments were also found, and their distributions are of interest here. Three corner notched thin ground slate points were found, one from natural stratum N, one from G/O, and one from G with shell. The basal notched thin ground slate point fragment was recovered from natural stratum F. Tip fragments and medial fragments of thin ground slate points came from natural strata F, G/O, G with shell, and H. Of the 14 thin ground slate points and fragments, four are from natural stratum F, one is from N, three are from G/O, four are from G with shell, one is from dark G, and one is from H.

Thick ground slate points are listed as distinctive of the Marpole and Locarno Beach Culture Types (Mitchell 1971a: 52, 57). Only one of these items was recovered from Lot 73, and it came from natural stratum G with shell. Two point bases that appear to be from thick points of this class were also recovered, one from natural stratum G with shell and the other from natural stratum H.

Thin ground slate knives are found in both the Gulf of Georgia and Marpole Culture Types (Mitchell 1971a:48, 52). On Lot 73 this class of artifact was found in natural strata A, F, "G", and G with shell in quantities of two, one, one, and one respectively. One medium thick ground slate knife fragment was recovered from natural stratum I.

Celts of various forms are distinctive of each culture type. Gulf of Georgia Culture Type celts are fairly large, thin, and well made (Mitchell 1971a:48). Marpole Culture Type celts are of various sizes, but usually large. They are roughly made with a flattened oval cross section and sides that often taper to a rounded, rough poll (Mitchell 1971a:52). The Locarno Beach Culture Type celts are small and well made with rectangular plan and cross section (Mitchell 1971a:57). Two celts were recovered from Lot 73, one from natural stratum "G", and the other from natural stratum G with shell. The former celt was small and rectangular in plan and cross section and was well made. The latter was quite large and well made, with edges converging toward the well finished poll. Unfortunately, neither of these forms corresponds stratigraphically with the associations expected of them in terms of other artifacts. These two artifacts do not seem to conform to the distribution expected of them on the basis of Mitchell's proposed distinctive features, but since only two celts are involved, reliance should not be placed on them as indications of cultural affiliation.

Stone disc beads are reportedly distinctive of the Marpole Culture Type (Mitchell 1971a:52). Four were recovered from the Lot 73 excavations, one from natural stratum N, one from G/O, and two from G with shell.

There were 156 bone artifacts recovered from Lot 73, forty-six of them from the disturbed historic strata. Of the remaining 110 artifacts in aboriginal deposits, only six are found below natural stratum dark G, and none were found below natural stratum S. As with ground stone, natural strata F, G/O, and G with shell contain the majority of the bone artifacts from aboriginal deposits. There are 31 in F, 28 in G/O, and 29 in G with shell for a total of 88 (81%).

The largest single artifact class is worked bone fragments, of which there are 38 in aboriginal deposits. Light duty bone points are next most numerous with twenty, ten of which are from natural stratum F alone. Fifteen bone bipoints were recovered. Seven of these were from natural stratum F, while the other eight were found in strata G/O, G with shell, and H. The ten split bone awls from aboriginal deposits were scattered evenly from natural stratum F down to natural stratum G with shell. This class of artifact is reportedly distinctive of the Gulf of Georgia and Marpole Culture Types (Mitchell 1971a:48, 52). Heavy duty bone points accounted for 8 artifacts, 5 of which were found in natural stratum G/O of below. Five bone wedges/chisels were found, and it is worth noting that they all came from natural strata N, G/O, and G with shell. All four wedge base bone points were found in aboriginal deposits. One was found in natural stratum F, two in G/O, and one in dark G.

One distinctive archaeological feature of the Gulf of Georgia Culture Type is "numerous single-and double-pointed bone objects of various sizes . . . " (Mitchell 1971a:48). Aboriginal deposits on Lot 73 contained 47 of these artifacts, or 43%, of the bone artifacts in aboriginal deposits. Natural stratum F contained 19, or 40%, of these artifacts. Ten of them are light duty bone points, 7 are bipoints, 1 is a heavy duty bone point, and 1 is a wedge base bone point. Natural stratum G/O contains 8 of these points, 4 of which are light duty, 2 are wedge base, 1 is heavy duty, and 1 is bipoint. Natural stratum G with shell contains 14 of these artifacts, only 3 of which are light duty while 5 are heavy duty. Six bipoints were recovered, but wedge base points were absent. The lowest bone point was found in natural stratum Q.

Two patterns seem to emerge from this scrutiny of bone points. First, bipoints, when they are found in numbers, seem to comprise approximately the same proportion of bone points for each natural stratum. Second, there may be an inverse relationship in the proportions of heavy duty and light duty bone points through time. Heavy duty points seem to be more common in earlier strata on Lot 73 and light duty points are more common in later strata. If more than one component is represented in the aboriginal strata, as will presently be shown to be the case, then the distinctiveness of the previously quoted archaeological feature should be reconsidered.

Unilaterally barbed bone points are another class of artifact thought to be distinctive of the Gulf of Georgia Culture Type (Mitchell 1971a:48). Two were found on Lot 73, one in natural stratum K, and the other in natural stratum H. The latter specimen had been broken transversely at about one-third to one-half its original length, and the break had been abraded to form a new broad, wedge shaped tip. The workmanship on this point was inferior to that of the former example. A field assessment of component divisions places one of these points in a Gulf of Georgia component and another in a Marpole component, thereby raising the issue again of the reliability of distinctive archaeological features for all cases.

The remaining bone tools are found in small numbers. It is of interest to note that a bead and a pendant were found in natural stratum G with shell, and that a bird bone whistle fragment was recovered from H-1. All three of these items could be thought of as decorative or ceremonial, and all are from deep in the midden deposits. The bead and the whistle are both of bird bone. Two similar artifacts were recovered from Montague Harbour I (Mitchell 1971a:136).

The unidentified sea mammal bone artifact was recovered from natural stratum J. With the sea mammal bone wedge from stratum N, there is a suggestion that sea mammal utilization may have become important during the period when the later strata were being deposited.

Only 33 antler artifacts were recovered, and 25 of these came from aboriginal deposits. The majority of these artifacts, ten, were from natural stratum G/O, followed by natural stratum F with six, and G with shell with four. The most frequent artifact class is antler composite toggling harpoon valves, which are reportedly distinctive of the Gulf of Georgia Culture Type (Mitchell 1971a:48). The seven specimens recovered from aboriginal deposits were evenly distributed in natural strata F, G/O, and G with shell. Since a component division may fall in between these strata, the universal applicability of this feature must again be questioned. The two specimens from natural stratum G with shell are much more slender and elongated in form, and they appear to be channelled to receive a piercing point of circular cross section. The other valves, it will be recalled, have a shallow channel more suited to wedge base bone points.

Antler wedges are listed as distinctive archaeological features of the Gulf of Georgia and Marpole Culture Types (Mitchell 1971a:48, 52). The five recovered from aboriginal deposits on Lot 73 are evenly distributed between natural strata F and G with shell.

Three antler points, analogous to the bone points discussed above, were recovered from natural stratum G/O. This may be another indication of a shift through time from antler to bone as a raw material for tools. These points would be classed as light duty rather than heavy duty, however.

A single barbed antler point was recovered from natural stratum G with shell. This class of artifact is listed as an archaeological feature distinctive of the Marpole Culture Type (Mitchell 1971a:52). Although a single example of this artifact class cannot be conclusive, its location is suggestive when viewed relative to other artifact classes that are indicative of the Marpole and Gulf of Georgia Culture Types.

As mentioned earlier, antler artifacts are found more often in the lower strata of their range. This range is also of interest since no antler artifacts are found below the bottom of natural stratum G with shell. This distribution seems unusual considering that substantial shell midden deposits of similar pH continue underneath G with shell. Like the paucity of bone below this point, the lack of antler artifacts may indicate cultural variation through time in the choice of raw material for artifact manufacture. On the other hand, both bone and antler distribution may reflect changes in activities carried on at the site.

There are 67 shell artifacts, of which 65 are from aboriginal deposits. Of these undisturbed artifacts, 49 are shell disc beads. Thirteen whole or fragmentary dentalia shells came from natural stratum G with shell. These artifacts, like the bone pendant and the copper beads, were associated with Burial 4. The vertical distribution of shell artifacts is identical to that of antler artifacts, none being found below natural stratum G with shell. A total of 49 shell disc beads were recovered, one from G/O and the other 48 from natural stratum G with shell. There were 14 dentalia artifacts, the additional specimen coming from natural stratum F. Half a shell ring segment was found in natural stratum K, and a Mytilus californianus chisel or gouge fragment was recovered from natural stratum F. Disc beads and dentalia shells are often included with burials in the Marpole Culture Type (Mitchell 1971a:52).

Twenty-seven mineral artifacts were recovered from aboriginal deposits on Lot 73. One was mica, and the remaining 26 were ochre. The vertical distribution of mineral artifacts is almost identical to that of shell and antler artifacts, only two pieces of ochre being recovered from natural stratum H. Natural strata F, G/O, and G with shell contained the largest numbers of ochre artifacts, eight, five, and four respectively. The mica flake was found in natural stratum G with shell.

Two wood artifacts were recovered, both from aboriginal deposits. The cedar bark wrapping found in natural stratum G with shell was associated with Burial 4 and contained copper, shell disc beads, and dentalia shells. The wood fragments from natural stratum H do not have any identifiable appearance and may represent the remains of a stake that was driven into this stratum recently.

Several fragments of native copper were treated as one artifact because they were found with the cedar bark wrapping. Their fragmentary condition precluded the possibility of establishing how many beads there were initially. Native copper is listed as an inclusion with burials of the Marpole Culture Type (Mitchell 1971a:52). These specimens, associated with Burial 4, were found in natural stratum G with shell. Table XXII summarizes the locations of Mitchell's distinctive archaeological features in the natural strata of Lot 73 at Deep Bay.

TABLE XXII

Comparison of Distinctive Archaeological Features of Three Culture Types from the Gulf of Georgia Area (after Mitchell 1971a:48, 52, 57) with Artifact Class Distribution, Lot 73, DiSe 7.

artifact class	culture type	stratigraphic association, DiSe 7.
small, triangular chipped basalt points	Gulf of Georgia	I, G-2
various chipped stone point forms; stemmed and unstemmed; common asymmetric triangular forms	Marpole	G with shell
contracting stem chipped basalt points	Locarno Beach	P, G/O, G-2
microblades and cores	Marpole Locarno Beach	P, G-2
chipped slate/sandstone knives or scrapers	Locarno Beach	H
cobble, split cobble, and boulder spall tools	Locarno Beach	I, K, G/O, G with shell, P
large faceted ground slate and bone points	Locarno Beach	-
large ground slate points, faceted on lenticular cross section	Marpole	G with shell
thin, triangular ground slate points	Gulf of Georgia	G/O, G with shell, G-2, F, N
thin ground slate knives	Gulf of Georgia Marpole	A, F, "G", G with shell
thick ground slate knives, partial abrasion	Locarno Beach	I
large, well made celts	Gulf of Georgia	G with shell
various sized, roughly finished celts	Marpole	-

TABLE XXII (continued)

artifact class	culture type	stratigraphic association, DiSe 7.
small, well made celts	Locarno Beach	"G"
labrets and earspools	Marpole Locarno Beach	-
Gulf Islands Complex items	Locarno Beach	-
flat-topped hand mauls	Gulf of Georgia	-
decorated-top hand mauls	Marpole	-
numerous, irregular abrasive stones	Gulf of Georgia	A, D, C, F, K, N, G/O, G with shell, P
handstones and grinding slabs	Locarno Beach Marpole	-
disc beads of shale or clam shell	Marpole	N, G/O, G with shell, P
perforated stones, large and small	Marpole	-
grooved or notched sinkers	Locarno Beach	-
stone sculpture	Marpole	-
unilaterally barbed bone points	Gulf of Georgia	K, H
unilaterally barbed antler points	Marpole	G with shell
bilaterally barbed antler points	Locarno Beach	-
numerous single and double pointed bone objects	Gulf of Georgia	A, B, D, E, C, F, G/O, G with shell, H, J, G-2, dark G
split or sectioned bone awls	Gulf of Georgia Marpole	B, F, "G", I, K G/O, G with shell

TABLE XXII (continued)

artifact class	culture type	stratigraphic association, DiSe 7.
large needles (bone)	Marpole	-
heavy bone wedges	Locarno Beach	-
antler wedges	Gulf of Georgia	A, F, K, G/O, G with shell
barbed antler harpoons with line attachment	Marpole	-
antler sculpture	Marpole	-
antler composite toggling harpoons valves	Gulf of Georgia Locarno Beach	A, D, F, G/O, G with shell
antler one piece toggling harpoon heads	Locarno Beach	-
antler foreshafts for above harpoons	Locarno Beach	P
triangular ground sea mussel points	Gulf of Georgia	-
sea mussel shell celts	Locarno Beach	-
frequent use of native copper ornaments	Marpole	G with shell
loosely flexed midden burial above ground deposition; few lasting inclusions	Gulf of Georgia	-
midden burial, loose to tight flex; often inclusions, sometimes cairns	Marpole	F, K, G/O, G with shell, P
skull deformation	Gulf of Georgia Marpole	F
large post moulds and house outlines	Gulf of Georgia Marpole	-
clay lined depressions and vertical rock slab alignments	Locarno Beach	-
inland location occasionally	Locarno Beach	-

CHAPTER V

FEATURES

Introduction

Seven features are described in this section. They range in size from small basin-shaped depressions of less than one meter in diameter to rock alignments of 275 meters in length. These features are intended to show pertinent aspects of the cultural development at this site. Two features are included because their relationship to the cultural sequence is unknown.

Features

Figure 21 shows in plan the rock wall fish trap to the southeast of the site. It is believed that this trap was used to harvest the abundant herring run that occurs along this beach in early spring each year. A similar fish trap has been recorded approximately five miles south of the Big Qualicum River. In each case, advantage has been taken of natural inter-tidal beach formations. The trap is constructed in a large depression with a relatively sandy bottom. To the water side of the trap is a ridge of cobble covered beach, the elevation of which is higher than the top of the rock walls forming the trap. This beach ridge protects the rock walls

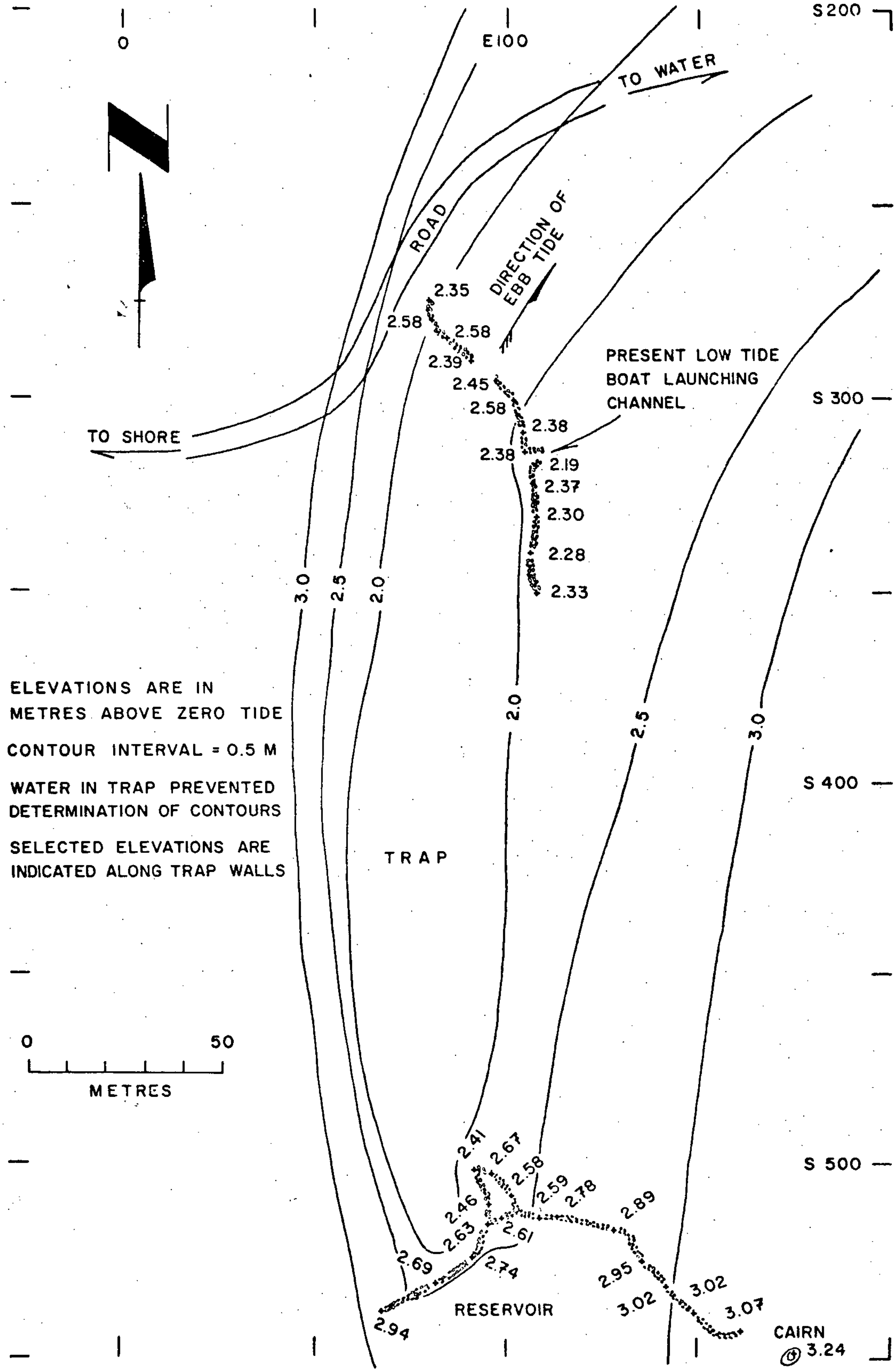

Figure 21. Rock wall fish trap, DiSe 7.

of the trap from wave destruction. Even in a large storm the walls are covered by about one meter of water before large waves pass over them. The floor of the depression in which the trap is constructed slopes down to the north. Water therefore enters and leaves the trap from the north end. Following the current out of the trap, fish would come to a relatively narrow aperture in the stone walls where they would be taken in set nets, dip nets, or basketry traps. Present use of the Deep Bay fish trap as a low tide boat launching basin may have altered this portion of the trap, but on the trap below Big Qualicum River the feature is quite evident.

At the high end of the trap the rock wall flares into two wings that meet in an abrupt V-shaped protrusion that points into the fish trap. This irregularity in the wall is at approximately the deepest part of the depression in which the trap is built. On an ebb tide the water inside the trap drains at a faster rate than water comes into it from the reservoir beyond this wall, and the water coming into the trap passes mostly through the V formation in the wall with considerable speed. The purpose of this configuration is unclear. Possibly it represents an initial trap for fish following the ebb tide out of the reservoir beyond the trap; possibly it regulates draining in the trap so that fish in the trap will seek an exit from the trap over a longer period of time than if a school were to exit all at once. In either case, the result would be a more efficient procedure for the acquisition of fish within the trap. No age can be assigned to the trap, but its ingenious construction would preserve it for as long as the cobble ridge remained stable.

An historic feature is shown in Figure 22. A cement block is clearly visible in the upper right corner of the picture, and the edge of another one can be seen between two boulders just above and to the left (west) of the stake in the foreground. To the left of this feature, in excavation unit 1, are a series of disturbed strata that were probably dumped there recently as fill for the outside of the rock alignment. To the right (east) of the feature, in excavation unit 2, the surface of natural stratum C is visible. Although historic materials are not uncommon in C, they may be present as a result of having been intruded into an aboriginal stratum that is relatively thin. It can be seen that the cobbles and at least one cement block rest on, rather than in, natural stratum C.

A concentration of adzed antler fragments, labelled artifact #1147, is shown in Figure 23b. These fragments, numbering well over one hundred, were found lying on the surface of natural stratum M in an area about 70 x 55 cm. A crescent of crushed mussel shell flanks the antler concentration to the west. Most of the fragments were small and in poor condition when collected. Subsequent preservation

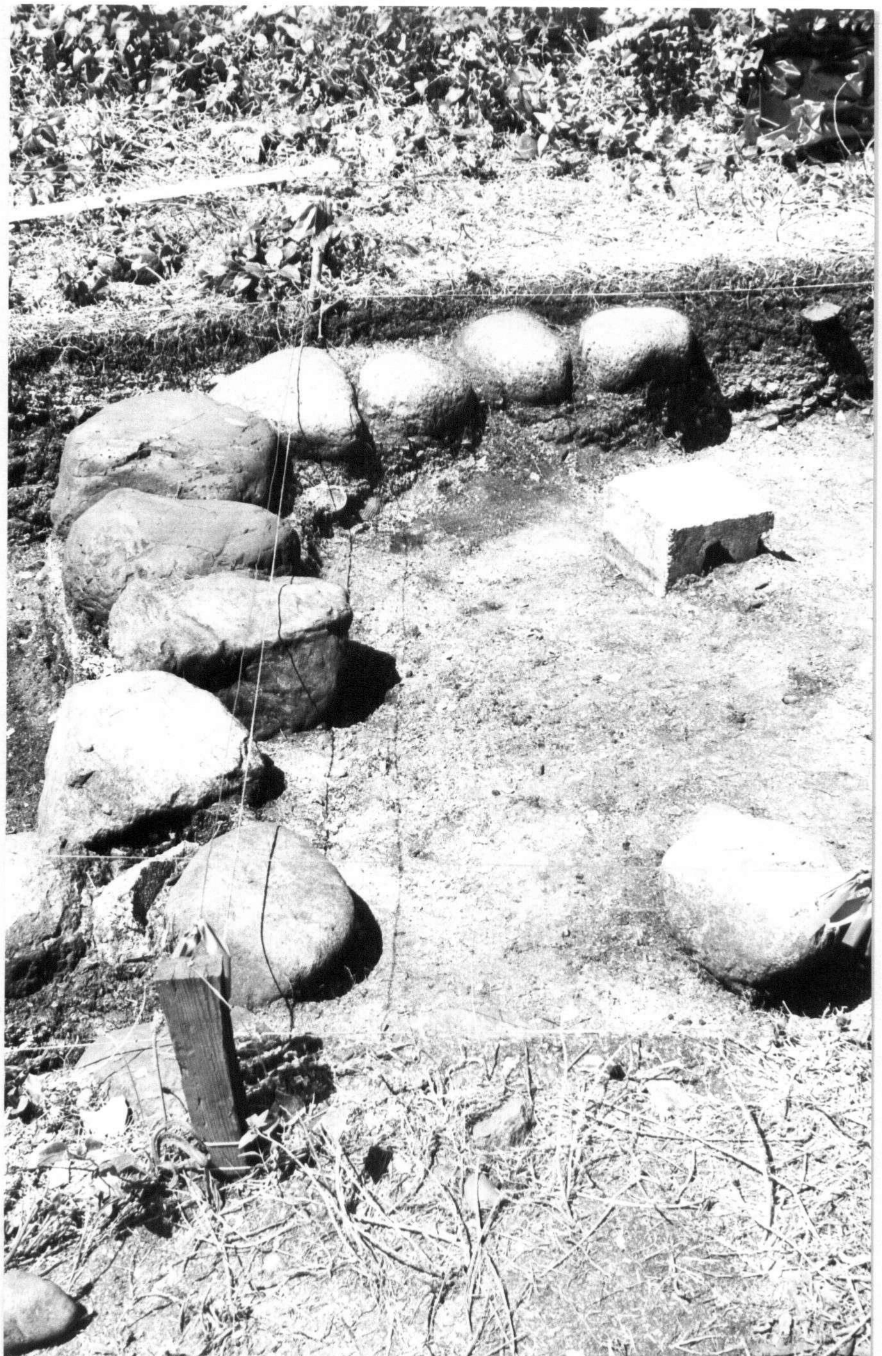

Figure 22. Historic feature showing cement blocks, Lot 73, DiSe 7.

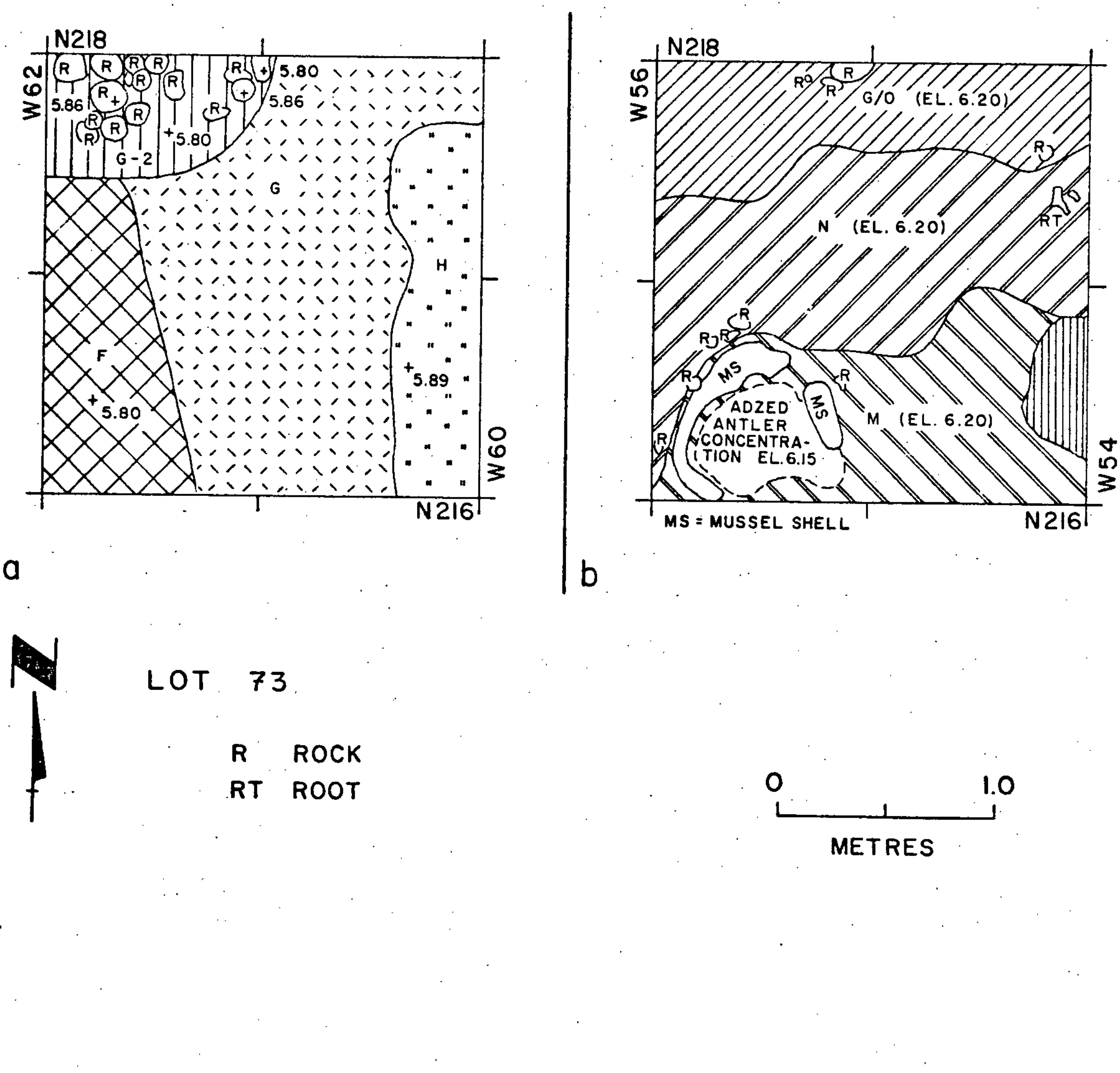

Figure 23. Features and burials, Lot 73, DiSe 7.
a. plan of natural stratum G-2;
b. concentration of adzed antler fragments.

in the laboratory managed to save most of them, but some simply disintegrated. The few larger fragments indicate that an antler beam--probably of an elk, judging from the reconstructed diameter of the beam--had been adzed along the surface and diagonally at one end. Many fragments appear to have been split from the beam after it was adzed. The concentration of the debris and the manner in which it has been worked suggests that it is the detritus of initial antler manufacturing. This process may have involved freeing the antler from the skull, producing useful pieces of antler, or roughing raw antler into shape for abrasion. The variety in fragment size and the very small size of most fragments suggests that this material constitutes primary refuse. As such, it may indicate a brief, seasonal site occupation (Schiffer 1972:162).

Figure 23a shows the areal extent of natural stratum G-2 and some of its stratigraphic associations. An appraisal of the shape of this feature, as shown by the profiles and the figure, suggests that it is a shallow, roughly circular pit excavated into natural stratum H. As the plan shows, there are numerous rocks in this feature, some of which are firecracked. The feature also contains large quantities of whole and fragmented clam shell. Butter clam, little neck clam, barnacle, and edible mussel are the predominant species. The matrix is loose brown sandy soil. This feature is reminiscent of two features of similar size, shape, and content at

Saltery Bay (Monks n.d. a).

Clams were reported to have been steamed open over hot rocks in earth ovens. This process is a prelude to clam storage preservation techniques (Gunther 1927:206; Barnett 1975:61), but it is not inconceivable that clams were cooked in this manner on an everyday basis as well. The denial of aboriginal stone boiling by four well informed sources (Barnett 1975:68) implies that cooking over hot rocks in an earth oven may have been very common in aboriginal times. Of the mollusc species found to be abundant in natural stratum G-2, basket cockle is the only one that was even occasionally sought for storage (Stern 1934:47). Thus, material stratum G-2 may represent an earth oven or steaming pit used to prepare several species of mollusc for everyday consumption.

Figure 24 shows disarticulated dog remains in the upper cairn of Burial 5. The remains pictured here were found between layers of cobbles covering the human remains. The photograph was taken facing east. A full discussion of these remains is included with the discussion of Burial 5 (see Appendix II). Cairn burials, often with inclusions, are listed by Mitchell (1971a:52) as distinctive archaeological features of the Marpole Culture Type. Although dog remains are not listed among the usual inclusions, dog burials are ethnographically recorded (Barnett 1975:97), and it is conceivable that a dog might be buried with its owner.

The clay floor as it was exposed in excavation units 3

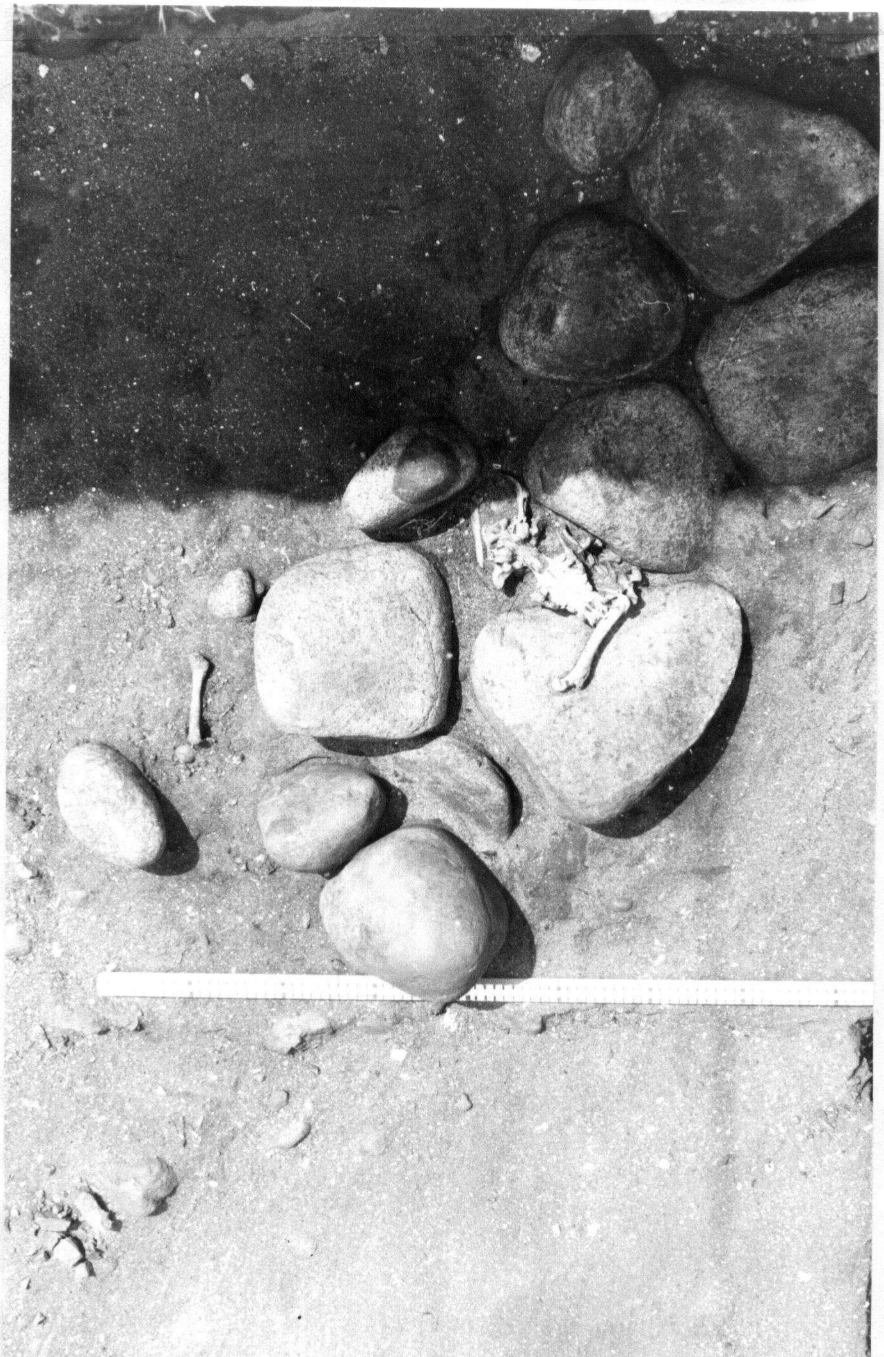

Figure 24. Dog remains in cairn of Burial 5, Lot 73, DiSe 7.

and 4 is shown in Figure 25. As the figure shows, the floor was only several centimeters thick, and it sloped down from its first appearance at about west 54.20 m. It was very thin in excavation unit 2 and consequently removed before it was noticed. No cultural remains were found below this floor. Carbon sample GaK-6039 was obtained from this feature in excavation unit 4. The genesis of this floor is unknown, but its uniqueness among the water deposited strata, its impregnation with many small pieces of charcoal, the presence of cultural material above it, and the absence of such material below it, all suggest that it may not be of natural origin. Instead, it may represent a compacted living area at a period of relatively low tides.

Figure 26 shows a depression in the surface of natural stratum D on Lot 81. This depression has a square outline with rounded edges and corners and is approximately one meter square. It is set in a clay stratum that is discontinuous throughout the excavation unit. Beside the feature is a large slab of disintegrated sandstone and a large hole through the clay stratum that may be a post hole or a cache pit. In this depression were found an abrasive stone, an antler composite toggling harpoon valve, whole butter clam and edible mussel shell valves, and a cherry pit (*Prunus sp.*).

The feature itself is 5 cm to 10 cm deep with sides that slope at approximately a 45° angle to a flat bottom. The perimeter of the depression is orange, as if the clay had

Figure 25. Compacted sand, gravel, and clay floor, Lot 73, DiSe 7.

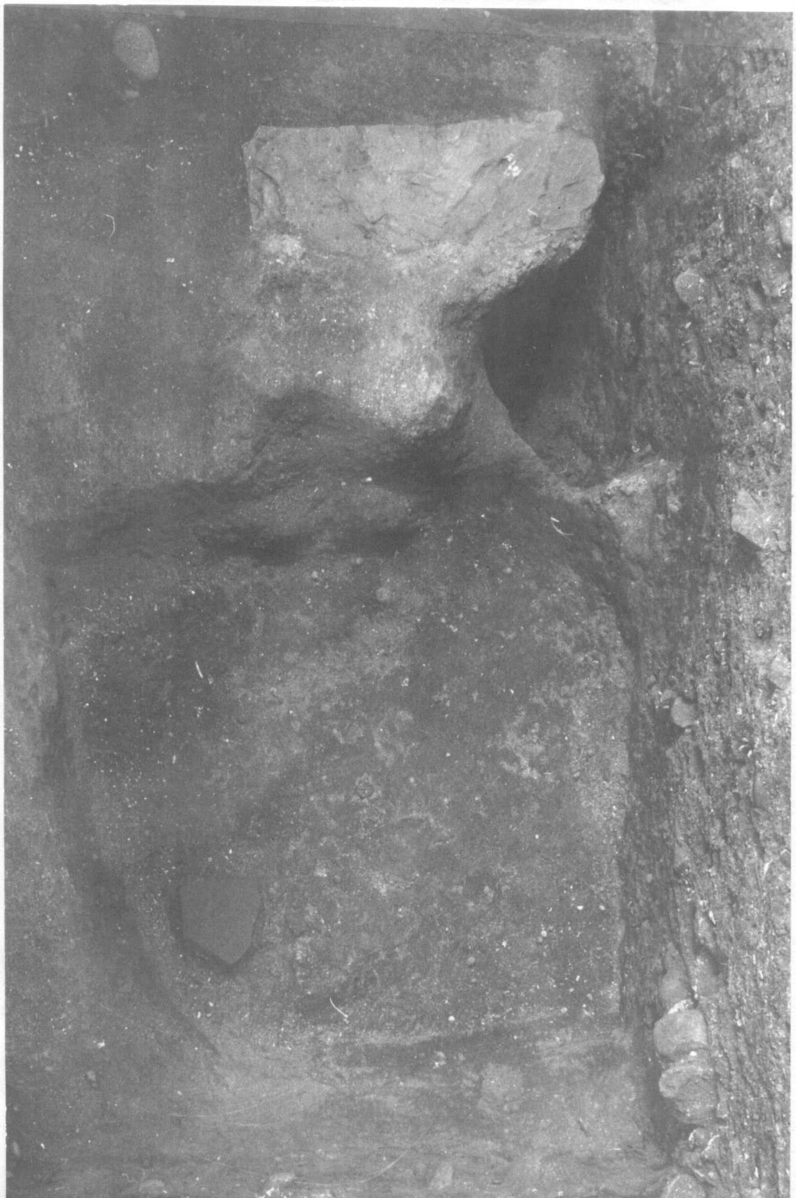

Figure 26. Depression in natural stratum D, Lot 81, DiSe 7.

been fired, but the bottom of the depression and the clay away from the perimeter of the depression are yellowish-brown. Combined with the total absence of charcoal and firecracked rock, these findings seem to indicate that the depression was not used as a hearth or fire pit. What the feature may have been used for is not clear, but it was probably inside a shelter of some sort. Otherwise, its surface would probably be eroded.

CHAPTER VI

FAUNAL REMAINS

Introduction

This chapter presents a description of the faunal remains recovered from the excavations on Lots 73 and 81. All the mammal and bird remains were weighed individually and identified. Identifications were based on comparative skeletal collections in the Department of Zoology Vertebrate Museum and the Archaeology Laboratory at the University of British Columbia and in the British Columbia Provincial Museum's Birds and Mammals Division. Primary written references were Olsen (1968), Howard (1929), Gilbert (1973), and Schmid (1972). The minimum numbers of individuals for each class of remains was calculated within each analytical unit by how many of any given skeletal elements were present and whether the elements were adult or juvenile. Estimating minimum numbers of individuals on the basis of both natural stratum and excavation unit boundaries produces a relatively inflated estimate compared to within-site or within-stratum estimates (Grayson 1973:432-439). Consequently, the estimates presented in this chapter should be used only to compare variations in abundance of a class from one analytical unit to another. These estimates hold no real value in terms of inter-site comparisons.

Estimates were also made of the grams of usable meat represented by each class of remains within each analytical unit. Multiplying the minimum numbers of individuals in a given class by the live weight of one individual produces a total live weight. This weight is then multiplied by a fraction, representing the usable portion of an individual animal of the class, to produce an estimate of usable meat represented by the remains in question. This procedure, the estimates of live weight, and the estimated fraction of usable meat for each faunal class follow White (1953:346-348). As with minimum numbers of individuals, these estimates are intended to be used only as a measure of relative availability within this particular site. Because these estimates are based on figures for minimum numbers of individuals, distortions contained in these estimates are inherent in subsequent estimates of grams of usable meat.

The fish and mollusc remains were not subjected to such rigorous treatment. The prodigious amounts of these remains made 100% identification impractical. It was decided to sample these faunal remains in conjunction with the soil samples reported in Chapter III and Appendix I. Consequently, there were thirty samples of these remains from analytical units on Lot 73 and ten from analytical units on Lot 81. A 500 cc sample of matrix was mechanically split from the dried 2 liter field samples. This was passed through a stack of Canadian Standard Sieves containing 8mm, 4mm, and 2mm mesh sizes. Rocks were removed, and the remaining organic debris, mostly fish and mollusc remains, were identified and separated according to faunal class. The remains in each class were then weighed. No estimates of minimum numbers of individuals or grams of usable meat were made.

Faunal Remains

Lot 81

Table XXIV presents the weights and minimum numbers of individuals of faunal remains from Lot 81. Table XXV shows the estimated grams of usable meat of each mammal and bird species in each analytical unit. Except in the case of elk, White's estimates for mammals seem to be conservative. Therefore, the weights of individuals used for these estimations are: elk, 500 lb (Cowan and Guiget 1968:361); mule deer, 200 lb (White 1953:397); sea lion, 1500 lb (average adult male and female, Cowan and Guiget 1968:347); and seal, 185 lb (average adult male and female, Cowan and Guiget 1968: 353). Estimates of live weights of bird species are taken from White (1953:398) and from inferences derived from Guiget (1958, 1967). For both birds and mammals the estimated percentages of usable meat for each species (White 1953:397-398) were used. Dogs are omitted because they are not ethnographically known to be a subsistence resource.

Mammal and bird remains not present at least twice will be deleted from subsequent analyses and are presented in Table XXVI. Fish and mollusc remains not present in at least two

TABLE XXIII

List of Generic and Common Names of Species Found in Tables XXIV through XXX, Lots 73 and 81, DiSe 7.

Generic Name	Common Name
Bos sp.	cow
Canis sp.	domestic dog
Castor canadensis (Kuhl)	beaver
Cervus elaphus (Linnaeus)	wapiti
Delphinidae	dolphins and porpoises
Eumetopias jubata (Schreber)	northern sea lion
Microtus sp.	mouse
Odocoileus hemionus columbianus (Rafinesque)	mule deer or coast black tail deer
Phoca vitulina richardii (Linnaeus)	harbor seal or hair seal
Procyon lotor (Linnaeus)	raccoon
Anas sp.	surface feeding ducks
Aythya marila (Linnaeus)	greater scaup duck
Bonasa umbellus (Linnaeus)	ruffed grouse
Brachyramphus sp.	murrelet
Branta sp.	goose
Corvus corax (Linnaeus)	raven
Dendragapus obscursus (Say)	blue grouse
Fulica sp.	coot
Gavia sp.	loon
Haliaeetus leucocephalus (Linnaeus)	bald eagle
Larus sp.	seagull
Mareca americana	american widgeon
Melanitta sp.	scoter
Olor sp.	swan
Phalacrocoracidae	cormorant
Podiceps/Colymbus	grebe
Spatula clypeata (Linnaeus)	shoveller
Uria sp.	murre
Clupea harengus pallasii (Valenciennes)	pacific herring
Hemilepedotus sp.	red irish lord
Oncorhynchus sp.	salmon
Ophiodon elongatus (Girard)	ling cod
Pleuronectiformes	flounders and halibuts
Squalus suckleyi (Girard)	dogfish

TABLE XXIII (continued)

Generic Name	Common Name
Acmaea sp.	limpet
Balanus sp.	barnacle
Bittium sp.	bittium
Clinocardium nuttalli (Conrad)	basket cockle
Echinarachinius exentricus (Eschscholtz)	sand dollar
Iselica obtusa laxa (Dall)	blunt or obtuse iselica
Macoma nasuta (Conrad)	bent nose clam
Mytilus californianus (Conrad)	sea mussel
Mytilus edulis (Linnaeus)	edible or bay mussel
Nassarius mendicus (Gould)	lean dog whelk
Ostrea lurida (Carpenter)	native oyster
Polinices lewisii (Gould)	moon snail
Protothaca staminea (Conrad)	little neck clam
Saxidomus giganteus (Deshayes)	butter clam
Strongylocentrotus drobachiensis (Muller)	green sea urchin
Thais sp.	purple whelk
Tresus sp.	horse clam
Cancer sp.	crab

TABLE XXIV

Weight (gm) of Faunal Remains by Excavation Unit and Natural Stratum, Lot 81, DiSe 7. MNI = minimum numbers of individuals

FAUNA																
MAMMALS							BIRDS									
Canis sp.	Cervus elaphas	Eumetopias jubata	Odocoileus hemionus columbianus	Phoca vitulina	Unidentifiable land mammal	Unidentifiable sea mammal	Anas sp.	Aythya marila	Larus sp.	Melanitta sp.	Olor sp.	Podiceps/Colymbus	Unidentifiable duck	Unidentifiable bird	Excavation units	Natural stratum
40.00	6.60		81.30	6.00	116.60	7.60	.10		.10	.30		1.10	4.80	7.10	1	A
24.20		5.50	147.20		189.90	9.70		.10	.40	5.70	4.50	.30	3.00	26.11	2	A
51.70		50.90	143.20	14.30	401.10	28.00			2.30				7.90	35.60	3	A
5.00	6.60		41.10		110.10	17.20				.60			.80	7.60	4	A
9.50			14.80		43.90	1.20		1.80				1.60	1.40	12.00	2	B
.90			5.10		26.00				.30		1.00	.10	1.30	5.00	3	B
8.50			11.50		14.90								.10	.60	2	C
2.30	26.60		8.60		30.20				.50			.10	.90	6.00	3	C
															3	C1
					1.10	1.20									3	C2
					1.70		.10								3	D
1.40			4.90		8.50										3	E
9.60			4.40		5.10		.70	.80					.50	2.50	3	F
			.27		.54								.30	.70	3	F1
															3	G

FAUNA														MNI														
FISH				MOLLUSCA										MAMMAL					BIRD									
Clupea harengus pallasii	Oncorhynchus sp.	Squalus suckleyi	Unidentified fish	Clinocardium nuttalli	Mytilus edulis	Protothaca staminea	Saxodomus giganteus	Unidentifiable clam	Iselica obtusa	Thais sp.	Balanus sp.	Echinarachnius exentricus	Strongylocentrotus drobachiensis	Canis sp.	Cervus elephas	Eumetopias jubata	Odocoileus hemonius	Phoca vitulina	Anas sp.	Aythya marila	Larus sp.	Melanitta sp.	Olor sp.	Podiceps/Colymbus	Unidentifiable duck	Excavation units	Natural stratum
														2	1		3	1	1		1	1		1	3	1	A
														2		2	3			1	1	1	1	1	1	2	A
.91	.07	.03	.30	6.19	22.81	8.08	13.63	6.92		1.47	7.73	.10	.16	4		1	2	1			1				2	3	A
														1	1		2					1			2	4	A
														2			1			1				1	1	2	B
1.55	.07	.06	.37		21.42	2.35	3.28	8.45	.05	1.44	4.79	.38	.58	2			1				1		1	1	1	3	B
														2			2								1	2	C
.01			.01		.36			.30						1	1		2				1			1	1	3	C
.36			.01		5.35	.18	.90	4.22		1.82	1.66		.04													3	C1
.08			.03		.07			.10			.10															3	C2
.03			.06		.24																					3	D
.21			.16		1.49			.52			.04	.08							1							3	E
.78			.18		27.45			.09	.01	.13	.50	.05		2			2								1	3	F
.27			.11		59.55			.14			.95	24		2			1		1	1					1	3	F1
.10					6.70			.10			.80						1									3	G

TABLE XXV

Estimated Weight of Usable Meat (gm) for each Identifiable Mammal and Bird Species by Excavation Unit and Natural Stratum, Lot 81, DiSe 7.

Natural Stratum	Excavation Unit	*Cervus elaphus*	*Eumetopias jubata*	*Odocoileus hemionus*	*Phoca vitulina*	*Anas sp.*	*Aythya marila*	*Larus sp.*	*Melanitta sp.*	*Olor sp.*	*Podiceps/Colymbus*	unidentifiable duck	Total
A	1	11364	-	13636	5910	79	-	95	95	-	48	237	31464
	2	-	95454	13636	-	-	63	95	95	477	48	79	109947
	3	-	47727	9090	5910	-	-	95	-	-	-	158	62980
	4	11364	-	9090	-	-	-	-	95	-	-	158	20707
B	2	-	-	4545	-	-	63	-	-	-	48	79	4735
	3	-	-	4545	-	-	-	95	-	477	48	79	5244
C	2	-	-	9090	-	-	-	-	-	-	-	79	9169
	3	11364	-	9090	-	-	-	95	-	-	48	79	20676
C-1	3	-	-	-	-	-	-	-	-	-	-	-	0
C-2	3	-	-	-	-	-	-	-	-	-	-	-	0
D	3	-	-	-	-	79	-	-	-	-	-	-	79
E	3	-	-	9090	-	-	-	-	-	-	-	79	9169
F	3	-	-	4545	-	79	63	-	-	-	-	79	4766
F-1	3	-	-	4545	-	-	-	-	-	-	-	-	4545
G	3	-	-	-	-	-	-	-	-	-	-	-	0
	Total	34092	143181	90902	11820	237	189	475	285	954	240	1106	283481

TABLE XXVI

Weight (gm) of Mammal and Bird Remains Not Present in at Least Two Excavation Units by Natural Stratum and Arbitrary Level, Lot 81, DiSe 7.

Species	Natural stratum	A				B	F-1
	Excavation unit	1	2	3	4	2	3
Mammals							
Bos		227.8	-	-	-	-	-
Castor canadensis		-	-	0.6	-	-	-
Microtus		0.2	-	-	0.1	-	-
Procyon lotor		-	-	-	-	2.8	-
Birds							
Dendragapus obscursus		-	1.5	-	-	-	-
Haliaeetus leucocephalus		-	-	-	-	1.4	-
Mareca americana		-	0.1	-	-	-	-
Phalacrocoracidae		-	-	-	-	-	0.3
Spatula clypeata		-	0.1	-	-	-	-

samples are presented in Table XXVII. Thus, birds and mammals not present in at least 6.7% of all analytical units and fish and mollusc remains not present in at least 10% of all samples are found in this table. It can be seen that land mammal remains are more common than sea mammal remains and that only 2.4 gm of a total of 141.6 gm of sea mammal remains were recovered from undisturbed deposits. Land mammal remains, primarily deer, dog, and unidentified land mammal, predominate in the undisturbed deposits. Of the identified remains, deer is the more common. Among birds, unidentifiable duck and unidentifiable bird are most common. All the identified species are water birds, and all but Larus sp. (seagull) are migratory. The greatest weight of bird remains comes from the disturbed stratum. The fish remains indicate that a very narrow range of species was commonly exploited. No species is limited to the disturbed stratum, but dogfish and salmon are uncommon in the aboriginal deposits. The frequent occurrence of herring remains suggest its importance as a subsistence resource. The absence of fish species from natural stratum A in excavation units 1, 2, and 4, and from strata B and C in excavation unit 2 is a result of sampling procedure. The same is true for mollusc remains. All species are present in both aboriginal and historic deposits, with the exception of Iselica obtusa. This species is found only in aboriginal deposits. Edible mussel is the most frequently represented species, followed closely by barnacle. Unidenti-

TABLE XXVII

Weight (gm) of Fish and Mollusc Remains Not Present in at Least Two Samples by Excavation Unit and Natural Stratum, Lot 81, DiSe 7.

Species	Natural stratum	H	B	F
	Excavation unit	3	2	3
Fish				
Ophiodon elongatus		-	-	0.47
Mollusc				
Clinocardium nuttalli		6.19	-	-
Ostrea lurida		-	0.23	-
Polinices lewisii		-	4.21	-

fiable clam, not surprisingly, is plentiful. Natural stratum B contains more mollusc species than any other stratum, although natural stratum C-1 approaches the same species content.

The minimum numbers of individuals were calculated only on identified mammal and bird species. Among the mammals, it can be seen again that sea mammal remains are found only in the disturbed stratum. The calculation of minimum numbers of individuals is a good equalization mechanism of comparing relative abundance of species whose remains are of markedly different weights (Imamoto 1974:31). This can be seen in examining dog and deer remains. Whereas their total weights on Lot 81 are 153.1 gm and 464.8 gm respectively, they both represent the remains of twenty individuals. The range of individuals in a given stratum and excavation unit is not as great for birds as it is for mammals. Except for the presence of unidentifiable duck remains in several instances, all other species remains represent single individuals. Natural strata C-1, C-2, F-1, and G contain no bird individuals, and Melanitta sp. remains, as noted before, are confined to the disturbed stratum.

Table XXV indicates that sea lion accounts for the largest quantities of usable meat. Half of the usable meat represented by the Lot 81 mammal and bird remains comes from this source. Deer is next most important as a meat source, representing approximately one-third of the total usable meat on Lot 81. Elk ranks third at 12% of the total, and seal is the lowest ranking mammal at 4%. Thus, mammals represent about 98% of the usable meat from birds and mammals on Lot 81. This suggests that the taking of mammals was much more likely to have been a major activity than fowling, in terms of meat acquisition.

It is clear from the totals for each analytical unit that the greatest weights of remains occur in the disturbed/ historic stratum. Without chronological control, however, it is impossible to say whether this situation represents differential deposition of faunal remains over space, or through time, or both. If the disturbed/historic strata are omitted from consideration, then deer becomes the most important source of meat, followed by elk. No sea mammals were recovered from the aboriginal deposits. However, mammals continue to account for by far the largest amount of usable meat. Although land mammals predominate in the strictly aboriginal context (i.e. they are found in the undisturbed natural strata), it seems clear that sea mammals were exploited at some time in the past and that sea lions especially could have accounted for large proportions of the total usable meat.

Table XXVI and XXVII contain species that do not occur frequently enough to be included in Table XXIV. These species are found only in natural stratum A. Mouse is included in this table rather than in Table XXIV because these rodents are not reportedly used as food resources. Their remains are often found articulated, suggesting that they may have died in burrows intruded into earlier strata. It is somewhat surprising that raccoon, a common species, occurs infrequently. On the other hand, the absence of beaver, which is locally uncommon, is not too surprising. Of the five bird species represented, eagle and grouse are not migratory. The single fish species represented, ling cod, is surprisingly infrequent considering its general availability throughout the Gulf of Georgia. Equally surprising is the infrequent occurrence of basket cockle when it is so readily available in the intertidal zone on either side of the site. Native oyster and moon snail are not as commonly used for food as clams, according to ethnographic sources, so it is reasonable that they should occur infrequently in archaeological deposits.

Lot 73

The faunal remains from Lot 73 have been edited as well. Bird and mammal species not present at least five times (i.e. those not having a chance of occurring at least once in each excavation unit) were omitted from Table XXVIII. Thus, in 63 possible occurrences, those occurring 6.3% of the time or less are deleted. The deleted species are presented in Table XXIX. Also, fish and mollusc remains not present in at least three out of thirty samples (10%) are deleted and found in Table XXIX as well. This table indicates that bird, fish, and mollusc remains are absent, except for one minute exception, from natural stratum P and earlier strata. It is also apparent

TABLE XXVIII

Weight (gm) of Faunal Remains by Excavation Unit and Natural Stratum, Lot 73, DiSe 7. MNI = minimum numbers of individuals

Excavation Unit	Natural Stratum	FAUNA: MAMMALS							BIRDS							FISH			
		Canis sp.	*Eumetopias jubata*	*Odocoileus hemionus columbianus*	*Phoca vitulina richardi*	Unidentifiable land mammal	Unidentifiable sea mammal	Unidentifiable mammal	*Branta* sp.	*Aythya marila*	*Haliaeetus leucocephalus*	*Larus* sp.	*Podiceps/Colymbus*	Unidentifiable duck	Unidentifiable bird	*Clupea harengus pallasii*	*Oncorhynchus*	*Squalus suckleyi*	Unidentifiable fish
A	1	3.50		2.10		23.00		.40						.30					
	2	2.90		38.70		37.90			3.30	.40		.60			1.60	.53	.03	.04	.09
	3	12.00		14.10		115.20					1.30			.50	3.50				
	4	38.70		51.70		222.30	78.90				3.50	1.10	.30	4.30	5.50	.27		.01	
	5	14.60		26.50		151.10	20					40		2.80	2.30				
B	1			12.50	3.70	71.70								90	1.30				
	2															1.39	.01		.26
D	1	26.60		.90		24.47	5.80			.60			10	70	4.30	.19			.23
	2			2.40		7.70									30				
E	1														4.00	.07			.08
	2																		
C	2	50.30		9.90		49.30								.10	2.90	1.04			.10
	3	9.90		.50		44.90	1.90							1.20	1.00				
	4			4.70		20.90									2.10	54		03	04
F	1	99.90	17.80	61.00	14.10	145.90						.70		1.50	6.40				
	2	33.40	96.10	23.70	1.10	54.70	60		1.00						30	1.21			.19
	3	17.70		17.10		177.40	19.90		.20			2.90		40	5.00	-			
	4	4.30				107.50	7.90					.20			4.80	09			.02
	5	15.00		34.60		124.70					4.10			.70	2.50				
GX	4			8.70	1.50	98.10	5.70						.20		2.20	06	.03		.06
	5	2.10		18.20		34.33									30				
I	3	17.50		23.60		46.10									4.30				
	4	10		3.50		4.00									10				.10
	5	10.30				28.70													
J	4																		.03
	5			7.60		10.60													
K	3	11.10		12.40		20.50							.10		.60				
	4	1.40		3.40		32.40	5.60	2.50	4.00					1.40	1.60	.06			.01
	5	20.70		8.50		33.80								50	.80				
M	3	4.00		1.20		3.10													
	4	13.80		30		6.40	6.20					2.40			.20	76			.03
	5	53.60				6.10	1.00												
N	3		1.90			21.60	9.40							.20	.10				
	4	47.20	125.00	4.00		27.40	49.80							.80	40	03			.02
	5	149.60	59.30	26.70	36.40	43.70	13.60			.60					20				
GO	1	1.80		2.10		1.70													
	2	13.20		15.90		51.30	4.00							.90		1.20		.30	.23
	3	20.60		55.20		85.00	8.10				9.00		.40	.10	6.70				
	4	52.20		35.10	17.10	109.90	21.00					40	.10	2.20	3.40	.56	.02	.03	.04
	5	2.00	79.00	8.60	5.10	84.00	31.00			.50				1.20	1.70				
GS	1	5.80	153.60	34.40	4.30	103.00				.70		5.00		1.30	1.50	1.04	.08		.33
	2	69.30	65.00	68.30		204.80	5.50		1.20			3.80		11.00	14.00				
	3	205.00	209.60	51.60		83.20	23.40				.10	8.50	.60	5.00	5.10				
G2	1			10.00		18.00								.40		1.14			.03
GD	3															.10			.07
H	1	.60		24.50	28.00	66.30					7.50			.30	2.40				
	2				26.30	67.50		2.30				80			2.30	1.13		.02	.11
HI	1	60				13.40									1.30	04			
	2	.10				2.50						10		.10	.30	.58			
Q	2					3.60								.40	10				
R	1																		
	2					.10			1.10						10				
S	2															.05			
P	1			4.70	7.20	7.10									.90				
	2			1.60		3.60									1.00				
	3			10		9.40													
	4	11.90				3.50								1.00	.40				
T	2					1.50													
	4																		
P1	1			3.00		9.70													
	4																		
T1	2					1.20									2.60				
P2	2					.30													

TABLE XXVIII (continued)

FAUNA: MOLLUSCA															MNI: MAMMAL				MNI: BIRD							
CLINOCARDIUM NUTTALLI	MACOMA NASUTA	MYTILUS EDULIS	PROTOTHACA STAMINEA	SAXIDOMUS GIGANTEUS	TRESUS SP.	UNIDENTIFIABLE CLAM	ACMAEA SP.	BITTIUM SP.	ISELICA OBTUSA	THAIS SP.	UNIDENTIFIABLE GASTROPOD	BALANUS SP.	ECHINARACHNIUS EXENTRICUS	STRONGYLOCENTROTUS DROBACHIENSIS	CANIS SP.	EUMETOPIAS JUBATA	ODOCOILEUS HEMIONUS	PHOCA VITULINA	BRANTA SP.	AYTHYA MARILA	HALIAEETUS LEUCOCEPHALUS	LARUS SP.	PODICEPS/COLYMBUS	UNIDENTIFIABLE DUCK	EXCAVATION UNIT	NATURAL STRATUM
						7.19			.30			7.86	.27		2		1							1	1	A
4.27	2 74	35 60	3.75	7.04											1		2		1	1		1			2	A
						8.44			.02			1.60			2		1				1			1	3	A
.13	.24	9.92	.47	5.93	1.13										3		2				1	1		2	4	A
															3		1	1				1		2	5	A
						3.51	.31		.48			84.36	1.69	.25			2							2	1	B
39.57	2.89	113.55		8.25	23.21	15.53		.04		1.31		21.97	1 03												2	B
3.15	4.35	52.36	14.65	47.77			.26								2		1							1	1	D
						6.53		.12	3.20	.09		57.72	2.25				1								2	D
4.83	3.40	125.96	20.49	11.78	.72																				1	E
						19.07	.08		.70	3.42		29.70	.41	.97											2	E
4.67		119 75	15.60	77.97	25.88										2		1							1	2	C
						7.51	.11	.11	.60		1.87	43.36	.24		2		1							2	3	C
16.54		119.67	4.50	70.98													1								4	C
						8 49	01		03			4.21	.20		3	1	2	1				1		1	1	F
1.78		44.77	1.47	13.21	7.28										2	1	2	1	1						2	F
						6.24			.13			9.11	.24	.58	2		3		1			1		1	3	F
1.42		23.60	.19	5.72																		1			4	F
						4.94	.03		.01			6.34	.61		1		2				1			1	5	F
2.80		60.96	.49	3.11													1	1					1		4	GX
															1		2								5	GX
						.20	.10				.10	.10			1		1								3	I
		1.40		.80	.30										1		1								4	I
						3.22	.03		.18	2.78		23.73	.15	.03	1										5	I
.42		76.12	2.35	3.60																					4	J
																	1								5	J
						1.32			.02			.49	.15		1		1						1		3	K
		2.31	.62	5.03											1		1		1					1	4	K
						.40	420								2		1							1	5	K
						.27			.08			4.69	.05		1		1							1	3	M
2.50		73.86		.38											1		1					1			4	M
															1										5	M
						.20					.07	.15				1								1	3	N
		1 .06	.50	4.59											2	1	1							1	4	N
															3	2	1	1		1					5	N
						7.36	.01					.25			1		1								1	GO
34		1 86	.39	2 16											2		1							1	2	GO
						4.77			.03	6.66		1.15		.05	1		1				1		1	1	3	GO
1 31		11 55	1.44	7.43											2		2	1				1	1	2	4	GO
															2	2	2	2		1				2	5	GO
.95						7 97			.07	46		3.28		06	1	1	2	1		1		3		1	1	GS
		12 09	1.38	16.76	65										3	2	2		1			1		3	2	GS
						30.67		.11	.10	1.45		13.98	.20	3.57	3	2	1	2			1	1	1	2	3	GS
2.27		28 42	16.35	124.75		2.50						.12					1					1		1	1	G2
.50		.72	.53	3 88																					3	GD
						15 55				.94		1.58		.11	1		3	1			1			1	1	H
		5.09	1.14	.61		57.21			.02			4.19						1				1			2	H
5.46		34.91	82.90	242.88		35.24			.03		.22	2.49		.11	1										1	HI
.66	1.10	3.94	19.38	34.29	9.48	.84						.15			1						1			1	2	HI
		.17	.77	.36											1						1			1	2	Q
						18.44			.17	1.40	.81	1.46		.03											1	R
.92		8.34	3.68	8.80		3.30			.04			1.24							1						2	R
12.61		37.18	1.09	2.97																					2	S
																	1	1							1	P
																	1								2	P
																	1								3	P
															1										4	P
																									2	T
					.11																				4	T
																	1								1	PI
																									4	PI
																									2	TI
																									2	P2

TABLE XXIX

Weight (gm) of Mammal, Bird, Fish, and Mollusc
Remains Deleted from Table XXVIII, Lot 73, DiSe 7.

Species	Natural stratum Excavation unit	A 1	A 3	A 4	A 5	B 1	B 2	D 1	E 1	C 2
Bos sp.		-	-	-	-	-	-	16.1	-	-
Castor canadensis		1.7	-	-	-	-	-	-	-	-
Cervus elaphus		-	-	-	-	6.4	-	5.0	-	-
Delphinidae		-	-	17.1	-	-	-	-	-	-
Microtus sp.		-	0.1	-	-	-	-	-	-	-
Procyon lotor		-	-	-	-	-	-	-	-	-
unidentifiable mammal		0.4	-	-	-	-	-	-	4.0	1.2
Cancer sp.		-	0.9	-	-	-	-	-	-	-
Anas sp.		-	-	-	0.2	-	-	-	-	-
Bonasa umbellus		-	-	0.2	-	-	-	-	-	-
Brachyramphus sp.		-	-	-	-	-	-	-	-	-
Corvus corax		-	-	-	-	-	-	-	-	-
Fulica sp.		2.0	-	-	-	-	-	-	-	-
Gavia sp.		-	-	-	-	-	-	-	-	-
Melanitta sp.		-	-	-	-	-	-	-	-	-
Uria sp.		-	-	-	3.1	-	-	-	-	-
Mytilus californianus		-	-	-	-	-	-	0.87	-	-
Ostrea lurida		-	-	-	-	-	-	-	-	-
Nassarius mendicus		-	-	-	-	-	-	-	-	-
Hemilepidotus sp.		-	-	-	-	-	-	-	-	-
Ophiodon elongatus		-	-	-	-	-	0.59	-	-	-
Pleuronectiformes		-	-	-	-	-	-	-	-	-

TABLE XXIX (continued)

Species	Natural stratum Excavation unit	C 3	C 4	F 2	F 3	F 4	F 5	"G" 4	J 5	K 4	G/O 2
Bos sp.		-	-	-	-	-	32.4	-	-	-	-
Castor canadensis		-	-	1.4	-	-	-	5.7	-	-	-
Cervus elaphus		-	-	-	-	-	-	-	-	-	-
Delphinidae		-	-	-	-	-	-	-	-	-	-
Microtus sp.		-	0.5	-	0.1	0.1	-	-	-	-	0.4
Procyon lotor		0.3	-	-	-	-	-	-	-	-	2.6
unidentifiable mammal		-	-	-	-	-	-	-	-	2.5	-
Cancer sp.		-	-	-	-	-	-	-	-	-	-
Anas sp.		-	-	-	-	-	-	-	-	-	-
Bonasa umbellus		-	-	-	-	-	-	-	-	-	-
Brachyramphus sp.		-	-	-	-	-	-	-	-	-	-
Corvus corax		-	-	-	-	-	-	-	-	-	-
Fulica sp.		-	-	-	-	-	-	-	-	-	-
Gavia sp.		-	-	-	0.1	-	-	-	-	-	-
Melanitta sp.		-	-	-	-	-	-	-	-	-	-
Uria sp.		-	-	-	-	-	-	-	-	-	-
Mytilus californianus		-	-	-	-	-	-	-	-	-	-
Ostrea lurida		-	-	-	-	0.50	-	-	-	-	-
Nassarius mendicus		-	-	-	-	-	-	-	-	-	-
Hemilepidotus sp.		-	-	-	-	-	-	-	0.90	-	-
Ophiodon elongatus		-	-	-	-	-	-	-	-	-	-
Pleuronectiformes		-	0.01	-	-	-	-	-	-	-	-

TABLE XXIX (continued)

Species	Natural stratum / Excavation unit	G/O 4	G/O 5	G shell 2	G shell 3	H 1	H 2	H-1 1	H-1 2	T-1 2
Bos sp.		-	-	-	-	-	-	-	-	-
Castor canadensis		-	-	-	-	-	-	-	-	-
Cervus elaphus		-	17.8	-	-	-	-	-	-	-
Delphinidae		-	-	-	-	-	-	-	-	-
Microtus sp.		0.3	0.2	-	0.4	-	-	-	0.1	-
Procyon lotor		-	-	-	-	-	-	-	-	-
unidentifiable mammal		-	-	-	-	-	2.3	-	-	-
Cancer sp.		-	-	-	-	-	-	-	-	-
Anas sp.		-	-	-	-	-	-	-	-	-
Bonasa umbellus		-	-	0.5	-	-	-	-	-	-
Brachyramphus sp.		-	-	-	-	0.2	-	-	-	-
Corvus corax		0.3	-	-	-	-	-	-	-	-
Fulica sp.		-	-	-	-	-	-	-	-	-
Gavia sp.		-	-	-	2.1	-	-	-	-	2.5
Melanitta sp.		-	-	1.4	1.4	-	-	-	-	-
Uria sp.		-	-	-	-	-	-	-	-	-
Mytilus californianus		-	-	-	-	-	0.52	-	-	-
Ostrea lurida		-	-	-	-	-	-	-	4.99	-
Nassarius mendicus		-	-	-	-	-	-	1.35	-	-
Hemilepidotus sp.		-	-	0.50	-	-	-	-	-	-
Ophiodon elongatus		-	-	0.30	-	-	-	-	-	-
Pleuronectiformes		-	-	-	-	-	-	-	-	-

that bird and mammal remains are less common in these strata compared with later strata. Among the mammals, the identified sea mammals are not found in strata that have, to this point, been treated as disturbed and/or historic strata. This distribution supports the previous treatment of the strata in question. Like Lot 81, dog, deer, and unidentified land mammal remains occur most frequently. It is worth noting also that seal remains are found in natural stratum P along with dog, deer, and unidentifiable land mammal. The persistence of land mammal remains into natural stratum P-2 suggests that, despite the absence of artifacts below natural stratum P-1, cultural deposits are being dealt with. Within the aboriginal strata, the frequency of mammal remains increases above and below natural stratum J, which contains relatively few remains.

Bird remains also tend not to be found in natural stratum J and to increase in frequency of occurrence on either side of this stratum. A very limited range of species is found in natural stratum P and below, only unidentifiable remains being found. Like the remains from Lot 81, the unidentifiable bird remains are most common on Lot 73, but among the identified species, seagull occurs most frequently. Seagull, bald eagle, and Canada Goose are non-migratory species. Like the bird species represented on Lot 81, the migratory birds represented on Lot 73 spend the winter on the coast. They nest in the interior of the province and in northern Canada.

Of the identified fish species, two out of three are also migratory. Salmon remains are found occasionally throughout the record, but herring remains are almost ubiquitous, being absent only from natural stratum I. Dogfish, like salmon, is occasionally present. As noted previously, no fish remains are found below natural stratum S.

Mollusc remains are also virtually absent below natural stratum S. The .01 gm of unidentifiable clam shell in natural stratum T hardly represents major cultural deposition. Bivalve species occur more frequently in the record than do gastropod species. Among the bivalves, edible mussel remains occur most frequently and are present in greater quantity than any other species. Little neck clam is the next most frequent in occurrence. It is interesting to note that bent nose clam, which has a high tolerance to polluted water conditions, is found only in the disturbed and historic strata. Those familar with the identification of mollusc remains from archaeological context will appreciate the difficulty in distinguishing fragmentary horse clam and fragmentary butter clam remains. One option is to create a single category for both remains (e.g. Connover 1972:276). The distinctive hinge and siphon aperture of horse clams, however, often makes it possible to assign some fragments to each of these species. Since the location of the hinge, relative to the long axis of the shell, is a major physical distinguishing characteristic, the existence of two species of horse clam in the Gulf of Georgia area is seldom recognizable among horse clam fragments. The fragmentary condition of most shells from Deep Bay therefore precluded this division. Fragments of horse clam or butter clam shell that were not clearly horse clam were assigned to the butter clam category. This procedure may result in over representation of butter clam and under representation of horse clam. On the other hand, large fragments that appeared more likely to be horse clam shell than butter clam shell were added to the former category, thereby reducing the potential disparity in weight and frequency of occurrence between these two species. The procedure outlined above may also account for the infrequency of horse clam occurrences on Lot 81.

Gastropods, it has been noted, are less frequent than bivalves on Lot 73. The exception to this rule is barnacle, which is present in as many samples as edible mussel, and which is often present in considerable quantity as well. Several species are not likely to be food resource species, for example Acmaea, Bittium, Iselica obtusa, and Echarachinius exentricus, but they are included here because they occur sufficiently in the deposits to warrant their inclusion. Iselica obtusa, unlike the other species just noted, is found on the rocky cobble beach to the northeast of the site in vast quantities at the present time. The other species are presently limited to the intertidal zone on either side of the spit.

The data on minimum numbers of individuals for birds and mammals show that only mammal individuals are found in natural stratum P and below. The same pattern that was observed on Lot 81 can be seen with these data as well. Specifically, dog and deer are the most frequently occurring mammal species, and most bird species are represented by only one individual in any given natural stratum and excavation unit. Sea lion and grebe are not found in the disturbed and historic strata, and seal is represented by one individual in these strata. Several strata do not contain remains of individuals of identifiable species. Natural strata E, dark G, R, S, and T fall into this category where mammals are concerned. No identifiable bird individuals were found in natural strata E, I, J, dark G, S, P, T, P-1, T-1, and P-2. Among the birds, seagull is again the most frequently represented species.

The situation regarding estimates of usable meat, as shown in Table XXX, is somewhat different than the situation on Lot 81. The disturbed/historic strata on Lot 73 do not contain extraordinarily large estimated amounts of usable meat compared to the aboriginal natural strata. In fact, the greatest estimates of usable meat are found in natural strata F, G/O, and G with shell. These three natural strata account for 67% of the estimated usable meat on Lot 73. It is noteworthy that sea mammals are found most often in these natural strata. These three natural strata represent the

TABLE XXX

Estimated Weight (gm) of Usable Meat for each Identifiable Mammal and Bird Species by Excavation Unit and Natural Stratum, Lot 73, DiSe 7*

Natural Stratum	Excavation Unit	Eumetopias jubata	Phoca vitulina	Odocoileus hemionus	Branta sp.	Aythya marila	Haliaeetus leucocephalus	Larus sp.	Podiceps/Colymbus	unidentifiable duck	Total
A	1	-	-	4595	-	-	-	-	-	79	4624
	2	-	-	9090	254	63	-	95	-	-	9502
	3	-	-	4545	-	-	254	-	-	79	4878
	4	-	-	9090	-	-	254	95	-	158	9597
	5	-	5910	4545	-	-	-	95	-	158	10708
B	1	-	-	9090	-	-	-	-	-	158	9248
	2	-	-	-	-	-	-	-	-	-	0
D	1	-	-	4545	-	-	-	-	-	79	4624
	2	-	-	4545	-	-	-	-	-	-	4545
E	1	-	-	-	-	-	-	-	-	-	0
	2	-	-	-	-	-	-	-	-	-	0
C	2	-	-	4545	-	-	-	-	-	79	4624
	3	-	-	4545	-	-	-	-	-	158	4703
	4	-	-	4545	-	-	-	-	-	-	4545
F	1	47727	5910	9090	-	-	-	95	-	79	62901
	2	47727	5910	9090	254	-	-	-	-	-	62981
	3	-	-	13635	254	-	-	95	-	79	14063
	4	-	-	-	-	-	-	95	-	-	95
	5	-	-	9090	-	-	254	-	-	79	9423
"G"	4	-	5910	4545	-	-	-	-	48	-	10503
	5	-	-	9090	-	-	-	-	-	-	9090

TABLE XXX (continued)

Natural Stratum	Excavation Unit	Eumetopias jubata	Phoca vitulina	Odocoileus hemionus	Branta sp.	Aythya marila	Haliaeetus leucocephalus	Larus sp.	Podiceps/ Colymbus	unidentifiable duck	Total
I	3	-	-	4545	-	-	-	-	-	-	4545
	4	-	-	4545	-	-	-	-	-	-	4545
	5	-	-	-	-	-	-	-	-	-	0
J	3	-	-	-	-	-	-	-	-	-	0
	4	-	-	-	-	-	-	-	-	-	0
	5	-	-	4545	-	-	-	-	-	-	4545
K	3	-	-	4545	-	-	-	-	48	-	4593
	4	-	-	4545	254	-	-	-	-	79	4878
	5	-	-	4545	-	-	-	-	-	79	4624
M	3	-	-	4545	-	-	-	-	-	79	4624
	4	-	-	4545	-	-	-	95	-	-	4640
	5	-	-	-	-	-	-	-	-	-	0
N	3	47727	-	-	-	-	-	-	-	79	47806
	4	47727	-	4545	-	-	-	-	-	79	52351
	5	-	-	-	-	63	-	-	-	-	63
G/O	1	-	-	4545	-	-	-	-	-	-	4545
	2	-	-	4545	-	-	-	-	-	79	4624
	3	-	-	4545	-	-	254	-	48	79	4926
	4	-	5910	9090	-	-	-	95	48	158	15301
	5	95454	11820	9090	-	63	-	-	-	158	116585
G with shell	1	47727	5910	9090	-	63	-	285	-	79	63154
	2	95454	-	9090	254	-	-	95	-	237	105130
	3	95454	11820	4545	-	-	254	95	48	158	112374
G-2	1	-	-	4545	-	-	-	95	-	79	4719

TABLE XXX (continued)

Natural Stratum	Excavation Unit	*Eumetopias jubata*	*Phoca vitulina*	*Odocoileus hemionus*	*Branta* sp.	*Aythya marila*	*Haliaeetus leucocephalus*	*Larus* sp.	*Podiceps/Colymbus*	unidentifiable duck	Total
dark G	3	-	-	-	-	-	-	-	-	-	0
H	1	-	5910	13635	-	-	254	-	-	79	19878
	2	-	5910	-	-	-	-	95	-	-	6005
H-1	1	-	-	-	-	-	-	-	-	-	0
	2	-	-	-	-	-	254	-	-	79	333
Q	2	-	-	-	-	-	-	-	-	79	79
R	1	-	-	-	-	-	-	-	-	-	0
	2	-	-	-	254	-	-	-	-	-	254
S	2	-	-	-	-	-	-	-	-	-	0
P	1	-	5910	4545	-	-	-	-	-	-	10455
	2	-	-	4545	-	-	-	-	-	-	4545
	3	-	-	4545	-	-	-	-	-	-	4545
	4	-	-	-	-	-	-	-	-	-	0
T	2	-	-	-	-	-	-	-	-	-	0
	4	-	-	-	-	-	-	-	-	-	0
P-1	1	-	-	4545	-	-	-	-	-	-	4545
	4	-	-	-	-	-	-	-	-	-	0
Total		524997	76830	249975	1524	252	1178	1425	240	2844	859865

* For the method behind the estimates of live weights of individuals, see page 181.

major aboriginal strata on Lot 73. The likelihood seems great, then, that sea mammal hunting was an important aspect of the food quest for a large portion of the time represented by the Lot 73 deposits. Indeed, sea mammals are represented in natural strata N and P as well, implying a temporally extensive and continuous exploitation of this type of food resource.

Of the estimated weight of usable meat represented in the aboriginal deposits, 76% is sea mammal, most of it sea lion. Deer, the only land mammal represented on Lot 73, represents 29% of the total estimated usable meat from all natural strata and 24% of the estimated usable meat from the aboriginal deposits. Since sea mammals account for 70% of all meat, all birds represent less than 1% of the total usable meat represented on Lot 73. As far as the frequency with which the various species occur in the table, deer seem to be the most frequently represented species. Seal and sea lion, although they comprise a large portion of the total usable meat estimation, occur much less frequently. As already noted, they tend to occur only in the major natural strata. The frequency of occurrence of mammal species in the Lot 73 deposits may represent their relative abundance in the environment, however cultural patterns in the acquisition of these species may be indicated as well. Because sea mammals represent such large quantities of usable meat per individual, the opportunity to acquire them is unlikely to have been missed, despite their relative scarcity when compared to deer. On the other hand, it should be kept in mind that calculating minimum numbers of individuals from infrequently occurring species, such as sea mammal, will result in an inflated estimate. Extrapolating from these estimates to estimates of usable meat, especially when the usable percentage of live weight is high (White 1953:398), results in figures that may be unduly inflated. For these reasons, the apparent abundance of sea mammal meat should be regarded with caution. The acquisition of deer, a more ubiquitous but less meaty species, seems likely to have occurred on a more routine basis. Birds clearly represent a peripheral dietary item and were probably taken as adjuncts to the main items of the food quest. These generalizations apply to the midden deposits but not to the P and T strata. In this water-laid group of strata birds are not represented, either through lack of acquisition or lack of preservation.

Table XXIX presents species not incorporated in Table XXVIII. The most notable feature of Table XXIX is the occurrence of cow remains in natural stratum F. Given the degree of disturbance of this stratum toward the eastern end of the trench, it is likely that these remains, like the eight historic artifacts, have been intruded into aboriginal deposits. Again, beaver, raccoon, and mouse occur infrequently, but they are joined by crab, elk, unidentifiable mammal, and a sea mammal of the dolphin family. Both the

Delphinidae and crab remains are found only in the disturbed and historic strata.

Half the bird species represented are migratory, the other half being available all year. Only two of the bird species (crow and grouse) are land birds and neither is migratory. Even though crows are land birds they are very common along the shore. Infrequently occurring fish species include ling cod, a species of sculpin, and a flatfish of unidentifiable species. Since sculpin species are not ethnographically reported to be major food resources, and since flatfish species are rare around Deep Bay, relative to other fish species, it is reasonable that these two kinds of fish should not occur frequently in the archaeological record. The infrequent occurrence of ling cod is as surprising on Lot 73 as it was on Lot 81. Native oyster occurs infrequently on Lot 73 as it does on Lot 81. It is joined, however, by *Mytilus californianus*, which grows only on the open coast and dog whelk, which inhabits the lower intertidal and subtidal zones of rocky beaches along the coast. The presence of *Mytilus californianus* probably does not indicate its use as a subsistence resource. Instead, it was probably brought from the outer coast to Deep Bay through an exchange network, and was probably intended for use in artifact manufacture.

CHAPTER VII

DELINEATION OF COMPONENTS

Introduction

In this chapter the cultural components thought to be represented by the material from Lot 73 are defined and identified. Lines of evidence contained in Chapters III through VI and Appendices I through IV are brought together for this purpose. It is thought that this diversified approach to component delineation will help to avoid the tendency to define components primarily on the basis of artifact distributions. Subsequent to the delineation of components, an attempt is made to establish cultural affiliations between the Deep Bay components and other components in the Gulf of Georgia area.

Component I

Although natural strata H through S contain only 17 artifacts, the nature of these artifacts and the composition of the matrices in which they were found suggest affinities with later, rather than earlier, deposits. Unlike the overlying strata, natural strata P, T, P-1, T-1, and P-2 contain an artifact assemblage that is entirely lithic except for one worked mammal bone fragment. Among the lithic artifacts, all but three are made by chipping. The faunal remains also exhibit a marked change in frequency at the upper surface of natural stratum P. Below this boundary only a few land mammal and bird remains and no fish or mollusc remains are found. All these classes of remains are found in abundance above natural stratum P. Frequency distributions of grain sizes in soil samples (Figure 9) indicate that the surface of natural stratum P marks the top of the deposits containing what are thought to be water borne natural constituents. Natural constituents of subsequent natural strata are thought to be primarily wind transported. Analysis of soil pH also indicated that a change in degree of alkalinity of matrices occurs at or near the surface of natural stratum P.

Two dates were recovered below the top of natural stratum P. A date of 2630±100 B.P. (GaK-6038) was recovered from natural stratum T and a second date of 4860±180 B.P. (GaK-6039) was recovered from the clay floor feature. The younger of these two dates is thought to be a maximum age for natural stratum P, which contains almost all of the lithic assemblage. The true age is probably somewhat younger than this date. The next carbon sample above GaK-6038 is from natural stratum H and is dated at 1910±110 B.P. (GaK-6037), or A.D. 40. The oldest reliable date for the Marpole Culture Type is 2310±105 B.P. (GaK-4646), or 360 B.C., (Matson 1976,Table 1-2), and the youngest reliable date for the Locarno Beach Culture Type is 2200±120 B.P. (M-1515), or 250 B.C., (Mitchell 1971a:61, Table XI). Consequently, it would seem that a cultural distinction ought to exist between GaK-6037 and GaK-6038. The preceding factors indicate quite clearly that the upper surface of natural stratum P should be considered as the upper boundary of what will be labelled here as Component I.

Components II and III

The cluster analysis of soil samples based on granulometric constituents, reported in Appendix I, suggests that the group of natural strata consisting of "G", I, J, K, M, and N (cluster 2b) may form an important interruption in the deposition of aboriginal habitation deposits. This suggestion may be all the more important if natural stratum G/O, which contains almost no shell and which lies under the natural strata of cluster 2b, is interpreted as a buried soil surface (Abbott,pers. comm). I cannot demonstrate, however, that natural stratum G/O is, in fact, an old midden surface.

There is a marked decrease in the amount of shell in natural stratum G/O from earlier strata. The natural strata of cluster 2b show a high variability of shell content, then natural stratum F and the natural strata of cluster 2a contain relatively large amounts of shell again. These data suggest that a division of strata near the surface of natural stratum G/O might legitimately be made. In addition, the analysis of clam shell seasonality (Appendix IV) shows a possible change in seasonal exploitation patterns between natural strata G-2 and G/O on one hand, and natural strata F and I on the other

(Table XLIV). This further suggests a boundary at the top of natural stratum G/O.

Major variations in the types of fish, mammal, and bird remains are not apparent in the aboriginal portion of the shell midden deposits. Neither is there any apparently major variation through time in the relative amount of any one bird, fish, or mammal species in the aboriginal deposits.

Burials show relatively little variation in form through time. Except for the abundant inclusions with Burial 4 and the several minor inclusions with Burials 1 and 5, cairn burial in a tightly flexed position without grave goods appears to have been the predominant form of interment. Occasional cairn burial and occasional elaborate grave goods are thought to be distinctive of the Marpole Culture Type (Mitchell 1971a: 52). Therefore, burials from natural stratum F down through natural stratum P could conceivably belong to this culture type. The skull deformation on Burial 1, however, does not allow the possible presence of the Gulf of Georgia Culture Type to be excluded. That Burial 4 also contained elaborate grave goods of the type described by Mitchell strengthens the possibility that the Marpole Culture may be represented by at least a portion of the Deep Bay deposits.

The A.D. 40 date (GaK-6037) was recovered from the top of natural stratum H. This date falls in the middle of the time period ascribed to the Marpole Culture Type (Mitchell 1971a:65). The charcoal sample that produced this date was recovered from the surface of natural stratum H, immediately under Burial 4, which lay at the bottom of natural stratum G with shell. This date and the nature of Burial 4 both suggest that a second component may be present at this site. This component seems to be well established, at least by the time that natural stratum G with shell was deposited. Probably the component was established earlier, according to the GaK-6037 date. Since the evidence of this second component is recovered almost exclusively from shell midden deposits, the assignment of a component boundary to the top of natural stratum P receives further support.

The artifact inventory from the aboriginal deposits exhibits considerable continuity through time. There are, nevertheless, several variations in this inventory that are informative. The relative abundance of chipped stone and bone in the Gulf of Georgia Culture Type has been discussed by Mitchell. This culture type tends to contain 4 to 8% chipped stone and 50% to 70% bone (Mitchell 1971a:47). An examination of Table II reveals that the aboriginal natural strata above the surface of natural stratum G/O contain 104 artifacts, of which 8.6% are chipped stone and 41.3% are bone. Moving the boundary downwards to include natural stratum G/O decreases the percentage of bone artifacts only slightly (38.9%), but it doubles the chipped stone percentage (17.5%). Moving the boundary upwards from the upper surface of natural stratum G/O has almost no effect on relative frequencies of bone and chipped stone in the upper group of aboriginal strata. On this basis, it can be argued that the upper surface of natural stratum G/O marks an important change in the relative amounts of chipped stone and bone artifacts in the deposits.

Individual artifact classes also indicate that a division occurs in the cultural inventory. Table XXII shows the distribution in the Lot 73 deposits of artifact classes thought to be distinctive of culture types in the Gulf of Georgia (Mitchell 1971a:47, 52, 57). Because the lower shell midden deposits appear to contain some material of the same age as the Marpole Culture Type, Table XXII can be examined in terms of which artifact classes serve to distinguish this culture type from succeeding ones. Materials distinctive only of the Marpole Culture Type include various chipped stone point forms, large ground slate points with faceted or lenticular cross section, disc beads of shale or clam shell, unilaterally barbed antler points, native copper ornaments, and midden burial in flexed position, sometimes with inclusions, sometimes under cairns. Except for disc beads and cairn burials, the other artifacts are found only in natural stratum G with shell on Lot 73. One stone disc bead is found in natural stratum H, one is natural stratum G/O, and one in natural stratum P. One shell disc bead is found in natural stratum G/O. Of 54 disc beads, one is found above the surface of natural stratum G/O and one is below the surface of natural stratum P.

The evidence of burials has already been discussed. It is worth noting that only Burial 1 showed evidence of skull deformation. This burial comes from natural stratum F and is dated at 790$\pm$80 B.P. (GaK-6035). This date falls within the time range of the Gulf of Georgia Culture Type (Mitchell 1971a:65).

Artifact classes distinctive only of the Gulf of Georgia Culture Type are small, triangular chipped basalt points (rare), thin triangular ground slate points, large well made celts, numerous irregular abrasive stones, unilaterally barbed bone points, and numerous single and double pointed bone objects. None of these artifact classes is confined to natural strata above the surface of natural stratum G/O. The only artifact class to approach this restricted distribution is unilaterally barbed bone points. One is found in natural stratum K, and the other in natural stratum H. This latter specimen was recovered from near the surface of the natural stratum very close to the west 64m wall of the excavation unit. Inspection of the profile (Figure 7) shows that natural stratum F lies on top of H at this point. It is possible that the artifact was originally from natural stratum F and that it has been intruded into the surface of the underlying natural stratum.

The Gulf of Georgia and Marpole Culture Types share a number of distinctive archaeological features. Thin ground slate knives, split or sectioned bone awls, antler wedges, and skull deformation are features from this list that are present on Lot 73. Possibly some or all of the Gulf of Georgia features that are present at Deep Bay should be added to this list since they do not appear to be restricted to a small group of natural strata. Distinctive archaeological features of the Marpole Culture Type, on the other hand, do seem to suggest component boundaries similar to those detected by other artifactual and non-artifactual criteria.

Art styles are thought to differ between the Gulf of Georgia and Marpole Culture Types. In the former culture type geometric design motifs seem to be emphasized, while in the latter culture type the emphasis seems to be on representational forms (Mitchell 1971a:49, 54). It is noteworthy that of the two decorated artifacts recovered from Lot 73, one is geometric and the other is zoomorphic. The geometric artifact comes from natural stratum G/O, the zoomorphic one from natural stratum G with shell. If the upper surface of natural stratum G/O is accepted as the top of a component, then this component contains decorated objects with both geometric and representational motifs.

Antler composite toggling harpoon valves are rare from components of the Marpole Culture Type (Mitchell 1971a:52, 56, 72). If the upper surface of natural stratum G/O is accepted as the upper boundary of a component, then both components contained in the shell midden deposits contain antler composite toggling harpoon valves. Of the ten such valves found on Lot 73, five are from natural strata G/O or G with shell, two are from natural stratum F, and three are from the disturbed/historic zone. In the northern Gulf of Georgia, at least, this artifact class appears to have a long and continuous history.

The evidence examined so far suggests that a component boundary might be drawn at the upper surface of natural stratum G/O. The component below this boundary, but above Component I, can be labelled Component II. The component in the aboriginal deposits above the surface of G/O can be labelled Component III. The preceding discussion makes it clear that Component II is thought to belong to the Marpole Culture Type and Component III to the Gulf of Georgia Culture Type.

The Gulf of Georgia Culture Type is thought to have evolved from the Marpole Culture Type, and no major cultural changes are thought to exist between these two types (Mitchell 1971a:72). The evidence from Montague Harbour supports this position, and the difficulty in establishing an obvious boundary between Components II and III at Deep Bay lends it further support. The distinctive archaeological features that successfully distinguished Component II from Component III are primarily those listed for the Marpole Culture Type and are usually found in small numbers. Disc beads, for instance, number 54, but of these, 48 were found in association with Burial 4. Therefore, these artifacts should probably be thought of as one artifact (possibly a necklace), bringing to seven the number of disc bead artifacts. Also, although ten burials were recovered, only Burial 4 conforms to the Marpole Culture Type pattern of having numerous grave goods, including shell disc beads, dentalia shells, native copper ornaments, and a zoomorphic bone pendant. There is one unilaterally barbed antler point, one thick faceted ground slate point, a few small fragments of native copper that are thought to be from one or two tube beads, and five fragments of various chipped stone points. This situation indicates fairly clearly that variations in the frequencies of relatively abundant artifact classes are probably not being recognized. Consequently, components are being defined on the basis of relatively infrequent artifact classes.

The lack of success met with in trying to separate components on the basis of distinctive archaeological features of the Gulf of Georgia Culture Type is puzzling. This situation suggests that the distinction between Components II and III may result from the termination of certain cultural patterns at the end of Component II. This interpretation is supported by the fact that only a few distinctive archaeological features of the Marpole Culture Type serve to distinguish the two components. These features, as already mentioned, occur infrequently at the best of times. The interpretation is further supported by the inability of any distinctive archaeological features of the Gulf of Georgia

Culture Type to distinguish between these two components. These archaeological features seem not to be too distinctive at Deep Bay, as they seem to have a more general distribution through time. This situation may not be true at other sites in the Gulf of Georgia area. This lack of distinctiveness between Components II and III suggests that there may have been a great deal of cultural continuity within the past 2000-2300 years. These findings are in accord with those offered for the Gulf of Georgia area as a whole (Mitchell 1971a:72). While some individual sites may exhibit discontinuities between artifact assemblages of the two most recent components, these apparent differences tend to diminish as the range of Gulf of Georgia sites is examined.

Up to this point, components have been distinguished from one another by subjective means. One wonders whether this subjective delineation of components can be objectively verified. To evaluate this problem a Kruskal-Wallis test was applied using analytical units as the sample unit. For each artifact class all sample units were ranked on the basis of artifact class raw frequency. The Kruskal-Wallis test was then applied to the three subjectively delineated components. A detailed description of the method used to apply the Kruskal-Wallis test is given in the analysis of soil pH (Appendix I). The fine distinctions between artifact classes listed in Table III were avoided by grouping some finely divided categories into the following transformed artifact classes:

utilized flakes, unifacially retouched flakes, bifacially retouched flakes, bifaces, triangular chipped stone points, other chipped stone points and fragments, choppers, abrasive stones, thin ground slate points and fragments, thick ground slate points and fragments, ground slate knives, ground slate fragments, unbarbed bone points and fragments, and antler fragments. This reorganization produced a new artifact list containing 54 transformed artifact classes (see Appendix V).

Because of the experimental nature of this test, and because it deals with only one of many Gulf of Georgia area sites, it was thought prudent to run a moderate risk of Type II error (accepting the null hypothesis when it is false). Subsequent work in the area may refine the results produced here, therefore it is better to err by including as many distinctive artifact classes as possible rather than by excluding too many. The chosen level of significance was therefore set at $\alpha \leq .05$. The significant artifact classes and their probabilities are presented in Table XXXI.

Bifaces, thick ground slate points and fragments, and wood include such small artifact frequencies that they should be excluded from further discussion. It is interesting to note, however, that five of the seven bifaces occur in Component I and that all three thick ground slate points and fragments occur in Component II.

Seven artifact classes remain that can distinguish between components. Six of these artifact classes involve

TABLE XXXI

Artifact Classes Significant at $\alpha \leqq .05$
Kruskal-Wallis Test of Cultural Components
by Artifact Classes, Lot 73, DiSe 7.

Artifact Class	α	N
utilized flake	0.0039	17
obsidian flake	0.0009	19
quartz crystal flake	0.0006	27
unifacially retouched flake	0.0008	18
biface	0.0154	7
leaf shaped chipped point & fragment	0.0256	20
thin ground slate point & fragment	0.0422	14
thick ground slate point & fragment	0.0208	3
unbarbed bone point	0.0389	44
wood	0.0247	2

stone as the material of manufacture and in five of the six instances the stone is chipped. Because the Kruskal-Wallis test program ranks the values of each variable from smallest to largest, and because the one-tailed substantive hypothesis states that the distribution function of one case will be greater than either of the other two, the artifact classes appearing in Table XXXI have a larger rank sum in one component than in either of the other two. The associated probability levels indicate the likelihood of occurrence of the distribution of these rank sums.

From prior knowledge of the artifact distributions, one would expect that the chipped stone artifact classes serve to separate Component I from the other two components. Indeed, between 58% and 82% of all chipped stone artifact classes in Table III are found in Component I. The thin ground slate points and fragments are found in Components I and II only. Five, or 36%, are from the former component and nine, or 64%, are from the latter. Thus, thin ground slate points serve to distinguish Component II from the other two components at the $\alpha \leqq .05$ probability level. This finding conflicts with the distinctive archaeological features of the Marpole Culture Type (Mitchell 1971a:52) because this class of artifact is customarily thought to indicate the Gulf of Georgia Culture Type. As the following analysis of Deep Bay component affiliations will show, and as the foregoing discussions of the relationships between components have indicated, the distinction between the two culture types may not be as great as is implied by their separate labels. As already mentioned, the relations between these two culture types are thought to be very close (Mitchell 1971a:72). The occurrence of thin ground slate points in both culture types, and the predominance of them in Component II at Deep Bay, may not be altogether surprising in this light (see Table XXXII).

A similar Kruskal-Wallis test on the weights of each faunal species in each analytical unit failed to produce any new means of distinguishing between components. The only species that could distinguish between components at $\alpha \leq .05$ were several mollusc species. It is obvious, even without this test, that Component I can be distinguished by the absence of mollusc remains in the matrix. These findings do indicate, on the other hand, that the relative amounts of each bird, mammal, and fish species do not tend to increase or decrease in a pattern between components. This situation suggests that the subsistence patterns practiced at Deep Bay may have been well developed when the site was initially occupied. It also suggests that subsistence patterns at Deep Bay may not have altered substantially throughout the occupation of the site.

This tendency away from substantial variation between components of bird, mammal, and fish remains may be related to the great similarity in artifact assemblages between Components II and III. Assuming that there is a functional

TABLE XXXII

Artifact Class Frequencies by Component, Lot 73, DiSe 7.

Artifact Class	Component I	II	III	disturbed/ historic	Total
Chipped Stone					
utilized flake, heavy duty	1	1	-	1	3
medium duty	4	1	-	-	5
light duty	8	1	-	-	9
microblade	1	-	-	-	1
obsidian flake	11	8	-	-	19
quartz crystal flake	20	6	1	1	27
unifacially retouched flake, heavy duty	3	1	-	-	4
medium duty	8	6	-	-	14
bifacially retouched flake, medium duty	1	2	1	1	5
light duty	-	1	-	-	1
retouched slate flake	-	3	2	1	5
biface, light duty	2	-	-	-	2
heavy duty	3	1	-	1	5
core, cobble/flake	5	3	2	1	11
microblade	-	1	-	-	1
point base, unilaterally shouldered	1	-	-	1	2
bilaterally shouldered	-	1	-	-	1
side notched	1	-	-	-	1
flat base, contracting edges	5	-	-	-	5
point tip	4	1	-	-	5
broad leaf shaped symmetric point	1	-	-	-	1
parallel edged leaf shaped point	2	-	-	-	2
asymmetric leaf shaped point	2	1	-	-	3
triangular stemmed point	-	2	-	-	2
triangular unstemmed point	-	1	1	-	2
chopping tool, unifacial	-	-	2	-	2
bifacial	1	2	-	-	3
Ground Stone					
abrasive stone, fine	-	5	4	3	12
medium	1	1	2	-	4
coarse	1	2	-	3	6

TABLE XXXII (continued)

Artifact Class	Component I	II	III	disturbed/ historic	Total
abrasive stone/saw	-	1	2	-	3
abrasive stone, edge retouched	-	1	-	-	1
point, tip fragment (thin)	-	3	2	-	5
medial fragment (thin)	-	1	1	-	2
basal fragment (thick)	-	2	-	-	2
thin ground slate point,					
triangular	-	3	-	-	3
corner notched	-	2	1	-	3
basal notched	-	-	1	-	1
thick point	-	1	-	-	1
ground slate knife, medium thick	-	-	1	-	1
thin	-	1	2	2	5
ground slate fragment	-	5	4	2	11
celt	-	1	1	-	2
saw	-	1	1	-	2
pendant	-	-	1	-	1
disc bead	1	3	1	-	5
incised stone object	-	2	-	-	2
Bone					
polished bone rod					3
awl, split bone	-	5	5	1	11
bone point, heavy duty	-	7	1	2	10
light duty	-	8	10	13	31
wedge base	-	3	1	-	4
barbed	-	1	1	-	2
bone bipoint	-	8	7	15	30
ulna tool	-	-	2	-	2
bird bone whistle	-	1	-	-	1
worked tooth	-	-	1	-	1
pendant	-	1	-	-	1
bead	-	1	-	-	1
chisel/wedge	-	4	1	2	7
unidentifiable sea mammal bone implement	-	-	1	-	1
worked fragment	1	25	12	13	51
Antler					
point, unbarbed	-	3	-	-	3
barbed	-	1	-	-	1
ring	-	-	1	1	2
wedge	-	3	2	2	7
foreshaft	-	-	1	-	1

TABLE XXXII (continued)

Artifact Class	Component I	II	III	disturbed/ historic	Total
composite toggling harpoon valve	-	5	2	3	10
tine flaker	-	1	-	-	1
incised tine	-	-	-	1	1
fragment, adzed	-	-	3	1	4
abraded	-	1	2	1	3
Shell					
disc bead	-	49	-	-	49
pecten	-	-	-	1	1
dentalium	-	13	1	1	15
ring	-	-	1	-	1
<u>Mytilus californianus</u> chisel/ gouge	-	-	1	-	1
Miscellaneous					
ochre	-	11	15	19	45
mica	-	1	-	-	1
wood	-	1	1	-	2
copper	-	1	-	-	1
Total	88	234	105	91	518

relationship between the artifacts and faunal remains found at a site, the tendency away from significant variations in either the artifact or faunal assemblages at Deep Bay further supports the interpretation that the subsistence patterns at the site are long standing and largely unaltered. Similar situations may subsequently be discovered at other sites, and this would not be surprising given the purposeful nature of the ethnographically described annual subsistence round. The situation at Deep Bay may be contrasted with sites where major environmental changes took place over the course of time, thereby altering site use patterns substantially. Two sites of this kind that come to mind are the St. Mungo Cannery Site (Calvert 1970) and the Glenrose Cannery Site (Matson 1976). The tendency, in both the artifact assemblage and the faunal assemblage from Deep Bay, not to exhibit substantial variation through time seems to support Mitchell's (1971a:72) hypothesis of a close cultural link between the Marpole and Gulf of Georgia Culture Types.

The emphasis until now has been on the delineation of components. A case has been made for the existence of three components at Deep Bay, and it would now be desirable to establish what cultural affiliation they have with other components in the Gulf of Georgia area. In a sense, the delineation of components at Deep Bay has been a determination of component affiliation. It is thus strongly suspected that Component III is a Gulf of Georgia Component and that Component

II is a Marpole Component. Recent work (Matson 1974) has indicated that clustering and multidimensional scaling of presence-absence data can substantiate the subjectively recognized relationships between components in the Gulf of Georgia. The following discussion is an attempt to build on the foundation provided by Matson.

To the 29 components listed in Table II (Matson 1974: 103) can be added Component II (DBY2, N=31) and Component III (DBY3, N=29). Component I is excluded because it contains only eight of the variables in Table II (Matson 1974:103). The cultural affiliations of Component I are discussed below. Confidence can be placed in the correspondences between artifact classes listed in Matson's Table II and artifact classes described in this study because his Table II is derived from Mitchell's (1968) doctoral dissertation. The classification used in this study follows closely the classification in Mitchell (1971a), which is his dissertation revised for publication. One conclusion of Matson's presence/absence study was that variables 6 through 17 were inconsistently reported in the literature and that their removal helped to produce clusters that closely approximated the subjectively established relationships between sites (Matson 1974:107). It was decided to exclude these variables from the present analysis of 31 components to produce results that were as closely comparable as possible to those of the original study. To this end, the same clustering and scaling techniques were applied to the data using the same computer programs (Matson 1974:102, 104-105). The intricacies of the techniques have already been discussed in Appendix I under the section on granulometric analysis. The dendrogram produced by clustering 1- dice coefficient values using the Furthest Neighbor method is shown in Figure 27.

Like Matson's revised dendrogram (Matson 1974,Figure 4) all the Gulf of Georgia Components are incorporated in a single large cluster. The two new components are found here. That Component II from Deep Bay should be a member of this cluster is not as surprising as it may first appear. Inspection of Table III and a review of the subjective division of Components II and III indicates how closely allied they are in terms of shared artifact classes and faunal remains. The association of Helen Point 2 and 3 in this cluster is another instance of close similarity between components. While coding consistency within a single site may be a factor producing these apparent anomalies, this is thought to be less likely than genuine cultural similarity. In the case of Deep Bay, the artifact classification was based on the same classification used in Matson's Table II. One would not expect this problem to appear at sites where site use has altered substantially over time, such as St. Mungo or Glenrose.

The second cluster appears to be predominantly Marpole Culture Type assemblages, but from here on noticeable divergences from Matson's Figure 4 begin to appear. This is

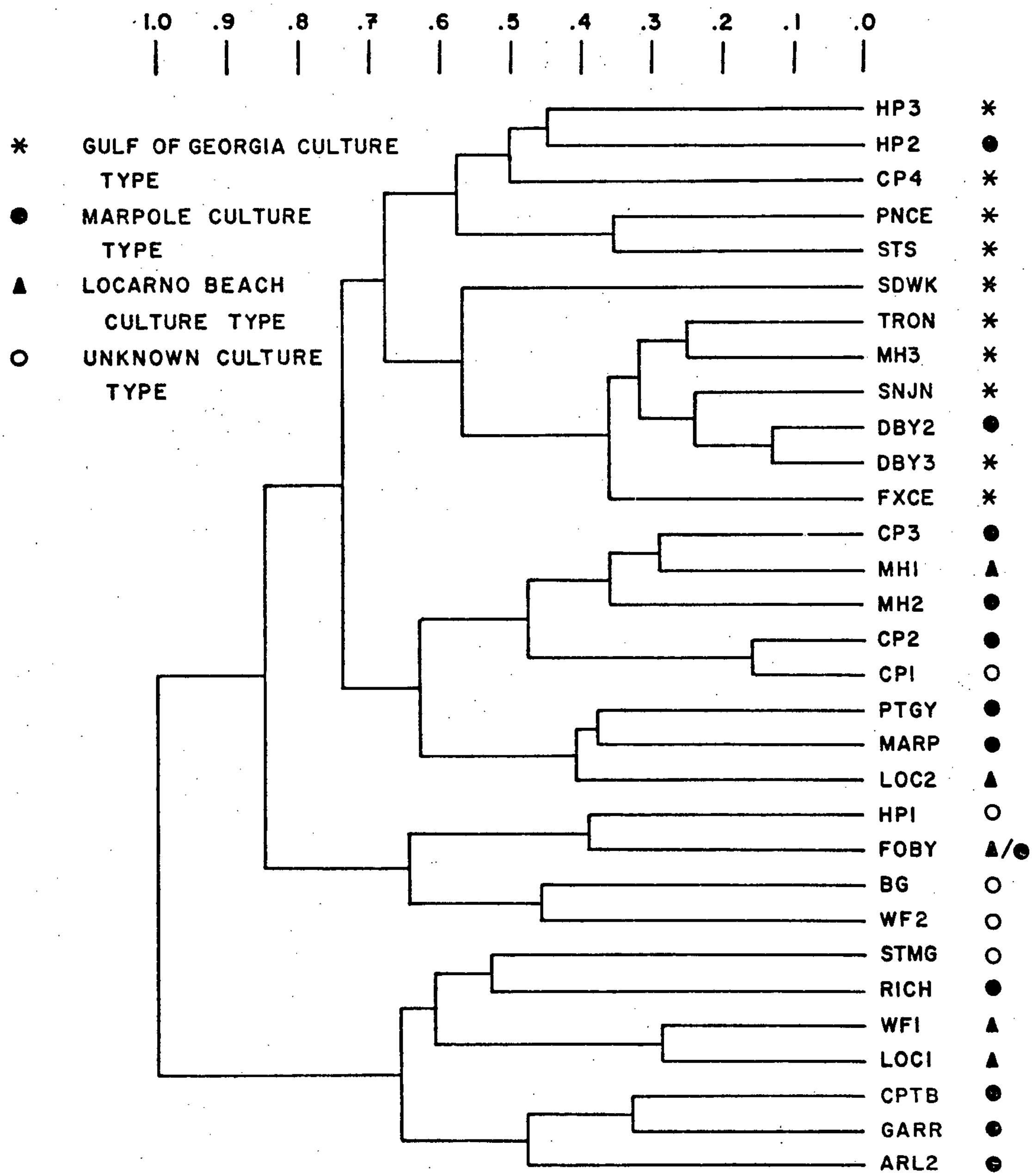

Figure 27. Dendrogram of Gulf of Georgia Components and Components II and III, Lot 73, DiSe 7.

undoubtedly the result of a) adding two assemblages to the study, and b) simply deleting the 12 "reportage" variables rather than recalculating the input matrix using metric vectors. Although these minor differences create a modified dendrogram, a number of specific clusters remain intact. The most noticeable changes are the association of Argyle Lagoon, Garrison, and Cattle Point Island with three early assemblages as part of an outlying fourth cluster. Also, the inclusion of the Richardson assemblage in this cluster is a surprise.

The third cluster consists of assemblages whose cultural affiliations are unclear. According to the present analysis, they are more closely allied to the Marpole and Gulf of Georgia Culture Types than they are to earlier assemblages.

The inclusion of Locarno Beach assemblages (LOC 2 and MH 1) in the largely Marpole Culture Type cluster, and the opposite situation in the fourth cluster, suggests that the differences between these two culture types may not be as abrupt as is often thought. Indeed, Locarno Beach 2 is recognized as a separate assemblage from Locarno Beach 1, and the former is stratigraphically above the latter (Borden 1950:15). It is quite possible that Montague Harbour I represents a transitional artifact inventory as well. The identity of Argyle Lagoon and Cattle Point East Bluff are unclear as well. The former bears only limited similarities to the Marpole Component (Carlson 1960:573), and of the 15 variables in the original list, the number is reduced to 11 by removing the "reportage" variables. Cattle Point East Bluff is also of dubious cultural affiliation (Carlson 1960: 571). The Garrison assemblage (N=22) is not affected by the cut in "reportage" variables, and it contains material strongly similar to other assemblages of the Marpole Culture Type. Richardson, on the other hand, consists of a very small assemblage (N=14) from a disturbed site. In fact, the investigator suspects the excavated assemblage represents more than one component, one of which is probably Marpole (Carlson 1960:571). Therefore, the apparent incongruities of Figure 27 can, to a certain extent, be satisfactorily resolved. As a consequence, fairly good general agreement between subjective and objective analyses can be attained and the relations of anomalous assemblages can be examined. The present analysis, however, was unable to separate Components II and III from Deep Bay into the culture types to which they were expected to belong. Similar situations from other sites, and reasons for their occurrence, have been noted. The inability of these objective techniques to distinguish between the two components from Deep Bay does not mean that differences between them do not exist. The nature of this particular test simply does not exploit these differences. For instance, the list of artifact classes does not include scrapers or antler composite toggling harpoon valves. Both of these occur often in components of Gulf of Georgia sites. Also, presence/absence analysis weights each artifact class equally, so one abrasive stone in component X equals fifty from component Y.

The dates obtained from Component III fall fairly well within the range of dates for the Gulf of Georgia Culture Type. The earlier date from Component II is consistent with the age range for the Marpole Culture Type, but the later date seems at first glance, to be too young for this culture type. From the section on chronology it will be recalled that GaK-6036 was dated at 900±90 B.P., or 1050 A.D. Also, there was some question of the validity of the date because a red synthetic thread was found in the field sample. If the date from this sample is not to be dismissed offhand as too recent, a consideration of components in this time period and artifact continuity at the site is warranted. The three earliest Gulf of Georgia Components have been dated at 370±100 A.D. for Pedder Bay (although there is some question as to whether this assemblage is really a member of the Gulf of Georgia Culture Type), 436±40 A.D. for Fossil Bay Late Component, and 550±90 A.D. for Dionisio Point IIb (Mitchell 1971a,Table XI). The next most recent Gulf of Georgia Component is Montague Harbour III, dated at 1160±130 A.D. (Mitchell 1971a,Table XI). Thus, there is a gap of at least 390 years at one standard deviation unit between these two dates. No Gulf of Georgia Components are presently known from this time period. On the other hand, the most recent Marpole Culture Type component is Beach Grove, dated at 560±

25 A.D. Prior to this date an uninterrupted series of dates exists for the Marpole Culture Type.

Because there is no sharp distinction between the two culture types, and because one culture type is directly ancestral to the other, it is only reasonable to expect that considerable temporal overlap should exist between assemblages having Gulf of Georgia and Marpole characteristics. Also, cultural adaptation, as reflected by remains of material culture, is likely to be more or less gradual, affecting different aspects of culture at different rates. Activities common during the period of greatest Marpole Culture Type influence that retained their relevance, despite changes in other aspects of culture, would thus persist into the Gulf of Georgia time period. On the other hand, activities common during the time period of the Gulf of Georgia Culture Type are unlikely to have developed overnight, so it is not surprising that some assemblages with affinities to this culture type are found at a relatively early date. This argument is consistent with the concept of culture types which are strictly formal units.

The present evidence suggests that recognizable changes in the Marpole Culture Type adaptation began after 1600 B.P. and continued until at least 1400 B.P. The GaK-6036 date of 900±90 B.P. suggests that this period of change may have lasted longer than 200 years, possibly for as long as 700 years. The difference in age between GaK-6036 and the youngest presently accepted Marpole Culture Type date (Beach Grove, 1390±25 B.P.) is only 490 years, whereas the difference in age between the two oldest presently accepted Gulf of Georgia Culture Type dates (Dionisio Point IIb and Montague Harbour III) is 610 years. Since the larger time gap is accepted within a single culture type, it does not seem unreasonable to accept the smaller time gap within another culture type. If GaK-6036 is younger than the true age of the sample due to contamination, the argument for accepting this date is strengthened because it would reduce the time gap between late Marpole Components. However, the point remains that a period of change from the Marpole Culture Type seems to have begun about 1600 B.P. and ended between 1400 B.P. and 900 B.P. Assemblages from this transitional period exhibit characteristics of both culture types, and it is conceivable that this change did not occur at the same time or at the same rate throughout the Gulf of Georgia area. Although a late Marpole date of 900 B.P. seems unduly young now, subsequent research may find that this culture type persisted longer in the northern Gulf. It may also be determined that the transition period between these culture types was quite slow throughout the entire Gulf of Georgia. The considerable similarity in the artifact assemblages between Components II and III suggests that a discussion of the "real" culture type affiliation of GaK-6036 may simply be academic.

The cultural affiliation of Component I is more difficult to assess than was the case for Components II and III. The lithic character of the Component I assemblage suggests a possible affiliation with the Lithic Culture Type (Mitchell 1971a:59). This culture type is composed of assemblages containing abundant stone artifacts, primarily medium to large fairly well made chipped stone points that are usually leaf-shaped, various cobble implements, and sometimes chipped "crescents". Ground stone artifacts are often lacking (Mitchell 1971a:59-60). Dionisio Point I contains a barbed antler point fragment but it is classed in the Lithic Culture Type. It would seem, then, that non-chipped stone artifacts, i.e. ground stone and non-stone, can be part of assemblages legitimately belonging to the Lithic Culture Type. On these grounds, there seems to be little reason not to classify Component I at Deep Bay as a member of the Lithic Culture Type. The only dated components of this culture type are from the Fraser Canyon Sequence. They indicate a time range of 5400 to 7000 B.C. (Mitchell 1971a,Table XI after Borden 1961:6). Within this time range, components of the Mazama and Milliken Phase are found. The lithic character of Component I at Deep Bay is also broadly similar to the Old Cordilleran Component at the Glenrose Cannery Site. This component is dated between 8500 and 5500 B.P. (Matson 1976:17). The other components from the Gulf of Georgia that are assigned to the Lithic Culture Type are undated (Mitchell 1971a,Table X). The date subsequent to which virtually all the artifacts in Component I were found, however, is only 2630±100 B.P. (GaK-6038). This date suggests that a dominant adaptation from the earliest portions of Gulf of Georgia prehistory continued as a useful part of subsequent, more technologically diversified adaptations. While the Lithic Culture Type may have been dominant between 8500 B.P. to 5500 B.P., certain aspects of it may have continued to be useful for an additional 3000 years.

The lithic assemblage at Deep Bay appears to fall within the time range of the late Locarno Beach and early Marpole Culture Types. The former culture type occupies the time period approximately between 3200 to 2200 B.P; the latter culture type occupies the time period 2300 B.P. (Matson 1976; Table 1-2) to 1400 B.P. (Mitchell 1971a,Table XI). Since Component I is bracketed by dates of 2360±100 B.P. and 1910±110 B.P., and the component seems likely to have been deposited earlier, rather than later, during this time period, it seems safe to say that this assemblage was in use during the time when the transition from the Locarno Beach Culture Type to the Marpole Culture Type was being made in some areas of the Gulf of Georgia. If the Component I assemblage is seen as a continuation of the formerly dominant Lithic Culture Type, then the kinds of activities represented by the assemblage may have been more or less appropriate at least until the late Locarno Beach and early Marpole Culture Type time periods.

There is considerable continuity in the stone artifacts between Components I and II. Except for chipped stone points, all stone artifact classes are found in both components. The remaining chipped stone artifact classes occur in greater numbers in Component I. The materials from which stone artifacts are made are also continuous between these two components, although the quality of the basalt tends to improve through time. The limited evidence from the faunal assemblage indicates that similar species were being exploited in both components as well. These data suggest that there is substantial continuity, of material culture at least, between these two components. As there is good reason to argue, Component II contains material thought to belong to the Marpole Culture Type. The apparent continuity between Components I and II, and the estimated age range of Component I, suggest that this component may belong to the Locarno Beach Culture Type time period.

Given this background, it is argued that Component I at Deep Bay contains a specialized assemblage from the Locarno Beach time period. Thus, while assemblages of the Locarno Beach Culture Type are geographically limited within the Gulf of Georgia area (Mitchell 1971a:59), there now is evidence that varying adaptations from this time period are more widely distributed. The Component I assemblage appears to be specialized, but the sample size is small and the physical context of the assemblage must be remembered. The spit has been building for at least the past 5000 years, probably longer. At present, we are unaware of the spit morphology at the time of occupation represented by Component I. It would seem unlikely, however, that the whole spit at that time was exactly the same as the deposits uncovered on Lot 73. The older portion of the site, closer to the base of the spit, was probably permanently above water. If this were the case, it is reasonable to think that the kinds of activities conducted on the portion of the site permanently above water would not be the same as those conducted on the periodically inundated part. The variations in matrix content between the Glenrose Cannery Old Cordilleran Component deposits in excavation units 3, 4, and 6 on one hand and 1, 1/5, and 5 on the other (Matson 1976:11) are a good example of differing use of site areas early in Gulf of Georgia prehistory. Since the assemblage from Component I was recovered from the latter context, it would seem to be a specialized portion of the whole site assemblage at that time. This site assemblage may also have been specialized in terms of an annual seasonal round.

The relatively un-waterworn appearance of the artifacts from Component I suggests that they may have been fairly high up on the beach and therefore infrequently subjected to wave action. The large cobbles on the inside beach of Deep Bay that showed evidence of flake removal may therefore represent the remains of a later but similar manner and location of chipped stone artifact manufacture.

Many of the artifact classes from the Component I assemblage appear intuitively to be associated with land hunting, e.g. chipped stone points, bifaces, retouched flakes, and utilized flakes. The predominant faunal remains from this component were unidentifiable land mammal and deer. The Coast Salish are reported to have driven deer into nets or ambushes in restricted areas (Barnett 1975:97, 103). This analogue suggests that the spit at Deep Bay could have been used for a similar purpose. Duck nets were also erected on flyways (Barnett 1975:103). Remains of unidentifiable duck and unidentifiable bird comprise the remainder of the Component I faunal assemblages. If land mammal and bird species were being sought at Deep Bay during this time period, this exploitative pattern would appear to be consistent with the interpretation of seasonal exploitation patterns for other Locarno Beach Components.

The status of other lithic assemblages in the Gulf of Georgia needs to be discussed. Lithic assemblages from the Fraser Canyon sequence fall within the 9000 to 7350 B.P. time range (Borden 1961:6), and the assemblage from the Old Cordilleran Component at Glenrose falls in the 8500 to 5500 B.P. time range. At the other end of the time range within which lithic assemblages are found is Component I dated at 2630 B.P. Undated lithic assemblages in the Gulf of Georgia consist of Dionisio Point I, Olcott Site, James Site, and the Deception

Pass Phase (Mitchell 1971a,Table X). It would seem, on the basis of the present evidence, that this kind of assemblage can exist almost anywhere within the 8500 B.P. to 2500 B.P. time range. This argument is supported to some extent by evidence for the existence of specialized artifact assemblages as far back as 4100 to 4200 B.P. (Grabert and Larsen 1975:240, 245). To my knowledge, none of the lithic assemblages listed in Mitchell (1971a,Table X) is followed by a Locarno Beach Component. In fact, Dionisio Point I is followed by Dionisio Point IIa which is suspected of being a Marpole Culture Type Component (Mitchell 1971c:167). This situation follows the same pattern that is observed at Deep Bay. It is quite possible, then, for Dionisio Point I also to be a specialized assemblage belonging to the Locarno Beach Culture Type time period. These data suggest that lithic assemblages do not always represent the cultural remains of early, unspecialized, land-oriented hunters as suggested by Bryan (1957:7; 1963:89) and King (1950:79).

Until recently, Locarno Beach Components were known only from the Fraser Delta, southern Gulf Islands, and southern Vancouver Island (Mitchell 1971a,Table IX). Evidence for components of this culture type, and technological specialization among these components, is now coming to light from other areas. The Cherry Point A Component has a middle date of 2630±420 (RL-272) and a minimum date of 2300 B.P. The assemblage consists of pebble tools, chipped slate knives, drilled sinker stones, elongated hammerstones, large perforated cobbles, two heavy faceted ground slate points, several flake tools, and some Gulf Islands Complex items. This component is thought to represent a fishing station. It falls into the time period of the Locarno Beach Culture Type, lies under deposits of the Marpole Culture Type, and contains artifact classes thought to be distinctive of the Locarno Beach Culture Type. The abundance of the chipped stone tools also suggests affiliations with the Lithic Culture Type. Grabert and Larsen conclude that Cherry Point A represents a specialized activity site of the Locarno Beach Culture Type (Grabert and Larsen 1975:241-248). That specialization of assemblages occurred at an even earlier time is evidenced by the 4100±500 B.P. date from basal midden deposits at Semiamoo Point (45-WH-17) and by the 4180±120 B.P. date from early, shell free strata containing flake tools, pebble tools, projectile points, and Marpole style harpoons at site 45-WH-34 on the Nooksack River (Grabert and Larsen 1975:240, 245). Thus, Mitchell's argument that variation in Locarno Beach assemblages may be related to seasonal pursuits appears to be supported (Mitchell 1971a:57). Also, these data suggest that large quantities of chipped stone artifacts are found in specialized activity assemblages that are as old as, or older than, the Locarno Beach Culture Type.

The lithic assemblage at Deep Bay is also pre-dated by the assemblages from stratigraphic unit 1 at the St. Mungo

Cannery Site (Boehm 1970) and the St. Mungo Component at the Glenrose Cannery Site (Matson 1976). It seems safe to conclude that not all lithic assemblages are early. It also appears that well developed specialized activity patterns precede at least one lithic assemblage. It may be true that the earliest lithic assemblages were products of relatively unspecialized land-oriented hunters (Bryan 1957:7; 1963:89; King 1950:79), but subsequent lithic assemblages seem to have been specialized constituents of increasingly more complex cultural adaptations.

The Lithic Culture Type appears to have been the dominant adaptation for approximately 3000 years in the initial portion of Gulf of Georgia prehistory. Continued interaction between man and his surroundings produced progressively more refined and complex tool kits. Part of these subsequent adaptations continued to be pertinent aspects of the earliest adaptation. Thus, between 5500 B.P. and 2500 B.P. lithic assemblages, which can be interpreted as later modifications of the original Lithic Culture Type, continue to be found as integral parts of later adaptations in the Gulf of Georgia area. The Lithic Culture Type was initially defined in terms of the emphasis on chipped stone and the minor importance of ground stone. The substantive data on lithic assemblages suggests that in the 5500-2500 B.P. period more ground stone, pecked stone, antler, and probably bone came into use, although the bulk of each assemblage still consists of chipped stone artifacts.

The evidence now seems to indicate that lithic assemblages may persist for a long time in the Gulf of Georgia area. The activities that these assemblages represent may have been more or less important adjuncts to a series of phases or culture types, including the Locarno Beach Culture Type. Thus, lithic assemblages could legitimately be considered as site-specific, seasonal assemblages of various time periods or culture types. In this sense, all lithic assemblages need not be assumed to have great antiquity or to represent an unspecialized, land-oriented type of culture early in the human history of the Gulf of Georgia (Bryan 1957: 7, 1963:89; King 1950:74).

Efforts in this chapter have been directed toward delineating components at Deep Bay and establishing their cultural affiliation. Three components were distinguished, although there is very considerable continuity between the artifact assemblages of the two most recent components. Component I is thought to be a late manifestation of the Lithic Culture Type from the time period when the late portion of the Locarno Beach Culture Type predominated. Component II appears most similar to the Marpole Culture Type, and Component III seems most closely related to the Gulf of Georgia Culture Type.

A variety of information and techniques have been used in the delineation of components. Traditionally, characteristic artifacts and features have been used to distinguish components. An attempt has been made here to add further information such as soil characteristics and faunal variables (after Chang 1967:28). A subjective method of component delineation has been followed in which the distributions of artifact classes, faunal species, soil pH, granulometric constituents, clam shell seasonality, and carbon-14 dates are analyzed and compared to stratigraphic discontinuities. The cultural affiliations of these components were then assessed using both monothetic and polythetic methods. The monothetic method consisted of comparing the distinctive archaeological characteristics of each culture type in the Gulf of Georgia with the three components from Deep Bay. The polythetic method consisted of comparing a series of artifact assemblages from the Gulf of Georgia, including Components II and III from Deep Bay, by means of a furthest neighbor cluster analysis. Component I from Deep Bay could not be included in this analysis because of its small sample size. The polythetic set of variables used to determine degree of component similarity is that presented in Matson (1974,Table II).

It was concluded that each time period can be seen as a collection of assemblages, each of which represents a group of activities. Such groups of activities, or even individual activities, may persist as a culture type for varying periods of time, may be related to seasonal activity, and may vary in cultural importance from one time period to another. This emphasis on cultural continuity is consistent with Mitchell's model of cultural development in the Gulf of Georgia area (Mitchell 1971a:67-72). The cultural continuity suggested by linguistic evidence, particularly Jorgensen (1969:21, 52), also seems to be supported. Because of the potential continuities of cultural phenomena from one time period to another, it seems doubly important to examine the widest possible spectrum of criteria when attempting to establish boundaries within the archaeological record. The more criteria that are examined, however, the less likely are such boundaries to be clear cut. This lack of artificial clarity is in keeping with the idea that there is considerable continuity of activities from one segment of the cultural continuum to another. Therefore, the transition from the predominance of one culture type to another can be seen as a period of accelerated change. Based on the preceding discussion, the persistence of some characteristics of a given phase or culture type beyond their most common period of occurrence, such as the seemingly too recent material in natural stratum G/O, can be taken to represent the continuance of useful activities through a period of cultural change.

CHAPTER VIII

ASSOCIATIONS OF ARTIFACT AND FAUNAL DATA

Introduction

This chapter is concerned with relationships between artifact classes and faunal species. As stated in Chapter I, the aim of this analysis is to determine whether ethnographically recorded relationships between artifacts and fauna can be detected in the archaeological record. This chapter is therefore divided into two parts, the results of the quantitative analyses, and a discussion of these results. Since the greatest amount of data is available for Lot 73, the following discussion will deal only with that part of the site.

The preceding chapters have indicated that three components may be represented in the deposits on Lot 73. These components are thought to belong in the Locarno Beach, Marpole, and Gulf of Georgia Culture Type time periods. Because these three culture types are thought to be manifestations of the same cultural continuum, and because there is considerable continuity of artifact classes and faunal remains across component boundaries, the following analyses disregard component boundaries. This procedure may obscure whatever variations occur through time in the association of artifact and faunal variables, but since the culture types involved are thought to be closely linked in a cultural sense, it seems unlikely that this procedure will create serious distortions in the results. Also, since this is an exploratory study, it seems more appropriate to present generalizations about all the data as a first step, leaving more refined analyses of individual components to a later date.

Quantitative Analysis: Method

For the examination of the Lot 73 mammal and bird remains 63 analytical units were included because 100% of these remains were identified and weighed. Because the fish and mollusc remains were sampled before identification and weighing, only thirty analytical units were eligible for analysis. In the following analyses, the data have been treated at two levels of measurement: presence/absence within analytical units and rank order of relative frequency within analytical units. For each faunal variable relative frequencies were calculated for weight of remains, minimum numbers of individuals, and estimated grams of usable meat. The artifact classes presented in Table III were regrouped so that the variable "utilized flake" consisted of heavy duty, medium duty, and light duty utilized flakes. These transformed artifact classes are listed in Appendix V and are henceforth the only referent for the term "artifact class". The following analyses therefore consist of a presence/absence analysis of artifact classes by faunal species, a rank order analysis of artifact classes by faunal species weight, a similar analysis substituting faunal species minimum numbers of individuals, and another similar analysis substituting faunal species estimated weight of usable meat.

The data were analyzed by means of two computer programs, both of which were contained in the Statistical Package for the Social Sciences (SPSS) (Nie, Bent, and Hull 1970). The program used to treat the presence/absence data was the chi-square test. This test produces a statistic that is compared to a chi-square distribution for the appropriate degrees of freedom. The location of the test statistic on the ordinate of the distribution provides a probability for the difference between the observed and the expected distributions of the variables, given fixed marginals, if the population distributions were actually independent (Nie, Bent, and Hull 1970: 275). Where the number of cases is larger than 21 the test statistic is calculated using Yates' correction for continuity (Nie, Bent, and Hull 1970:125) according to the following formula:

$$X^2 = \frac{N\left(|AD-BC| - \frac{N}{2}\right)^2}{(A+D)(A+C)(B+C)(B+D)}$$

where X^2 is the test statistic, N is the number of cases, and A, B, C, D are the contingency table cell frequencies (Siegel 1956:107). This correction improves the approximation of the computed value of X^2 to the chi-squared distribution (Siegel 1956:107). The advice of Cochran, cited in Siegel (1956:110), has been followed in this study. That is, where $N > 20 < 40$ the Fisher Exact Test (two-tail) has been applied when one or more expected cell frequencies in a 2 x 2 table are less than 5.

Chi-square, when used as a test of independence between variables, assumes that the variables have been sampled randomly and independently from a universe that is either infinitely large or that is sampled with replacement (Mueller, Schuessler, and Costner 1970:437; Pierce 1970:189, 194, 196). The Deep Bay data were not acquired in a manner that was consistent with these assumptions. First, excavation units were chosen on the basis of where it was convenient to dig on the lots where permission to excavate was granted. Artifact classes and faunal species were therefore not sampled independently since both these categories of variables were contained in the chosen excavation units. Since the universe of each artifact class and faunal species was not known, and excavation units were not sampled randomly, it is impossible to claim that each variable was sampled randomly. These problems are unavoidable in archaeology. The results of analyzing such data by means of such techniques, which are still the most appropriate ones despite their shortcomings, must be interpreted with these considerations in mind. Indeed, the nature of the analytical units, analytic techniques, and data must all be considered together in terms of their effects on the results of any analysis.

The chi-square test is one of independence between distributions of paired variables. Its associated probability allows for acceptance or rejection, at a chosen significance level, of the null hypothesis that the distributions of the variables are independent. Besides this information, calculating a coefficient of association will show the strength and direction of association between variables.

The Spearman rank order correlation coefficient, described below, varies from -1 to +1. Since a coefficient of association to accompany chi-square should also vary between these two values, Yule's Q and phi (ø) were considered. The former coefficient is a special case of gamma, a test of the predictability of rank order for variable pairs. This measure is based on data that are assumed not to have disproportionately large marginal totals for a few categories of the variables (Mueller, Schuessler, and Costner 1970:287). Since the Deep Bay data seldom meet this assumption, Yule's Q was rejected as an appropriate coefficient.

The second coefficient, phi, is preferable to Q because of its affiliation with the chi-square statistic according to:

$$\phi = \pm\sqrt{\frac{X^2}{N}}$$

where ø = phi, X^2 = chi-square, N = total number of observations. However, phi calculated according to this formula by SPSS does not always provide the same coefficient compared to the result of:

$$\phi = \frac{AD - BC}{(A+C)(A+B)(B+D)(C+D)^{\frac{1}{2}}}$$

where ϕ = phi, and A, B, C, and D = 2 x 2 cell frequencies (Monks n.d. b). Phi is influenced by sample size when calculated from chi-square with Yates' correction. Calculated independently, however, phi is not subject to sample size. Further, consistency of phi values can be maintained in cases where the Fisher exact probability has been calculated. Substantial discrepencies have been noted between phi values calculated by the two preceding formulae (Monks n.d. b). In the following analyses, phi has been calculated independently of chi-square. Note that the phi coefficient includes D cell frequencies; that is, it includes negative matches of variables. The inclusion of D cell frequencies in the calculation of a coefficient of association rests on the argument that these cell frequencies should be included when all variables in the data under study vary within the data (Sneath and Sokal 1973:130-131). Large numbers of negative matches will inflate the values of phi and chi-square. Consequently, the statistical significance and the strength of association of any variable pair in the presence/absence analysis should not be accepted uncritically. One means of reducing the number of potentially spurious associations is to eliminate variable pairs involving infrequent occurrence of one or both variables. This criterion is set out below. Another means of evaluating the reliability of any coefficient of association is to examine its data base.

The data were also analyzed in rank order form by the SPSS version of the Spearman rank order correlation coefficient and its associated level of probability. The coefficient is calculated by ranking analytical units from lowest to highest on the basis of the relative frequencies of one artifact class and one faunal variable at a time, subtracting the ranks for each analytical unit, squaring the difference and applying the following formula:

$$r_s = 1 - \frac{6 \Sigma D^2}{N^3 - N}$$

where r_s = Spearman's rank order correlation coefficient, D^2 = the sum of the squared differences in rank, and N = the number of analytical units involved. For computational simplicity and to allow for correlation of within-case tied ranks, the following formula is substituted:

$$r_s = \frac{T_x + T_y - \Sigma D^2}{2(T_x T_y)^{1/2}}$$

where D^2 = the sum of squared differences in rank, T_x and T_y = the correction values for tied ranks on either of the variables under analysis. T_x or T_y may be computed by:

$$T_{x,y} = \frac{N(N^2-1) - \Sigma R(R^2-1)}{12}$$

where R = the number of ties at a given rank for X or Y.

The probability of r_s can be determined by comparing the value derived by the following formula with a student's t distribution with N-2 degrees of freedom:

$$r_s = \left(\frac{N-2}{1-r_s}\right)^{1/2}$$

(Nie, Bent, and Hull 1970:154).

Spearman's rank order correlation coefficient tests whether two observations are independent in each of n randomly drawn units. The measure assumes that there is independence between both variates in the bivariate sampled population, that samples are drawn randomly, that variables are continuous, and that measurement is precise (Bradley 1968:91, 92). The last two assumptions, taken together, mean that tied ranks among the observations for either variable are assumed not to occur. The data from Deep Bay again do not entirely meet these criteria. The absence of a variable from a number of analytical units causes tied ranks for zero values to occur. These are corrected for, according to the formulae presented above. Therefore, the use of the measure is justified on these grounds. The problem of randomness, as noted in the discussion of chi-square, is almost never overcome in studies such as this one. With respect to independence between the variables under consideration, the arguments concerning the deposition of primary refuse, outlined in Chapter I, are sufficient to show that this condition is also not met in these data.

Although a correction forties is made in the calculation of r_s, it is still possible to obtain high values of the coefficient where one or both variables exhibit large numbers of zero values. This procedure has been outlined under the discussion of chi-square. Omitting from consideration those variable pairs where one or both variables have large numbers of zero values, and examining the data base of each variable pair are two means of overcoming this problem.

A moderately low level of probability was chosen in order to include as many potentially meaningful relationships as possible. It was thought that the exploratory nature of this study justified running a moderate risk of Type II error. For this reason, the $\alpha \leqq .05$ probability level is again applied in this analysis. The four analyses of the data were performed, and the results were synthesized. Those relationships between artifact classes and faunal species that occurred in two or more analyses, excluding relationships based on more than 90% tied values for one or both variables, are presented in Table XXXIII. All the associations are direct except those marked by a dash (-), which are inverse. The relationships in this table are not only significant at less

TABLE XXXIII

Variable Pairs Significant at $\alpha \leq .05$ in Two or More Analyses, Artifact Class by Faunal Species. Lot 73, DiSe 7 (-) = inverse relationship

Variable Pair	Analysis: +/- ϕ	α	wt% r_s	α	MNI r_s	α	meat wt r_s	α
utilized flake x basket cockle (-)	0.509	0.0336	0.4092	0.025	-	-	-	-
utilized flake x mussel (-)	0.523	0.0489	0.3704	0.044	-	-	-	-
utilized flake x butter clam (-)	0.523	0.0489	0.4525	0.012	-	-	-	-
quartz crystal flake x mussel (-)	0.523	0.0489	0.3977	0.030	-	-	-	-
unifacially retouched flake x mussel (-)	0.523	0.0489	0.3657	0.047	-	-	-	-
unifacially retouched flake x unidentifiable clam (-)	0.523	0.0489	0.4170	0.022	-	-	-	-
unifacially retouched flake x barnacle (-)	0.523	0.0489	0.4299	0.018	-	-	-	-
abrasive stone x dog	0.635	0.0052	-	-	0.2938	0.019	-	-
abrasive stone x unidentifiable duck	0.667	0.0329	0.3043	0.015	-	-	-	-
abrasive stone x sea lion	0.762	0.0196	-	-	0.3130	0.013	-	-
thin ground slate point x sea lion	0.825	0.0106	0.3873	0.002	0.3517	0.005	0.2965	0.018
thin ground slate point x unidentifiable sea mammal	0.746	0.0110	0.3636	0.003	-	-	-	-
thin ground slate point x seagull	0.809	0.0031	0.4069	0.001	-	-	-	-
thin ground slate point x unidentifiable duck	0.667	0.0295	0.2632	0.037	-	-	-	-
ground slate knife x seagull	0.809	0.0253	0.3055	0.015	-	-	-	-
ground slate fragment x unidentifiable mammal	0.762	0.0048	0.3938	0.001	0.4374	0.001	0.5014	0.001

TABLE XXXIII (continued)

Variable Pair	Analysis +/- ϕ	α	wt% r_s	α	MNI r_s	α	meat wt r_s	α
ground slate fragment x grebe	0.905	0.0280	0.3507	0.005	-	-	-	-
ground slate fragment x sea lion	-	-	0.2735	0.030	0.2929	0.020	-	-
ground slate fragment x goose	-	-	-	-	0.2733	0.030	0.2575	0.042
bone point x seagull	0.794	0.0002	0.4048	0.001	-	-	-	-
bone point x unidentifiable duck	0.682	0.0151	0.2762	0.028	-	-	-	-
bone bipoint x seagull	0.841	0.0000	0.4997	0.001	-	-	-	-
bone bipoint x unidentifiable duck	0.667	0.0331	0.3053	0.051	-	-	-	-
bone bipoint x unidentifiable bird	0.540	0.0260	0.2729	0.030	-	-	-	-
worked bone fragment x sea lion	0.746	0.0075	0.2956	0.019	0.2854	0.023	0.3605	0.004
worked bone fragment x unidentifiable sea mammal	0.762	0.0008	0.3644	0.003	-	-	-	-
worked bone fragment x unidentifiable duck	0.683	0.0151	0.3468	0.005	-	-	-	-
antler wedge x eagle	0.905	0.0048	0.4465	0.001	0.2519	0.046	-	-
antler wedge x seagull	0.810	0.0253	0.3062	0.015	-	-	-	-
antler wedge x grebe	0.889	0.0123	0.3848	0.002	-	-	-	-
antler wedge x goose	-	-	-	-	0.3025	0.016	0.4699	0.001
antler composite toggling harpoon valve x unidentifiable sea mammal	0.778	0.0009	0.433	0.001	-	-	-	-
antler composite toggling harpoon valve x grebe	0.021	0.0001	0.5411	0.001	-	-	-	-
ochre x dog	0.682	0.0023	0.2861	0.023	-	-	-	-
ochre x unidentifiable sea mammal	0.730	0.0021	0.3531	0.005	-	-	-	-
ochre x unidentifiable duck	0.682	0.0128	0.3465	0.005	-	-	-	-

than $\alpha \leqq .05$ in their respective analyses, but they are also reliable in the sense that they have been observed in more than one analysis. In addition, the relationships based on excessively high tied values have been removed. Therefore, it can be argued that these relationships reflect actual patterns in the data. These relationships can not be considered as artifacts of the techniques used in the analyses. The data were analyzed using two different kinds of tests and, in the case of the faunal remains, four different forms. That consistent results were produced under these conditions indicates that patterning in the data, not patterning imposed by the analytic techniques, has been detected.

Quantitative Analysis: Results

In the presence/absence analysis and weight of remains analyses, 52 artifact classes were matched against 33 faunal variables. Thus, 1716 combinations of variables were considered, and a chi-square probability calculated for each one. If the chosen significance level is $\alpha \leqq .05$, then one would expect, at this level, to have 5%, or 86, relationships occur by chance alone. In fact, the presence/absence analysis produced 58 paired variables and the weight of remains analysis produced 150. The minimum numbers of individuals analysis involved 518 paired variables, of which 5%, or 26 pairs, could occur by chance. A total of 68 pairs significant at $\alpha \leqq .05$ were produced in this analysis. The estimated weight of usable meat analysis involved 486 possible pairs of variables, of which 23 could occur by chance at the chosen significance level. This analysis produced 72 pairs. Thus, only the presence/absence analysis produced fewer significant pairs of variables than could be expected by chance at the chosen level of significance.

The fact that the data do not entirely meet the assumptions of the analytic techniques, and the fact that variation in sample unit size can affect the likelihood of association judged by chi-square, both suggest that any problem perceived as a result of this shortfall is strictly academic. Indeed, even when more than 5% of the possible variable pairs are found to be significant, one is still never sure which are the significant pairs. When it is considered that a number of the variable pairs significant in the presence/absence analysis are also found in the other analyses, the possibility seems small that the significant presence/absence variable pairs are still due to chance alone.

In the analysis that provided the relationships presented in Table XXXIII, three potential reasons for the pairing of variables can be distinguished. Variables can be associated or correlated because they were involved in the same activity, e.g. thin ground slate knives and salmon remains. In this instance the association could be called "coterminous". This term is used in the following analysis to indicate a relationship with an ethnographic analogue indicating that both variables were used in the same activity. Variables can also be associated because they were involved in unrelated activities that occurred at the same time, e.g. herring remains and chipped stone points. This association could be called "concomitant" because there is an ethnographic analogue indicating that herring fishing and deer hunting were practiced by different members of a single group at the same time of year (Barnett 1975:29). Thirdly, a variable pair can associate, even below the chosen level of significance, on the basis of chance alone. In this case, one would not expect to find ethnographic analogues for the relationship, and it could be labelled "coincident". Such a relationship would not exhibit an ethnographic or logical basis. While a number of coincident relationships are obvious in the individual analyses, they seem to be virtually eliminated in the synthesized results (Table XXXIII). Thus, the largest portion of the relationships in this table appear to be due to either coterminous or concomitant activity.

The above table presents pairs of artifact classes and faunal species that occur at $\alpha \leqq .05$ in at least two of the four analyses. Fish and mollusc remains were not included in the MNI or estimated weight of usable meat analyses, therefore these paired variables occur in two out of two analyses. The first seven pairs of variables are inversely related in both analyses, and their occurrence in both these analyses suggests that they are reliable relationships. Except for the relationship of utilized flake to basket cockle, however, all the coefficients of association and all the probabilities for these pairs are the same. This situation results from the similar distribution among analytical units of the mollusc species in question, the similar distribution of the lithic artifact classes among analytical units, the almost total exclusivity of artifact and faunal distributions, and the disproportionately large number of shell bearing analytic units compared to those with the lithic artifact classes in question. The frequencies of the A, B, C, and D cells are 1, 2, 25, and 2 respectively for these six pairs. Intuitively, one would expect a high negative coefficient of association, given the relationship of the B and C cell frequencies to those of the A and D cells. Indeed, the phi coefficient is higher for each variable pair than the Spearman rank order correlation coefficient.

The proper statistical interpretations of these relationships states that where one variable is found or where it increases in rank, the other variable tends to do the opposite. This finding confirms the subjective impression that most chipped stone artifact classes are found in Component I deposits, whereas most mollusc remains are found in Component II and III deposits. In terms of activities, these data imply that the activities conducted at this particular part of the site changed through time. Initially, activities involving chipped stone artifacts took place on the beach, but after beach build up ended and midden build up started, this location was used for different purposes. The continuity of simple chipped stone tools continues into Component II, but not nearly in the same numbers as are present in Component I. A shift in activity loci, or a gradual decline in the importance of such tools are seen as factors affecting the observed relationships. These findings support the suggestion made at the end of Chapter III that activity areas within the site may have changed as the spit continued to build up. It should be noted that salmon remains and coarse grained basalt debitage are negatively associated in the St. Mungo Component at Glenrose Cannery. This relationship suggests that there is variation in the areas of site use within the component (Matson 1976:189). The negative relationships of certain chipped stone categories and faunal species at Deep Bay and Glenrose seem to indicate that activities involving chipped stone and marine resources tend not to co-occur.

Abrasive stones pair with dog, sea lion, and unidentifiable duck. The first two of these pairs occurs in the presence/absence and MNI analyses, and the last pair occurs in the presence/absence and percentage weight of remains analyses. No ethnographic accounts relate this artifact class with these faunal species, and concomitant activity is the only non-coincidental basis on which any of these relationships could reasonably occur. Abrasive stones, being common artifacts, would have been used while dogs inhabited the site. They could have been in use while the other species were being taken, and they may have been used to make artifacts that were used to take the latter two species. This interpretation is tenuous and should not be given much confidence. The virtual absence of any of these variables from Component I suggests that these relationships pertain mostly to Components II and III. The degree of difficulty in interpreting these relationships is not related to the reliability of the relationships. It is maintained that, although the meanings to be inferred from these relationships are obscure, the relationships themselves are reliable and potentially meaningful.

Thin ground slate points are related to sea lion, unidentifiable sea mammal, seagull, and unidentifiable duck. While the latter three relationships occur in the presence/absence analyses, the first relationship is found in all four analyses. Of all these variables, only seagull occurs in analytical units from Component I. It occurs once. The relationships between these variables, therefore, apply largely to the two most recent components. The thin ground slate points involved in these pairs consist of triangular, corner notched, and basal notched forms as well as fragments. These classes of points are often thought of as arming points for either arrows or composite toggling harpoons. Blade type arming points for composite toggling harpoons, used in the quest for seals and sea lions, are reported (Barnett 1975: 98-99), but it should be pointed out that the composite toggling harpoon valves from Deep Bay do not have slots to receive such arming points. Arrow points of slate are reported ethnographically (Barnett 1975:101), and hunting birds with arrows is also reported (Barnett 1975:102). However, the bird arrows described do not specifically include ones with thin ground slate points. These points could have armed arrows used to take seagulls and ducks, since both were taken for food (Barnett 1975:63), but the inference is tenuous at best. It seems most likely that these bird and mammal species were being taken by other means at the same time as other species were being hunted with arrows. Thus, these variable pairs suggest concomitant activity.

Since thin ground slate points occur primarily in Component II, these relationships should apply primarily to that archaeological unit. There are none of these variables to speak of in Component I, and few members of the artifact class in Component III.

The relationship of ground slate knife to seagull is puzzling. Occurring in two analyses, the distributions of these two variables suggests that the relationship is most pronounced in Component III. The minimal presence of ground slate knives in analytical units indicates that heavy reliance should not be placed on interpretations of this variable pair. Nonetheless, the intuitive association of both variables with fish catching and butchering activity implies that concomitant activity may serve as the basis for this relationship. No ethnographic substantiation can be found for this idea.

Ground slate fragments are associated with sea lion, unidentifiable sea mammal, grebe, and goose. All these variables are absent from Component I. The two bird variables are minimally present in Components II and III. Therefore, the most reliable relationships occur between ground slate fragments and sea mammal variables in Components II and III. The interpretation to be placed on these relationships is far from clear. Because ground slate fragments are non-functional artifacts, and because, not surprisingly, no ethnographic analogues exist for these relationships, the most reasonable interpretation of these variable pairs is that they occur by coincidence.

Bone points are related to seagull and unidentifiable duck. This artifact class consists of both heavy duty and light duty points; however, the latter outnumber the former by 34 to 10. Of the three variables involved, only unidentifiable duck is found in Component I, and here only in one analytical unit. The distributions of these variables appear to be fairly homogeneous throughout Components II and III. Therefore interpretations based on these pairs should refer only to the two recent components at Deep Bay. Within these two components, the probability of chance occurrence of these pairs is quite low, and the strength of association is moderate to high. These two relationships may reflect coterminous activity, with light duty bone points arming arrows with which birds were hunted. This interpretation seems less likely than concomitant activity because bone points of a variety of sizes could have been used for a number of other activities. For instance, ducks may have been taken at the same time as herring were being raked.

Bone bipoints share relationships with seagull, unidentifiable duck, and unidentifiable bird. Bipoints are not found in Component I, and are evenly distributed in Components II and III. The bird remains are also evenly distributed in the two most recent components, but unidentifiable duck and unidentifiable bird remains are also found in Component I. The relationships, therefore, apply only in Components II and III.

Bone bipoints are often thought of as fish gorges or herring rake teeth (Barnett 1975,Fig. 27, 86). The bipoints from Deep Bay show no medial girdle, as if they had been fish gorges (Mitchell 1971a:202). But girdling may not have been required for such a use. They could be herring rake teeth. They do not seem to be directly involved in activities concerned with acquiring, processing, or consuming the bird species involved here. An interpretation based on concomitant activity appears to be most reasonable. At the same time as fishing was conducted using bone bipoints, the birds represented by these faunal variables may have been taken.

Worked bone fragments are paired with sea lion, unidentifiable sea mammal, and unidentifiable duck. Like pairs involving ground slate fragments, little in the way of meaningful interpretation can be derived from these relationships. The absence of all four variables from Component I, with one trivial exception, suggests that Components II and III account for all of these relationships. It may, however, be more than coincidence that sea lion and unidentifiable sea mammal co-occur with both miscellaneous ground slate and bone variables.

Antler wedges share relationships with four bird variables, eagle, grebe, goose, and unidentifiable duck. Antler wedges are not abundant at Deep Bay. They are absent from Component I and evenly distributed in Components II and III. Eagle, goose, and grebe are also absent from Component I and uncommon but evenly distributed in the other two components. Unidentifiable duck is almost absent from Component I but evenly distributed in the other two components. Thus, the two late components contain all the variable pairs in question.

Antler wedges are manufacturing tools used in woodwork (Barnett 1975:108). They are unlikely, therefore, to have been used in the acquisition of the bird variables involved here. The bases of these relationships may be coincidence, owing to the minimal occurrences of antler wedges. At the least, the high coefficients of association and correlation should be accepted with caution since so many common absences are involved in these data. However, the possibility should not be discounted that woodworking and fowling may have been concomitant activities. Woodworking specialists are known to have exchanged their products for other resources that they needed (Barnett 1975:107). Also, woodworking was often undertaken at slack periods of the year (Barnett 1975:107), such as winter, when migratory species such as grebe were available (Munro and Cowan 1947:44-48).

Antler composite toggling harpoon valves tend to co-occur with unidentifiable sea mammal and grebe. None of these variables is found in Component I. Unidentifiable sea mammal remains occur in a number of analytic units in Components II and III, but antler composite toggling harpoon valves and grebe occur only in the minimum number of such units. The inflated coefficient values for these two pairs should therefore not be blindly accepted. Instead, it would be reasonable to say that some reliable patterns of co-occurrence exist between the artifact and faunal variables, but the number of tied zero values causes inflated coefficient values and probabilities to be produced.

Composite toggling harpoon valves are reportedly used to hunt salmon, seals, and sea lions (Barnett 1975:83, 98-99). Four Coast Salish composite toggling harpoons used for salmon range in length from 4.8 to 6.6 cm with an average of 5.7 cm (Hoover 1974,Table V). For the northwest coast in general, eight salmon harpoon head valve lengths range from 4.8 to 11.1 cm with an average of 6.9 cm (Hoover 1974,Table IV). Salmon composite toggling harpoon heads all belong to Type I (Hoover 1974:39). The most common subtype of this type is Ia which has two valves of equal length, both of which are spurred. They are mounted on a fixed foreshaft and have a separate, shanked, unbarbed arming element (Hoover 1974:38). They also lack lashing grooves, and the arming channel is laterally bound (i.e. it is closed along the edges where the valves meet) (Hoover 1974:97).

The four complete valves from Deep Bay range in length from 5.0 to 6.8 cm with an average of 5.8 cm. Their form is that of Hoover's Subtype Ia. The evidence therefore suggests that the Deep Bay valves were most likely to have been parts of salmon harpoons. If this is the case, the relationship between antler composite toggling harpoon valves and sea mammals appears to be based on concomitant activity. Salmon remains are not common at the site. But, like seals and sea lions, salmon are known to prey on herring. It is reasonable to expect salmon acquisition tools to associate with sea mammals under these circumstances. Indeed salmon are also prey to seals and sea lions, so the common presence of herring, salmon, and sea mammals is to be expected.

It should be pointed out that the sample sizes involved in the calculations of ranges and averages for valve lengths are small in both Hoover's case and my own. Also, very few of Hoover's valves are definitely made of antler. For these two reasons his results should be applied with caution to the Deep Bay data. Secondly, sea mammals were tired and hindered by means of floats tied to harpoon lines (Barnett 1975:99). When tired, the animal could be brought alongside and dispatched. I contend that excessively robust harpoon valves are not needed for this purpose. If this is true, then salmon harpoons could have doubled as expedient means for acquiring sea mammals. In this case, the relationship between sea mammal and antler composite toggling harpoon valve may be based on coterminous activity.

The relationship of the valves to grebe is tenuous. Aside from statistical considerations and the possibility that the relationship is coincident, there may be another basis for the pairing of these two variables. Grebes prey on small fish as an integral part of their diet (Carl 1963: 47), and in this respect they are similar in habit to seals and sea lions. Since herring are known to spawn near the site at a time when grebes are still on the coast, and since seals, sea lions, and salmon could also be expected to be present as predators at this time, it is possible that the relationship between the antler composite toggling harpoon valves and grebe remains is based on concomitant activity.

Ochre shares relationships with dog, unidentifiable sea mammal, and unidentifiable duck. All of these variables are common throughout Components II and III. This abundance suggests that the coefficients and the probabilities are reliable for the three variable pairs. Unidentifiable sea mammal and ochre are absent from Component I, and dog and unidentifiable duck each occur in only one analytical unit of Component I.

Ochre was used as a cosmetic and as body ornamentation (Barnett 1975:74; Gunther 1927:224). It was also used in first fruit ceremonies (Barnett 1975:90-91, 105), and in preparing houses and initiates for spirit dance ceremonies. It is interesting to note that duck down is spread on the floor at such ceremonies (Kew 1970:163-164). Given the abundance of the variables in question and the extreme unlikelihood that ochre was used to acquire or process the faunal variables in question, the relationships observed here seem most likely to be based on concomitant activity. In the case of unidentifiable sea mammal and unidentifiable duck, first fruit ceremonies may have involved the use of ochre (coterminous activity). This seems unlikely, however, since first fruit ceremonies seem to have been restricted to salmon on Vancouver Island (Barnett 1975:107), and since first kill ceremonies (Barnett 1975:107) are unlikely to have accounted for the abundance of ochre at Deep Bay. Ochre may have been used for body care or ornamentation while subsistence activities were in progress, or, given the suspected late winter occupancy of the site, the association of ochre and duck may imply some form of ceremonial activity.

A number of subsequent analyses not reported here were conducted on these data. Artifact classes were re-grouped according to function and material, and faunal variables were re-grouped according to taxonomic and ecological similarities. These re-grouped data were analyzed by the same means as the data reported above, and consistent results were again obtained among the analyses. Further, the re-grouped data tended to support the specific relationships reported here.

Theoretical Framework

The preceding analyses have pointed to a number of associations between specific artifact classes and faunal species. These relationships are thought to result from activities that are coterminous, concomitant, or coincident. Because all the faunal species, except dog, that are considered here are ethnographically recorded food resource species, the topic of subsistence comes immediately to mind. The following discussion attempts to place the results of the preceding analyses in a more general, subsistence oriented context.

A recent study by Flannery (1972) defines a procurement system as part of the complex adaptive system which is culture. Each procurement system requires a technology involving implements and facilities, and the focal point of each system is the plant or animal food resources being acquired (Flannery 1972:222-234). Note here that the term "procurement system" refers only to food resource procurement. The food resource is held to be the focus of the procurement system (Flannery 1972:223), and seasonality and scheduling are said to be regulating mechanisms of such subsistence systems. These mechanisms may counteract or amplify cultural deviation (Flannery 1972:228, 231; after Maruyama 1963). This model, although valuable as a foundation and as a stimulus, has a number of features that are debatable.

First, the term "system", as defined below, denotes a useful but overworked concept in archaeology. Most of this overwork arises as a result of assuming, rather than demonstrating, that a system exists. In many cases there is no alternative but to make such an assumption in order to account for an observed phenomenon, and in this case the use of a verbal system model (von Bertalanffy 1968:24) is acceptable. But, in many cases it is possible to demonstrate that there exists " . . . a complex of elements directly or indirectly related in a causal network, such that at least some of the components are related to some others in a more or less stable way at any one time. The interrelations may be mutual or unidirectional, linear, non-linear or intermittent, and varying in degrees of causal effectiveness or priority. The particular kinds of more or less stable interrelationships of components that become established at any time constitute the particular structure of the system at that time" (Buckley 1968:493).

The archaeological record does not contain many elements, of what Flannery calls procurement systems, because they are either non-observable or unpreserved. For this reason, it seems unwise to consider archaeological manifestations of what once may have been a system as the system itself, as he appears to do (Flannery 1972:227). Instead, it is thought more appropriate to consider the archaeological evidence as a potential indicator of a system. Also, Flannery does not demonstrate that causal relationships exist between variables in what he calls a system, even though techniques for detecting the association, and possible causation, of system variables are at hand and have been employed in the present study. It seems doubly inappropriate, therefore, to consider the phenomena discussed by Flannery as procurement _systems_. Instead, the archaeological indicators of what may be procurement systems will be called procurement _complexes_. It is argued here that by demonstrating the possible existence of procurement _complexes_ in the archaeological record, and by inferring from them the non-observable and unpreserved aspects of food resource acquisition and processing, a more reasonable basis can be laid for evaluating whether or not relationships between variables imply the existence of procurement _systems_.

Second, the designation of the food resource as the focus of a procurement complex is subject to debate. It is reasonable to argue that, without appropriate technology, food resources could not be procured. In this sense, technological variables are as important in a procurement complex as food resources. The particular food resource may serve as a convenient label for a procurement complex, but it does not follow that technological variables are less important.

The procurement system concept assumes that a relationship exists between a culture and the food remains that it deposits archaeologically. While this is undoubtedly true, the possibility of establishing specific culture-food resource relationships must be kept in mind. The method used in the first part of this chapter avoids this generalized assumption by demonstrating specifically which material cultural variables and which food resource variables are associated. Having avoided this assumption, inferences about non-observable and unpreserved variables involved in food resource procurement rest on a firmer foundation than those of Flannery, which rest on the assumed relationship of faunal remains and the rest of culture. Furthermore, without the axiom that technological variables are as important as environmental variables in procurement complexes, the demonstration of specific relationships between material culture and food resources is made more difficult, and the inferences drawn from the data about non-observable and unpreserved cultural variables are consequently weaker.

Third, seasonality is a given non-cultural mechanism around which procurement systems develop and scheduling decisions are made (Flannery 1972:227). Although scheduling can result in either deviation amplifying or deviation counteracting situations, the phenomenon called "scheduling" by Flannery (1972:227) appears in fact to be two different but related things. Part of Flannery's concept of scheduling appears to be the cultural decisions that are made concerning where to be at what time of year in accordance with the seasonality of various food resources. This concept can be called "annual round". The second concept, also affected by seasonality, relates to the decisions as to who will be at which place at which time of year to exploit resources. This concept can be labelled "organization of labor". The adoption of these two terms would not only specify the cultural mechanisms that regulate the use of procurement complexes and their relationships, but it would also provide a means by which the sources of variation in food resource availability noted by Suttles (1960:302) can be incorporated into archaeological usage.

Synthesis of Results

In the light of this discussion, many of the associations detected in the first part of this chapter may be seen as implying procurement complexes. Associations that are thought to represent both coterminous and concomitant food resource acquisition and processing activities fall into this category. However, not all coterminous and concomitant relationships are necessarily involved in subsistence activities. Relationships involving non-subsistence species, such as dog, would not be involved in procurement complexes, although dogs could be considered as a technological item in terms of hunting. Nor would non-subsistence oriented artifact classes be involved in procurement complexes. Into this category fall antler wedges, abrasive stones, ground slate fragments, worked bone fragments, and ochre. Also, inverse relationships, such as those between simple flake tools and various mollusc species, cannot be considered as procurement complex indicators because they imply temporal variation in activities conducted at the same part of the site. The remaining associations that may imply procurement complexes are: thin ground slate point and sea lion, thin ground slate point and unidentifiable sea mammal, thin ground slate point and seagull, thin ground slate point and unidentifiable duck, ground slate knife and seagull, bone point and seagull, bone point and unidentifiable duck, bone bipoint and seagull, bone bipoint and unidentifiable duck, bone bipoint and unidentifiable bird, antler composite toggling harpoon valves and unidentifiable sea mammal, and antler composite toggling harpoon valves and grebe.

Clearly, the range of species involved in these associations is limited. Therefore, the relationship between variable associations and procurement complexes is not one to one. That is, a number of such associations may imply a single procurement complex. The species involved in these associations, along with the artifact classes associated with them, are: seallion-thin ground slate point; unidentifiable sea mammal-thin ground slate point, antler composite toggling harpoon valve; seagull-thin ground slate point, ground slate knife, bone point, bone bipoint; grebe-antler composite toggling harpoon valve; unidentifiable duck-thin ground slate point, bone point, bone bipoint; unidentifiable bird-bone bipoint.

The unidentifiable sea mammal variable is likely to consist almost exclusively of sea lion and seal because these species comprise all the identifiable sea mammal remains. Therefore it is not unreasonable to combine this variable and sea lion and label the result sea mammal. Thus, the artifact class associations of this variable are antler composite toggling harpoon valves and thin ground slate points.

These associations may represent a procurement complex. However, the size of most of the valves and the absence of an arming slot on them leaves open the question of whether this procurement complex is a result of coterminous or concomitant activity. If it is a result of coterminous activity, the size and form of a number of antler composite toggling harpoon valves and thin ground slate points seem inappropriate. If it is a result of concomitant activity, what resources were being taken with the artifact classes in question, and by what means were the sea mammal species taken? Small antler composite toggling harpoon valves may imply that salmon were being taken. These fish prey on herring, as do seals and sea lions, therefore they are likely to be available at Deep Bay at the same time as these species. If a relationship between antler composite toggling harpoon valves and sea mammals was based on concomitant activities of sea mammal and salmon acquisition, one would expect substantial quantities of salmon remains to have been recovered from the Deep Bay excavations. In fact, salmon remains are not common compared to other fish remains. It is not clear whether this situation results from salmon not being taken at Deep Bay or from salmon being processed and removed from the site.

Thin ground slate points, largely triangular and corner notched, may have armed hunting arrows (Duff 1952:59). Their small size and light weight virtually precludes their use in a projectile more robust than an arrow. Such arrows would have been effective in hunting deer, the remains of which are plentiful in the Deep Bay deposits. Bucks were preferred in the spring when they were well fed (Suttles 1951:82-83). The Slaiamman are reported to have acquired deer and herring during March (Barnett 1975:29). Herring are known to spawn at Deep Bay in March also. Therefore, it is possible that seals and sea lions, preying on the herring as they spawned, were taken at the same time as deer were being hunted by means of bows and arrows.

Although the pairing of thin ground slate points and antler composite toggling harpoon valves with seal and sea lion variables seems definitely to imply a procurement complex, the exact nature of the procurement system or systems represented by this complex is not clear. The ethnographic and ecological analogues provide for a variety of interpretations.

The bird remains, except for unidentifiable bird, also co-occur with the same artifact classes as the sea mammal remains. In addition, however, the bird species share relationships with bone points and bone bipoints. Relationships of the bird species with these latter two artifact classes may suggest a coterminous bird procurement complex, but there is little ethnographic support for this interpretation. Instead, the relationships, in some instances, of bird and sea mammal species with the same artifact classes implies that there may be some indirect connection between the acquisition of these faunal species. Seals and sea lions are known to prey on herring (Cowan and Guiget 1968:348, 353; Barnett 1975:15), and the birds presently under discussion commonly feed on herring and their roe (Carl 1966:47; Guiget 1967:8). Among the Lummi and other southeastern Coast Salish groups, nets were suspended underwater on herring spawning beaches in order to trap and drown birds feeding underwater on herring and their eggs (Stern 1934:41; Suttles 1951:73-74). Herring are known to inhabit Baynes Sound (Tester 1947) and to spawn on the beach to the southeast of the site in early spring (March in 1976). The migratory bird species presently under discussion leave the coast between March and May (Munro and Cowan 1947). It seems highly likely, therefore, that both the bird species and the sea mammal species in question were present at the site as predators on the herring.

Man, too, was present as a predator on all these species, as the faunal remains indicate. Herring were reportedly taken by means of rakes made of a wooden shaft set with pointed bone "teeth" (Stern 1934:50; Barnett 1975:86; Gunther 1927:202; Suttles 1951:126), and it is almost certain that herring were also taken by means of the fish trap to the southeast of the site. Herring remains are prolific in the shell midden deposits of the site, attesting to their heavy exploitation by man. Also present in the midden deposits are large numbers of single and double pointed bone objects that could easily have served as herring rake teeth.

Herring remains do not share relationships with bone points or bone bipoints--i.e. fish procuring artifact classes --as might initially be expected, because of their omnipresence. The massive amounts of these fish that could be caught in the fish trap, compared to the amounts that could be caught with herring rakes, probably made their remains so abundant that they do not covary with any artifact class. Also, the likelihood that herring were preserved whole by smoking and drying (Stern 1934:50; Gunther 1927:208; Suttles 1951:127) would account in large part for the lack of relationships between herring remains and fish processing artifact classes. Therefore, because these fish could be taken in large numbers, possibly without related artifact classes being left in the archaeological deposits, it is not surprising that herring remains share no relationships with artifact classes.

The relationships of seagull, grebe, unidentifiable duck, and unidentifiable bird with bone points and bone bipoints seem to suggest, on the basis of the preceding discussion, that a procurement complex exists and that this complex is based on concomitant activity. While herring were being taken, birds preying on herring and herring eggs were probably also taken as a subsidiary resource.

The same argument can be applied to the acquisition of seals and sea lions. Although these species may have been less peripheral than waterfowl to the subsistence base of the site inhabitants, and although the sea mammal procurement complex appears most likely to reflect concomitant activity (sea mammal and salmon acquisition), it can be strongly argued that sea mammals were probably exploited, like waterfowl, as they followed the spawning herring.

It was suggested in the discussion of the sea mammal procurement complex that thin ground slate points might imply hunting activity, since none of the antler composite toggling harpoon valves had slots to receive this kind of armament. If arrows are implied by these points, then a consideration of land hunting evidence is in order. Tables XXVIII and XXX indicate that deer is the major land mammal species represented in the Deep Bay deposits and that this resource was heavily exploited. In spite of this heavy exploitation, deer remains do not share significant relationships with the same artifact classes in more than one analysis. Possible reasons for this are: 1) because the durable artifacts used to acquire deer were valuable beyond the period of time that people stayed at Deep Bay they were probably curated, and 2) because non-durable artifacts, such as snares, traps, and nets (Barnett 1975:96-98, 99-103), could be used to take substantial numbers of deer without being evident in the archaeological record. This situation is the same as that outlined for the absence of variable pairs involving herring.

Deer limb bones, as pointed out in Chapter VI, are found in disproportionately large numbers compared to trunk bones in the Deep Bay deposits. This suggests that a number of the artifact classes used to hunt and preliminarily butcher deer are unlikely to be found at the site. Furthermore, the selective importation of deer bones to the site would mean that not all remains of these animals have the same chance to associate with artifact classes compared to species that were whole when brought to the site. The abundance of deer remains in the site, combined with the possibility that land hunting may have taken place at the same time as seals and sea lions were being taken, suggests that deer hunting may have been an important procurement complex at Deep Bay.

The abundance of dog remains, a species that could be interpreted as an artifact in the sense that dogs were often used as aids in deer hunting (Barnett 1975:96-97), further supports the inference that considerable deer hunting may have been undertaken at Deep Bay. In fact, deer and dog remains co-occur at $\phi = +0.398$, $\alpha = 0.001$ in the presence/absence data and at $r_s = +0.321$, $\alpha = 0.010$ in the weight of remains data. It has already been pointed out that this activity may have occurred in the spring when herring were available and when bucks are at their prime (Barnett 1975:29; Suttles 1951:82-83). It appears, therefore, that a deer procurement system may be implied by the sea mammal and waterfowl procurement complexes.

Verification of Results

If the preceding discussion is an accurate interpretation of past cultural and environmental relationships at Deep Bay, one could reasonably expect that relationships would occur among the artifact classes and among the faunal remains in question. Using the same techniques as were used to detect relationships between artifact classes and faunal species, the four forms of the data were examined. No relationships were found in the minimum numbers of individuals and estimated weight of usable meat data. The presence/absence and weight of remains data, however, produced the relationships shown in Tables XXXIV and XXXV. Table XXXIV indicates that all the artifact classes pair with at least one other artifact

TABLE XXXIV

Pairs of Selected Artifact Classes,
Lot 73, DiSe 7 $\alpha \leq .05$

Variable Pair	Analysis +/- ϕ	α	wt% r_s	α
thin ground slate point x bone point	+0.478	0.002	+0.3048	0.015
thin ground slate point x bone bipoint	+0.367	0.011	+0.2745	0.029
ground slate knife x bone bipoint	+0.308	0.051	+0.2824	0.025
bone point x bone bipoint	+0.516	0.000	+0.3949	0.001
bone point x toggling harpoon valve	+0.379	0.023	+0.2501	0.048
bone bipoint x toggling harpoon valve	+0.432	0.003	+0.3793	0.002

TABLE XXXV

Pairs of Selected Faunal Species,
Lot 73, DiSe 7 $\alpha \leq .05$

Variable Pair	Analysis +/- ϕ	α	wt% r_s	α
sea lion x unidentifiable sea mammal	+0.404	0.005	+0.4114	0.001
sea lion x seagull	-	-	+0.2478	0.050
sea lion x unidentifiable duck	-	-	+0.2745	0.029
unidentifiable sea mammal x seagull	+0.292	0.047	+0.2877	0.022
unidentifiable sea mammal x grebe	+0.410	0.005	+0.3871	0.002
unidentifiable sea mammal x unidentifiable duck	+0.374	0.007	+0.4031	0.001
unidentifiable sea mammal x unidentifiable bird	+0.391	0.025	-	-
seagull x unidentifiable duck	+0.309	0.032	+0.2740	0.030
unidentifiable duck x unidentifiable bird	+0.384	0.006	+0.3438	0.006

class in both analyses of the data. These relationships may be diagrammed as follows:

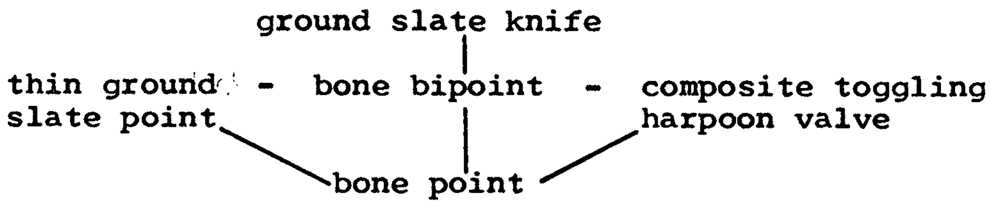

Figure 28. Relationships among selected artifact classes, Lot 73, DiSe 7.

These relationships tend to support the view that these artifact classes are mutually interrelated because of their involvement in related subsistence activities.

If one accepts only those paired faunal species that occur in both analyses, all faunal species are nevertheless found to pair with at least one other species (Table XXXV). The relationships among these variables can be shown as follows:

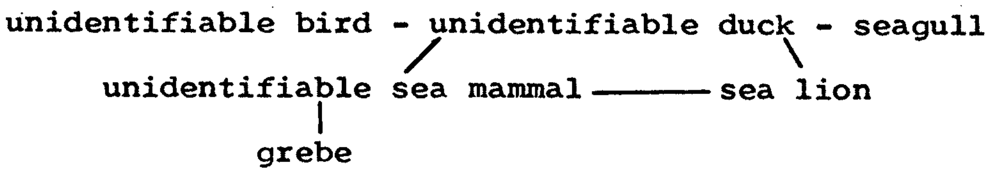

Figure 29. Relationships among selected faunal species, Lot 73, DiSe 7.

The remains of these species tend to co-occur in the archaeological record because, like the selected artifact classes, they were part of a related set of subsistence activities.

It remains to show that deer and herring remains are related to these selected faunal species and to each other. Table XXXVI shows those variable pairs involving deer that occur at $\alpha \leq .05$ in the presence/absence and weight of remains data.

TABLE XXXVI

Variable Pairs Involving Deer and Selected Faunal Species, Lot 73, DiSe 7 $\alpha \leq .05$

	Analysis			
	+/-		wt%	
Variable Pair	ϕ	α	r_s	α
deer x unidentifiable sea mammal	+0.285	0.0479	-	-
deer x unidentifiable duck	+0.365	0.0085	-	-
deer x unidentifiable bird	+0.359	0.0104	+0.3247	0.009

If one accepts only those variable pairs that are found in both analyses, then deer still is related to the selected faunal species through its co-occurrence with unidentifiable bird. If all three variable pairs in Table XXXVI are accepted, then deer is seen as tightly interrelated with selected faunal species.

Herring remains pair only with seagull remains. The relationship should not be considered as a strong one because of the minimal occurrence of seagull remains. However, there does seem to be a relationship between these variables that is significant at $\alpha = .006$ with a correlation coefficient of

r_s = +0.345 in the weight of remains data. This relationship is also found in the presence/absence data to have a significance of α = .022 and a coefficient of association of ϕ = +0.329. These data indicate that the seagull procurement complex, and by extension the waterfowl procurement complex, may indeed be linked to the acquisition of herring. Consequently, these data are thought to support the preceding concomitant activity interpretation that was derived for variable pairs involving waterfowl.

A significant direct relationship between herring and deer could not be detected in either the presence/absence or weight of remains data. The lack of a variable pair involving these two species does not necessarily indicate that they were unrelated to one another in terms of subsistence activities at the site. In fact, quite the opposite interpretation can be made. If the ethnographic analogy with the Slaiamman holds for the former inhabitants of Deep Bay, it is possible that different groups within the site inhabitants were involved in the independent activities of herring fishing and deer hunting. The number of participants in each type of activity could vary randomly through such mechanisms as inherited rights to specific resource locations, access to a number of resource locations through bilateral kinship ties, and specialist pursuits of both types of activity. Also, predictable and non-predictable fluctuations in the abundance of each resource may obscure whatever potential relationships exist between the remains of these two species. Because these two resources were likely to have been pursued independently, they can be seen as all the more important in terms of subsistence. Even if the harvest was poor from one of these resources, the abundance of the other resource would not be affected.

Conclusion

It seems reasonable to infer that the procurement complexes discussed above represent the tangible evidence of several food resource procurement systems. Several of these systems are clearly more important than the others. These systems can be defined and intuitively ranked as follows:

1a. The herring procurement system. Artifact class data, faunal data, ethnographic analogues and ecological analogues all suggest that herring were a primary food resource and that a well developed set of tools and behavior was associated with their acquisition.

1b. The deer procurement system. Ethnographic and ecological analogues and faunal data indicate that deer, as well as herring, were acquired independently as basic components of the subsistence strategy at Deep Bay.

2. The sea mammal procurement system. Both seal and sea lion belong within this system. Faunal data, possibly the artifact class data, ethnographic and ecological analogues all support the view that this procurement system was closely

tied to the herring procurement system. Although more usable meat on Lot 73 is represented by sea mammals compared to deer, the dependent relationship of sea mammals and herring suggests that the sea mammal procurement system should be assigned less importance than the deer procurement system.

3. The waterfowl procurement system. All four types of data indicate the existence of such a procurement system. An examination of the weights of remains of these species, their frequency of occurrence, and the amount of usable meat they contribute to the food resource inventory clearly shows that these species form a minor part of the subsistence base.

4. The mollusc procurement system. This system is added here, not because it seems to be the least important food resource procurement system at Deep Bay, but rather to indicate that mollusc gathering activity was undoubtedly an important day to day activity (Gunther 1927:206; Stern 1934:47). This system is also included as a reminder that it is possible for a coastal site to have been occupied without evidence of shellfish having been gathered, e.g. Component I.

These procurement systems are thought to constitute the subsistence base at Deep Bay. The absence from Component I of practically all the variables involved means that the relationships discussed here apply to Components II and III. The distributions of sea lion remains and thin ground slate points indicate that at least part of the sea mammal procurement system, and possibly the deer procurement system, may have been more prevalent in Component II than in Component III. Bone bipoints appear in greater numbers in Component III than in Component II. This suggests that the waterfowl procurement system may have developed through time in conjunction with the herring procurement system. On the other hand, light duty bone points are evenly distributed through Components II and III. Therefore, changes may have been minor in the procurement systems in which they were involved. The inability of the Kruskal-Wallis test to differentiate between components on the basis of many artifact classes or faunal remains seems to indicate that only minor shifts are likely to have occurred in the procurement systems throughout Components II and III.

CHAPTER IX

SEASONAL ASPECTS OF SITE USE

Introduction

The purpose of this chapter is to bring together the various lines of evidence pertaining to the seasonal occupation of Deep Bay. The data on which this discussion is based consist of the various attributes of the faunal assemblage recovered from the midden deposits on Lot 73. The virtual absence of faunal remains from the Component I deposits means that the findings presented here are applicable primarily to Components II and III. Physical characteristics and the ecology of selected birds, fish, and mammal species are examined and the conclusion is reached that, at least during the time when Components II and III were deposited, the Deep Bay site was occupied during the late winter and early spring. During the period of Component III, however, the site may have been occupied less intensively at various other times of year as well. An attempt is also made, in light of seasonal implications drawn from the faunal assemblage, to place the Deep Bay site into an annual subsistence round context. This context will be general in the sense that insufficient information is available for meaningful distinctions to be made between the roles played by Components

II and III in the annual round.

Faunal Evidence

The clam shell seasonality analysis suggested that at least 50%, and as much as 80%, of all clams recovered from the midden were taken in the first growth quarter. That is, they were gathered during the period during which the winter check ring was being formed or during the initial stages of post-winter growth. This evidence would imply that clams were being most heavily exploited during mid-to-late winter and early spring. The heavy exploitation of clams at this time of year may indicate that late winter and early spring was the period of most intensive occupation of the site, or it may indicate that other more desirable subsistence resources were not available at this time of year. The decrease in the emphasis on the spring quarter, and the increase in the emphasis on later quarters, of clam exploitation from the Gulf of Georgia Component might be accounted for by local environmental change affecting the availability of the range of subsistence resources. Or, it may be accounted for by a cultural change. One possibility is that increased population pressure and increased inter-group conflict prompted the construction of defensive structures such as earthworks. One such earthwork, reportedly very large, formerly existed on the spit at Deep Bay. With a need for greater security, the earlier annual round may have been slightly modified to include longer occupation, by some or all local group members, of sites such as Deep Bay that could be defended relatively easily. Thus, although there may be a slight change through time in the seasonal occupation of the site, it appears mainly to have been used during the late winter and early spring.

From Lot 73 the remains of fourteen bird species or genera were identified. In keeping with previous usage, the term "variables" will be used to refer to genus and species remains. Eight variables were found in three or less analytical units, thus suggesting their lack of importance in terms of subsistence. Five variables are sedentary while the remaining three are migratory. Six variables found in five or more analytical units are included in Table XXVIII, and it is inferred from their increased frequency of occurrence that they were relatively important in terms of subsistence. Three of the six variables are migratory and three are sedentary. Because of their importance for subsistence purposes, as well as seasonal dating purposes, the migratory variables from this table will be examined closely here. The three variables in question are Aythya marila, Podiceps/Colymbus, and unidentifiable duck. Aythya marila, or greater scaup duck, is a winter visitor to the coast of British Columbia (Godfrey 1966:69). It appears on the coast between September and November and departs between March and May (Munro and Cowan 1947:67; Guiget 1958:55). The greater scaup duck is a salt water bird when on the coast. Its diet is almost entirely animal matter such as shellfish, insects, and crustaceans (Godfrey 1966:56). This preference for animal foods is likely to include herring and their roe. Podiceps/Colymbus, or grebe, consists of some six species in the province. All are migratory, however, spending the period from September to November through March to May on the coast (Munro and Cowan 1947:44-48). The red-necked grebe and pied-bill grebe, however, are known to nest on the coast as well (Godfrey 1966:16, 19). When on salt water, grebes feed on small fishes that they chase and capture underwater (Carl 1963:47), as well as on crustaceans (Godfrey 1966:17, 18). Unidentifiable duck is a variable covering Anseriformes not belonging to the swan or goose category. These ducks all have a tendency to winter on the coast of British Columbia and to migrate north for nesting purposes in the summer. Nevertheless, some members of the various species involved, usually immature individuals, stay on the coast during the summer as well (Munro and Cowan 1947:59-72). Ducks in this category feed on a variety of plants, crustaceans, and shellfish. The migratory birds that are found in abundance on Lot 73 therefore appear to frequent the coast between October and April and to subsist there, to a considerable extent, on animal foods.

The frequently exploited sedentary species are Branta sp., Larus sp., and Haliaeetus leucocephalus. The first of these variables is most likely to be the greater Canada goose, although subspecies of this genus are imperfectly understood (Godfrey 1966:49). The second is most likely to be the glaucous-winged gull, and the last is the bald eagle. While the Canada goose feeds on vegetable matter (Guiget 1958:16), both the bald eagle and glaucous-winged gull feed to a greater or lesser extent on animal food, especially fish (Guiget 1967:8; Godfrey 1966:98; Carl 1963:68). Another notable feature of these sedentary birds is their large size. They are larger than almost any other locally available sedentary birds except herons and possibly cormorants. Thus, whereas the preferred migratory birds appear in large numbers, the preferred sedentary birds appear to be of large size.

Among the infrequently occurring bird variables, Brachyramphus sp. (murrelet), Gavia sp. (loon), Melanitta sp. (scoter), and Uria sp. (murre) are of particular interest. Murrelet is a sedentary bird, of interest because its diet consists of crustaceans and small fish such as herring (Carl 1966:83). The common loon, the arctic loon, and the red-throated loon are common winter residents on the British Columbia coast. The arctic loon is known but uncommon on the coast in summer. The yellow-billed loon winters on the coast, albeit in small numbers. The point of interest about loons is their capacity to swim underwater in pursuit of fish, which form a major portion of their diet. The white-winged scoter, known as M. fusca (Munro and Cowan 1947:72) and M. deglandi (Godfrey 1966:79), is a winter resident of the coast. Both white-winged and surf scoters are common winter coastal visitors (Godfrey 1966:79-80; Carl 1966:64-66). The white-winged scoter inhabits the coast between September-October and March-April. Its diet consists of animal foods such as shellfish and crustaceans. The surf scoter is present on the coast at the same time of year, but its diet is extended to include insects and small fish (Guiget 1958:73). Lastly, murres--most likely the common murre (Uria aagle)--inhabit different parts of the coast during different seasons. During the summer breeding season they are usually found in colonies along the open ocean and are usually absent from more protected waters. In the early fall, however, they move to protected inside waters where they remain for the winter. Murres are classified as fish eating birds (Carl 1966:82). As noted in Chapter II, all these bird species are recorded in Audubon Society Christmas bird counts (eg. Arbib 1973:179-180).

Turning to migratory fish, herring is the only species available in great numbers at the site. Herring remains were very abundant in the deposits, sometimes appearing almost carpet-like. The fish trap on the beach to the southeast of the site is a possible means by which they were acquired. Evidence has already been cited to the effect that, although herring were present in Baynes Sound adjacent to the site during the late fall and winter, the spawning of these schools, and therefore their greatest accessibility, did not occur until early spring. In 1976 the height of the spawn occurred about March 21st (J. Reid,pers. comm). Herring spawn on the seaweed and sand deposits surrounding and in the fish trap, and their abundance during this time can probably be judged by the ability of present day people to dip herring from the trap with trout nets and bare hands.

It has been noted that seals and sea lions prey on fish, including herring, during the spawning periods (Cowan and Guiget 1956:348, 353). Since the Deep Bay situation is unlikely to be different from any other herring spawning area, it can be inferred that the seal and sea lion remains in the deposits represent individuals taken while following the schools of spawning herring. Since the herring spawn occurs about March, it seems reasonable to conclude that seals and sea lions are most readily available at the site at this time of year.

Not only seals and sea lions preyed on spawning herring. Stern (1934:41) notes that the Lummi set nets underwater to trap birds feeding on herring and their roe. These birds consume animal foods, including fish, that are obtained in underwater pursuit. Thus, the migratory birds may easily have been taken while they fed on the herring or their eggs. Seagulls and eagles, both scavengers and consumers of fish, can be assumed to have been present in substantial numbers while herring spawned because of the relatively abundant and concentrated food supply.

Barnett reports for the Slaiaman that, while herring were caught at the mouth of Powell River during March to mid-May, deer were hunted on Powell Lake. The products of both pursuits were later exchanged (Barnett 1975:29). In the Deep Bay faunal assemblage, deer remains were among the most frequently and abundantly represented remains of any species. As has been pointed out by Suttles, bucks were preferred in the spring because of their well nourished condition, in contrast to does that had just given birth. Does, which were fat in the fall, were hunted in December for immediate consumption (Suttles 1951:82-83). Although there is no information on the sex of deer in the Deep Bay faunal assemblage, the two ethnographic reports of deer hunting in the spring, particularly in conjunction with herring acquisition, and the abundance of both deer and herring remains in the faunal assemblage, suggest that the seasonal acquisition pattern may also have been followed at Deep Bay.

Age composition of selected species is another means by which seasonal inferences can be made from the faunal assemblage. In the Deep Bay faunal assemblage, it is possible to examine the dog and deer remains and, to some extent, sea mammal remains in this light. Juvenile individuals, identified on the basis of bone size and fusion of epiphises, are present for dog and deer and to a lesser extent for sea lion, seal, and beaver. Given the rather generalized seasonal range outlined by these criteria it is desirable to accumulate more specific evidence (cf. Ham and Irvine 1975:371). In one instance, however, it was possible to assign one canine individual to the one to five month age bracket on the basis of tooth eruption. Also, the remains of a fetal deer were identified. Mule deer, or coast black tail deer (Odocoileus hemionus columbianus) give birth in the spring (Banfield 1974:389). While this is only an isolated instance suggesting a season of site occupation, it does support the other lines of evidence that suggest a late winter and early spring occupation. The isolated instance of a fetal deer may support Suttles' report that male deer were preferred in the spring.

The migratory birds imply a late fall to early spring time period. Within that time period the clam shells and the herring remains imply a late winter to early spring time period. The presence in the faunal assemblage of two sea mammal species and two sedentary bird species known to prey on small fish, including herring, supports the position that the species in question were most likely to have been taken at the site. The conclusion can be made, therefore, that the site was primarily occupied during the late winter and early spring for the purpose of taking advantage of the concentration of food resource species centered around spawning herring.

The faunal and ethnographic evidence also suggests that deer hunting may have occurred in conjunction with herring fishing.

If Deep Bay represents a site occupied during late winter to early spring, its place in an annual subsistence round should be examined. Not only is it of interest to reconstruct an annual round on the basis of what is known from Deep Bay, but it is also important to give some cultural context to the artifact assemblage. This context will enable hypotheses to be developed that help account for variation among assemblages.

There are certain fixed points of reference that can be dealt with in reconstructing an annual round in the Deep Bay area. First, there is the cessation of vigorous subsistence related activity during the height of winter, approximately December through February. There are no indications of where a winter village site might be located, but it would have to be relatively large in area and fairly protected from northern and southwestern winds. The entire local group could be expected to spend the main winter months there. In the early spring the initial subsistence activities would take place. There are several other herring spawning areas near Deep Bay, notably Comox Harbour and Nanoose Bay. Depending on size and composition, the local group could move en masse to one or more such locations to exploit the concentration of resources centered around herring. Possibly deer would also be exploited from the same sites at the same time.

From approximately May to November the largest portion of stored provisions, aside from salmon, had to be acquired. Principal among these would be clams, which are plentiful in the area and could be gathered and processed by small divisions of the local group, possibly one or two nuclear families. The Buckley Bay site (Mitchell 1973) may have been used for such activity given its proximity to extensive tidal flats in Fanny Bay. The gathering of berries and other vegetable foods, trolling for salmon, and deer hunting occupied much of the summer as well. The major salmon species spawning in the area is dog salmon (Oncorhynchus keta)*, which ascends local rivers and streams in November. The main rivers in this regard are the Puntledge, Big Qualicum, and Little Qualicum. In addition, this species was known to frequent all the smaller streams in abundance (A. Recalma,pers. comm). Hunting of does may have consumed a fair amount of time in the early fall. This activity could have been carried out almost anywhere by relatively small segments of the local

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* The name "Qualicum" is derived from an Indian word that refers to the place where dog salmon spawn (G. Reid,pers. comm). Within the Halkomelem linguistic group the Cowichan and Musqueam dialects share the same word for dog salmon (k̓ʷɑ́ʔləxʷ) and the Chilliwack have only a slightly different word (k̓ʷɑ́·ləxʷ) (Elmendorf and Suttles 1960:24).

group. A concentration of people could be expected again in the late fall at the major dog salmon fishing locations already noted. Excavated sites such as Sandwick Midden (Capes 1964), Tsable River Bridge (Whitlam ms.), and Little Qualicum River (Bernick ms.) may represent the loci of such activities. From these sites, the local group probably moved more or less directly back to the winter village sites where repair and manufacture of artifacts and social-ceremonial activities may have been focused.

In this chapter I have examined the faunal assemblage from Lot 73 at Deep Bay and have concluded that the site was probably occupied in late winter and early spring during the past 2000 to 2500 years. There is also some evidence that, during the past 1000 years, seasonal occupation of the site may have been prolonged to include portions of the summer and fall. Evidence for the seasonal use of Deep Bay enables it to be placed in a hypothetical reconstructed annual subsistence round based on ethnographic, environmental, and archaeological data. The chapter has also demonstrated a range of sources for data pertaining to seasonal aspects of site use. The synthesis of these data is seen as an appropriate method for inferring seasonality of site use.

CHAPTER X

CONCLUSION

The aim of this dissertation was to see whether ethnographically reported relationships between artifact classes and food resource remains could be observed in the archaeological record. On the basis of the procurement systems that were detected in Chapter VIII, it is concluded that this aim has met with moderate success. The archaeological data reveal relationships between artifact classes and food resource remains that are interpretable by means of ethnographic and ecological analogues. It is concluded that procurement systems involving herring, deer, sea mammals, and waterfowl, in addition to predictable clam gathering activities, are represented at the Deep Bay site. The artifact classes involved in these procurement systems are antler composite toggling harpoon valves, thin ground slate points, bone points, bone bipoints, and possibly thin ground slate knives. An analysis of the seasonal indicators in the faunal assemblage points to a late winter and early spring occupation of the site. A possible extension of seasonal site occupation may have occurred within the last 1000 years.

The fish trap to the southeast of the site was probably of major importance in terms of subsistence at the site. If the abundance of herring remains is a valid indicator, it would seem that the fish trap, or a fish trap, may have existed at the site for 2000 years or more. The elaborate trench embankments that formerly existed at the site suggest a need for defense, possibly in the face of population expansion. This embankment may be related to the evidence from clam shell seasonality that, during the time period of the Gulf of Georgia Culture Type, the period of site occupation was less confined to the late spring and early summer. The need for protection and the availability of a defensible location may have prompted populations to inhabit a formerly seasonal camp for slightly extended periods of time. This situation would not necessarily have meant a major change in subsistence patterns.

The absence of most faunal remains from Component I, and the different character of its artifact assemblage, suggest that the findings presented here are not applicable to this component. However, since the material from Component I may be atypical because it was recovered from what has been interpreted as a beach, it is possible that the procurement systems found in Components II and III might also be found in midden deposits associated with Component I. There is some minor evidence to suggest that the sea mammal procurement system may have been favored in Component II and that the herring and waterfowl procurement systems may have been favored in Component III. However, the inability of any major artifact class or faunal species to distinguish between these two components suggests that any shifts in preference among procurement systems probably was minor.

Lot 73 supplied the data on which the seasonal and procurement system interpretations are based. The findings of this dissertation, therefore, apply strictly to the Lot 73 material. Although a similar range of artifact classes and faunal species are found on Lot 81, it is not safe to apply the Lot 73 findings to the whole site. The type of analyses undertaken here are not yet duplicated elsewhere in the Gulf of Georgia area. For this reason it would be unwise to imply that similar relationships between artifact classes and faunal remains are likely to be found at other sites. It is noteworthy, in this regard, that an inverse relationship between basalt debris and salmon remains was found in the St. Mungo Component at Glenrose Cannery (Matson 1976:189). This component, in units 1, 1/5, and 5 is also interpreted as beach deposit. Future work in the Gulf of Georgia may subsequently show that evidence of procurement systems can be detected at other sites as well.

The methods used to detect relationships between artifact classes and food resource remains are judged to have been both appropriate and effective. The use of the chi-square test of independence between samples and the Spearman rank order correlation coefficient with an associated probability has proven effective in finding variables that are associated at high levels of probability. The use of these techniques to examine the artifact and faunal data in their presence/absence, minimum numbers of individuals, weight of remains, and estimated weight of usable meat forms has shown that a nucleus of consistent results can be produced from four different forms of the same data. The existence of this nucleus of results indicates that the method and techniques employed in this study can detect associations between artifact and faunal variables that are likely to be significant and reliable. The use of quantitative techniques, such as those employed here, to examine the artifact and faunal data has proven to be a successful procedure for effecting the aims set forth at the beginning of this dissertation. This conclusion is reinforced by the existence of a nucleus of consistent results from all four analyses.

The quantitative measures used to analyze the data are appropriate, although the data contained some features that tended to weaken the effect of the statistical measures. Relatively large numbers of common absences tend to inflate the values of phi and chi-square. Therefore, the strength of association of some variable pairs may be due in part to few common presences and many common absences. The probability for the chi-square statistic in such instances indicates too low a probability for chance occurrence of two variables. This problem is common, especially in archaeology, where there are often many variables that are found relatively infrequently among excavation units. The procedure applied in this dissertation, that is, screening out variables that occur very infrequently and examining variable pairs to assess relative reliability, is the most effective procedure to control for these distortions. Although Spearman's rank order correlation coefficient is also sensitive to tied values, the formula corrected for ties adequately compensates for the tied zero values in the data. Consequently, the probability associated with r_s appears to be accurate.

In looking back on the quantitative techniques employed and the results produced, the potential utility of still more sophisticated analytical techniques is apparent. Combining artifact and faunal variables into a single assemblage of variables, and applying R-mode clustering and scaling techniques subsequent to the procedures employed in this study, would help detect meaningful groupings of artifact classes and faunal species. The information thus derived would potentially illuminate the complex network of interrelationships that exist between the artifact and faunal variables in the archaeological record. A consistent nucleus of results produced by this method could be expected to conform even more closely than the present results to subsistence related ethnographic reports.

Different re-organization of the data for analysis would also be useful. The examination of each component separately would refine the preliminary results produced in this dissertation. A check on the reliability of variable pairs could be accomplished by redefining the analytical units. One obvious transformation is the natural stratum. These analytical units could be examined both within components and over all components.

The implications of this study for future work in the Gulf of Georgia are promising. A series of similar studies would help clarify relationships between artifact assemblages by indicating to which aspects of the annual subsistence round the artifact assemblages were related. In addition, valuable information would be gained on the nature of specific annual subsistence rounds throughout the region. This information, in turn, would form a solid foundation for more detailed studies of adaptation within the region at various times in the past. It would also open the way for more comprehensive examinations of seasonal site use and settlement patterns.

BIBLIOGRAPHY

Abbott, D.N.
1972 "The utility of the concept of phase in the archaeology of the southern Northwest Coast", Syesis 5:267-278. Victoria.

1977 personal communication

Allen, J.R.L.
1968 Current ripples: their relation to patterns of water and sediment motion. North-Holland Publishing Company, Amsterdam.

Anderson, J.R.
1937 Trees and shrubs: food, medicinal, and poisonous plants of British Columbia. Department of Education, Province of British Columbia, Victoria.

Arbib, R.S.Jr.
1973 American Birds (ed.) National Audobon Society 27(2):135-558. New York.

Ascher, R.
1968 "Time's arrow and the archaeology of a contemporary community", in Chang, K.C. (ed.) Settlement Archaeology. National Press, Palo Alto.

Banfield, A.W.F.
1974 The mammals of Canada. National Museum of Natural Sciences, National Museum of Canada. University of Toronto Press, Toronto.

Barnett, H.G.
1975 The Coast Salish of British Columbia. Greenwood Press, Westport.

Beattie, O.
1971 "Salvage archaeology at Bliss Landing", in Carlson, R.L. (ed.) Salvage '71. Department of Archaeology, Simon Fraser University, publication no.1, Vancouver.

Bernick, K.
1976 "Preliminary report of 1976 salvage excavations at the Little Qualicum River site: DiSc 1", ms. on file, Archaeological Sites Advisory Board of British Columbia, Victoria.

von Bertalanffy, L.
1968 General systems theory. George Braziller, New York.

Binford, L.R.
1973 "Interassemblage variability - the Mousterian and the 'functional' argument", in Renfrew, C. (ed.) The Explanation of Cultural Change. Duckworth, London.

Boehm (Calvert) S.G.
1970 "The St. Mungo Cannery site: a preliminary report", in Carlson, R.L. (ed.) Archaeology in British Columbia: new discoveries. B.C. Studies special issue 6-7:54-76. Vancouver.

Borden, C.E.
1950 "Preliminary report on archaeological investigations in the Fraser Delta region". Anthropology in British Columbia, 1:13-27.

1961 Fraser River archaeological project. Anthropological Papers, no. 1, National Museum of Canada, Ottawa.

1970 "Culture history of the Fraser-Delta region: an outline", in Carlson, R.L. (ed.) Archaeology in British Columbia: new discoveries. B.C. Studies special issue 6-7:95-112. Vancouver.

1977 personal communication

Bradley, J.V.
1968 Distribution-free statistical tests. Prentice-Hall, Englewood Cliffs.

Bryan, A.L.
1957 "Results and interpretations of recent archaeological research in western Washington with circum-boreal implications", Davidson Journal of Anthropology 3:1-16. Seattle.

Buckley, W.
1968 "Society as a complex adaptive system", in Buckley, W. (ed.) Modern Systems Research for the Behavioral Scientist. Aldine, Chicago, pp. 490-513.

Buxton, J.
1969 Earthworks of southwestern British Columbia. M.A. Thesis, University of Victoria, Victoria.

Calvert, S.G.
1970 "The St. Mungo cannery site: a preliminary report", in Carlson, R.L. (ed.) Archaeology in British Columbia: new discoveries. B.C. Studies special issue 6-7:54-76. Vancouver.

Capes, K.H.
1964 "Contributions to the prehistory of Vancouver Island", Occasional Papers of the Idaho State University Museum. Pocatello.

Carl, G.C.
1966 Guide to marine life of British Columbia. British Columbia Provincial Museum, Department of Recreation and Conservation, Handbook no. 21, Victoria.

Carlson, R.L.
1960 "Chronology and culture change in the San Juan Islands, Washington", American Antiquity 25:562-586. Salt Lake City.

1970 "Excavations at Helen Point on Mayne Island", in Carlson, R.L. (ed.) Archaeology in British Columbia: new discoveries. B.C. Studies special issue 6-7:113-125. Vancouver.

Chang, K.C.
1967 Rethinking Archaeology. Random House, New York.

Charlton, A.S.
1972 "Noons Creek and Belcarra: a preliminary report on excavations near Port Moody", in Carlson, R.L. (ed.) Salvage '71. Department of Archaeology, Simon Fraser University, Publication Number 1, Vancouver.

Church, M.
1976 personal communication

Clark, R.M.
1975 "A calibration curve for radiocarbon dates", Antiquity XLIX. London.

Connover, K.J.
1972 Archaeological sampling at Namu, a problem in settlement reconstruction. Ph.D. Dissertation, University of Colorado, Denver.

Conover, W.J.
1971 Practical nonparametric statistics. John Wiley and Sons, New York.

Cook, S.F. and R.F. Heizer
1965 Studies on the chemical analysis of archaeological sites. University of California Publications in Anthropology vol.2, Los Angeles.

Cornwall, I.W.
1958 Soils for the archaeologist. Phoenix House, London.

Cowan, I. McT. and C. Guiget
1956 The mammals of British Columbia. B.C. Provincial Museum, Victoria.

Craig, G.Y. and A. Hallam
1963 "Size-frequency and growth-ring analyses of Mytilus edulis and Cardium edule, and palaeoecological significance", Palaeontology vol.6, pt.4:731-750.

Day, J.H., L. Farstad, and D.G. Laird
1959 Soil survey of southeast Vancouver Island and Gulf Islands, British Columbia. British Columbia Soil Survey, Report no.6, Victoria.

Donald, L. and D.H. Mitchell
1975 "Some correlates of local group rank among the southern Kwakiutl", Ethnology vol.XIV, no.4:325-346. Victoria.

Duff, W.
1952 The Upper Stalo Indians. Anthropology in British Columbia, memoir no.1, Victoria.

Eades, D.C.
1965 "The inappropriateness of the correlation coefficient as a measure of taxonomic resemblance", Systemic Zoology 14(2): 98-100.

Elmendorf, W.W. and W.P. Suttles
1960 "Pattern and change in Halkomelem Salish dialects", Anthropological Linguistics 2(7):1-32.

Emory, K.P. and Y.H. Sinoto
1969 "Age of the sites in the South Point area, Ka'u, Hawaii". Pacific Anthropological Records, no. 8. Bernice P. Bishop Museum, Department of Anthropology. Honolulu.

Fladmark, K.R.
1970 "Preliminary report on the archaeology of the Queen Charlotte Islands", in Carlson, R.L. (ed.) Archaeology in British Columbia: new discoveries, B.C. Studies special issue 6-7:18-47. Vancouver.

1974 A paleoecological model for northwest coast prehistory. Ph.D. Dissertation, University of Calgary, Calgary.

Flannery, K.V.
1972 "Archaeological systems theory and early mesoamerica", in Leone, M.P. (ed.) Contemporary Archaeology. Southern Illinois University Press, Carbondale and Edwardsville.

Fraser, C. McL. and G.M. Smith
1928 "Notes on the ecology of the butter clam", Transactions of the Royal Society of Canada section 4, 22:271-286.

Freeman, L.G.
1973 "The analysis of some occupation floor distributions from earlier and middle paleolithic sites in Spain", IXth International Congress of Anthropological and Ethnological Sciences. Chicago.

Gilbert, B.M.
1973 Mammalian Osteo-Archaeology: North America. Missouri Archaeological Society, University of Missouri, Columbia.

Godfrey, W.E.
1966 The birds of Canada. National Museum of Canada, bulletin no. 203, Biological Series no. 73, Ottawa.

Grabert, G.F. and C.E. Larsen
1975 "Maritime transgression and cultural adaptation: preliminary tests of an environmental model", in Fitzhugh, W. (ed.) Prehistoric Maritime Adaptations of the Circumpolar Zone. Mouton, The Hague.

Gregory, W.K.
1933 "Fish Skulls: a study of the evoluation of natural mechanisms", Transactions of the American Philosophical Society 33(2).

Guiget, C.J.
1958 The birds of British Columbia (6) Waterfowl. British Columbia Provincial Museum, Department of Education, Handbook no. 15, Victoria.

1967 The birds of British Columbia (5) Gulls, Terns, Jaegers, and Skua. British Columbia Provincial Museum, Department of Recreation and Conservation, Handbook no. 13, Victoria.

Gunther, E.
1927 Klallam ethnography. University of Washington Publications in Anthropology, Seattle.

Ham, L.C.
1976 "Analysis of shell samples from Glenrose", in R.G. Matson (ed.) Glenrose Cannery Site. National Museum of Man, Mercury Series, paper no. 52:42-78. Ottawa.

Ham, L.C. and C.M. Irvine
1976 "Techniques for determining seasonality of shell middens from marine mollusc remains", Syesis 8:363-373. Victoria.

Hayden, B.
1975 "Curation: old and new", in Raymond, J.S. et.al. (eds.) Primitive Art and Technology. University of Calgary Student Press, Calgary.

Heusser, C.J.
1960 "Late pleistocene environments of north pacific America", American Geographical Society Special Publication 35. New York.

Hill, J.N.
1970 Broken K pueblo: prehistoric social organization in the American southwest. Anthropological Papers of the University of Arizona, no. 18. University of Arizona Press, Tucson.

Hoover, A.L.
1974 Socketed harpoon heads from the northwest coast. M.A. Thesis, Simon Fraser University, Vancouver.

Howard, H.
1929 "The avifauna of Emeryville shellmound", University of California Publications in Zoology 32(2):301-394.

Imamoto, S.S.
1976 "An analysis of the Glenrose faunal remains", in Matson, R.G. (ed.) The Glenrose Cannery Site. National Museum of Man, Mercury Series, Paper no. 52:21-41. Ottawa.

Johnson, S.C.
1967 "Hierarchical clustering schemes", Psychometrika 32:241-254.

Jorgensen, J.G.
1969 Salish language and culture. Language Science Monographs, Indiana University Publications. Mouton and Company, The Hague.

Keen, S.D.
1976 The growth rings of clam shells from two Pentlatch middens as indicators of seasonal gathering. M.A. Thesis, University of Victoria, Victoria.

Kew, D. and P.E. Goddard
1974 Indian art and culture of the Northwest Coast. Hancock House, Saanichton.

Kew, J.E.M.
1970 Coast Salish ceremonial life: status and identity in a modern village. Ph.D. Dissertation, University of Washington.

Kidd, R.S.
1969 "The archaeology of the Fossil Bay site, Sucia Island, northwestern Washington State, in relation to the Fraser delta sequence", Paper no.2, Contributions to Anthropology VIII: archaeology, National Museum of Canada, Bulletin 232. Ottawa.

King, A.
1950 "Cattle Point, a stratified site in the southern northwest coast region", Memoirs of the Society for American Archaeology, 7. Menasha.

King, C.A.M.
1971 Techniques in geomorphology. Edward Arnold, London.

Koyama, S.
1974 "Correlation of faunal remains and selected artifacts at Hogup Cave, Utah", Readings in Archaeological Method and Technique. Center for Archaeological Research at Davis, publication no.4.

Kruskal, J.B.
1964 "Multidimensional scaling by optimizing goodness-of-fit to a non-metric hypothesis", Psychometrika 29:1-27.

Kruskal, W.H. and W.A. Wallis
1952 "Use of ranks in one-criterion variance analysis", Journal of the American Statistical Association 47:583-621.

Lance, G.N. and W.T. Williams
1967 "A general theory of classificatory sorting strategies. I: Hierarchical Systems", Computer Journal 9:373.

Leone, M.P.
1972 "Issues in anthropological archaeology", in Leone, M.P. (ed.) Contemporary Archaeology. Southern Illinois University Press, Carbondale and Edwardsville.

Longacre, W.
1970 Archaeology as anthropology: a case study. University of Arizona Anthropological Papers, 17.

MacDonald, G.F.
1976 personal communication

Mann, H.B. and D.R. Whitney
1946 "On a test of whether one of two random variables is stochastically larger than the other", The Annals of Mathematical Statistics 18:50-60 (5.3).

Maruyama, M.
1963 "The second cybernetics: deviation-amplifying mutual causal processes", American Scientist 51:164:179.

Mathews, W.H., J.G. Fyles, and H.W. Nasmith
1970 "Post-glacial crustal movements in south-western British Columbia and adjacent Washington State", Canadian Journal of Earth Sciences 7(2):690-702.

Matson, R.G.
1973 "Progress report on the Glenrose cannery site (DgRr 6)", ms.

1974 "Clustering and scaling of Gulf of Georgia sites", Syesis 7:101-114. Victoria.

1975 personal communication

1976 The Glenrose Cannery Site. National Museum of Man, Mercury Series, paper no. 52, Ottawa.

McMillan, A.D. and D.E. Ste. Claire
1975 "Archaeological investigations in the Alberni Valley", B.C. Studies no.25:32-77. Vancouver.

Mitchell, D.H.
1968a "Excavations at two trench embankments in the Gulf of Georgia region", Syesis 3:29-46. Victoria.

1968b "Microblades: a long-standing Gulf of Georgia tradition", American Antiquity 33(1):11-15. Salt Lake City.

1971a "Archaeology of the Gulf of Georgia area, a natural region and its culture types", Syesis 4(supp.1):1-228. Victoria.

1971b "Artifacts from archaeological surveys in the Johnstone Strait region", Syesis 5:21-42. Victoria.

1971c "The Dionisio Point site and Gulf Island culture history", Syesis 4:145-165. Victoria.

1973 "Salvage excavations at site DjSf 13 Buckley Bay, British Columbia", in W.J. Byrne (ed.) Archaeological Salvage Projects 1973. National Museum of Man, Mercury Series, Archaeological Survey of Canada paper no.26, Ottawa.

Monks, G.G.
1971 "Excavations at Saltery Bay Provincial Campsite, DkSh 2", ms. on file, Archaeological Sites Advisory Board of British Columbia, Victoria.

1973 Interrelationships of artifact classes from the Gulf of Georgia. Unpublished M.A. Thesis, Department of Anthropology, University of Victoria, Victoria.

n.d. a "Saltery Bay: a mainland site in the northern Gulf of Georgia", ms. in preparation.

n.d. b "Associations of artifact classes and faunal species from two sites in the Gulf of Georgia", ms. in preparation.

Munro, J.A. and I. McT. Cowan
1947 A review of the bird fauna of British Columbia. British Columbia Provincial Museum, Victoria.

Newcombe, W.A.
1932 "A large Salish earthwork", British Columbia Provincial Museum of Natural History Report for the year 1931. Victoria.

Newcombe, W.A. and C.F. Newcombe
1913 "Sea lions on the coast of British Columbia", Report of the British Columbia Commissioner of Fisheries:131-145. Victoria.

Nie, N.H., D.H. Bent, and C.H. Hull
1970 Statistical package for the social sciences. McGraw-Hill, New York.

Olsen, S.J.
1968 Fish, amphibian, and reptile remains from archaeological sites: part I, southeastern and southwestern United States. Appendix: the osteology of the wild turkey. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, vol.LVI, no.2.

Osgood, C.
1940 Ingalik Material Culture. Yale University Publications in Anthropology no.22, New Haven.

Patenaude, V.
1976 "Deep Bay (DiSe 7) faunal analysis plus element list, excavation units 2, 3, 4, and 5", paper submitted to Dr. R.G. Matson for Anthropology 433, University of British Columbia, Vancouver.

Percy, R.C.W.
1972 "Miscellaneous archaeological work: 1971", in Carlson, R.L. (ed.) Salvage '71. Department of Archaeology, Simon Fraser University, publication no.1, Vancouver.

Quayle, D.B.
1970 The intertidal bivalves of British Columbia. British Columbia Provincial Museum, handbook no.17, Victoria.

Recalma, A.
1975 personal communication

Recalma, B.
1975 personal communication

Reid, J.
1975 personal communication

Rickets, E.F. and J. Calvin
1968 Between pacific tides. Stanford University Press, Stanford. Original edition 1948.

Roll, T.E.
1974 The archaeology of Minard: a case study of a late prehistoric Northwest Coast procurement system. Ph.D. Dissertation, Washington State University, University Microfilms.

Schmid, E.
1972 Atlas of Animal Bones for Prehistorians, Archaeologists, and Quaternary Geologists. Elsevier Publishing Company, Amsterdam.

Schiffer, M.B.
1972 "Archaeological context and systemic context", American Antiquity 37(2): 156-165. Menasha.

1976 Behavioral Archaeology. Academic Press, New York.

Shawcross, W.
1967 "An investigation of prehistoric diet and economy on a coastal site at Galatea Bay, New Zealand", Proceedings of the Prehistoric Society 33(2):107-131.

Shutler, R. Jr.
1971 "Pacific island radio-carbon dates: an overview", in Green, R.C. and M. Kelly (eds.) Studies in Oceanic culture history, vol. 2. Pacific Anthropological Records, no. 12, Bernice P. Bishop Museum, Department of Anthropology. Honolulu.

Siegel, S.
1956 Non-parametric statistics. McGraw-Hill Series in Psychology, McGraw-Hill, New York.

Simonsen, B.O.
1973 Archaeological investigations in the Hecate Strait-Milbanke Sound area of British Columbia. National Museum of Man, Mercury Series, Archaeological Survey of Canada, paper no. 13, Ottawa.

Smith, H.I.
1907 "The archaeology of the Gulf of Georgia and Puget Sound", American Museum of Natural History, memoirs 4(6). New York.

Sneath, P.H.A. and R.R. Sokal
1973 Principles of numerical taxonomy. W.H. Freeman, San Francisco.

Stern, B.J.
1934 The Lummi Indians of northwest Washington. Columbia University Contributions to Anthropology, 17, New York.

Suttles, W.P.
1951 The economic life of the Coast Salish of Haro and Rosario Straits. Ph.D. Dissertation, University of Washington.

1960 "Affinal ties, subsistence, and prestige among the Coast Salish", American Anthropologist 62:296-305. Menasha.

1962 "Variation in habitat and culture on the northwest coast", Akten des 34 Internationalen Amerikanistenkongresses. Wien.

Tester, A.L.
1947 "Herring schools in Baynes Sound", Fisheries Research Board of Canada, circular no. 10.

Torgerson, W.S.
1958 Theory and methods of scaling. John Wiley and Sons, New York.

Weide, M.L.
1969 "Seasonality of Pismo clam collecting at ORA-82", Archaeological Survey Annual Report. Department of Anthropology, University of California, Los Angeles 127-141.

Wentworth, C.K.
1922 "A scale of grade and class terms for elastic sediments", Journal of Geology 30(5):377-392.

Whitlam, R.
1974 1974 salvage excavations at the Buckley Bay site (DjSf 13) and the Tsable River Bridge site (DjSf 14): a preliminary report", ms. on file, Archaeological Sites Advisory Board of British Columbia, Victoria.

Zenkovich, V.P.
1967 Processes of coastal development. Steers, J.A. and C.A.M. King (eds.), D.G. Fry (trans), Oliver and Boyd, Edinburgh and London.

APPENDIX I

SOIL ANALYSIS

Introduction

This appendix presents in detail the procedures used in, and the results obtained from, the pH and granulometric analyses conducted on soil samples. The results produced by these analyses are used to interpret aspects of the stratigraphy discussed in Chapter III. Little attention is paid to the natural constituents of archaeological soils on the northwest coast, yet it is well known from other investigations (Cornwall 1958:204-216; Cook and Heizer 1965) that careful study of these data produces results that are often crucial to a proper understanding of the archaeological record. Because such an examination would be among the first on the northwest coast, and because information on environmental factors pertaining to the accumulation of midden deposits is an expected result, the natural constituents of soil samples from Deep Bay were examined.

The term "natural constituents" refers here to both physical and chemical properties of the soil. The term is used advisedly, however, since chemical properties of soils can result from cultural processes as well as natural processes. Since the distinction between the two processes is difficult to make, and since only an elementary chemical test is proposed, the term "natural constituents" is justified. The physical properties of the soil will be examined by means of a granulometric analysis, and the chemical property will be examined by means of a pH analysis.

Soil samples were collected from each natural stratum of each excavation unit after profiles were drawn. This produced 85 soil samples from Lot 73 and 15 from Lot 81 for a total of 100 samples excluding discretionary samples taken during the course of the excavation. Each soil sample was 2 liters. The large number of samples and the complexity of the procedure for acquiring the granulometric data required that a sample of the soil samples be selected. On Lot 81 the selection was easy; all ten soil samples from excavation unit 3 were used because this excavation unit was the only one on the lot that penetrated any substantial distance into aboriginal deposits. On Lot 73, the problem of choosing samples was more difficult. Although randomized designs could be formulated to guarantee the inclusion of each stratum, the maximum number of samples from each stratum was only five. Given this small a range of choice for any stratum, and given the unnecessary complexity of the sampling procedure, a simpler arbitrary design was selected. All soil samples from the second and fourth excavation units were selected, as were one sample each from strata that appeared in neither of these two excavation units. This selection procedure meant that the maximum distance that any natural stratum could extend between samples would be only two meters. The location of excavation units 2 and 4 relative to each other and relative to the remaining three excavation units aided in assessing the amount of granulometric and pH variation within each natural stratum over a known distance. Thirty soil samples from Lot 73 were selected using this procedure, bringing the total sample number of soil samples from both lots to forty.

pH Analysis

The soil pH tests were done in the U.B.C. Forestry Laboratory with the permission of Dr. C. Rowles and the assistance of Mr. B. von Spindler. Ten grams of each soil sample was placed in a paper cup and 20 ml of distilled water was added. The solution was stirred with a plastic stirrer that was washed with distilled water after stirring each sample. The solutions were left to equilibrate for one hour then stirred again. After the solution had settled for 10 to 15 minutes the pH was read using an electronic pH meter. The results are presented in Tables XXXVII and XXXVIII. Inspection of these tables suggests that relatively minor changes in soil acidity occur from top to bottom of the stratigraphic column on Lot 81. The figures for Lot 73, on the other hand, suggest that the lowest four samples are generally lower in pH than the majority of the upper samples, and that these two groups of samples are separated from one another by a natural stratum of unusually high alkalinity.

TABLE XXXVII

Soil pH, Lot 73, DiSe 7.

sample number	excavation unit	natural stratum	pH
58	2	A	7.6
35	4	A	7.5
62	2	B, B-1	7.7
59	2	C	7.8
36	4	C	7.9
79	1	D	7.6
80	1	E	7.7
60	2	F	7.7
37	4	F	7.7
38	4	"G"	7.6
61	2	G/O	7.6
42	4	G/O	7.6
64	2	G with shell	7.6
34	3	dark G	7.3
84	1	G-2	7.8
63	2	H	7.5
67	2	H	7.5
88	1	H-1	7.9
39	4	I	7.5
30	5	J	7.9
72	4	K	7.7
40	4	M	7.7
41	4	N	7.5
71	2	Q	7.3
69	2	R	7.8
70	2	S	8.1
66	2	T	7.3
44	4	T	7.0
65	2	P	7.2
43	4	P	7.0

TABLE XXXVIII

Soil pH, Lot 81, DiSe 7.

sample number	excavation unit	natural stratum	pH
5	3	A	7.6
6	3	B	7.7
7	3	C	7.4
8	3	C-1	7.6
9	3	C-2	7.5
11	3	D	7.5
10	3	E	7.5
12	3	F	7.4
13	3	F-1	7.7
14	3	G	7.8

In order to test whether the apparent differences in soil pH of the two stratigraphic groups on Lot 73 were due to chance, and in order to examine the Lot 81 data in the same manner, quantitative techniques were employed. To select among quantitative techniques the nature of the data and the aim of such an analysis must be considered. There is no reason to assume a priori that variables in the sampled population are normally distributed, therefore non-parametric statistics are to be favored over parametric statistics. Further, since the former type of statistic relies on observed rather than assumed distributions of variables, and since the asymptotic relative efficiency (A.R.E.) of non-parametric tests approaches that of parametric tests when the conditons for the non-parametric tests have been met, especially where small sample sizes such as the present ones are involved

(Bradley 1968:18), the non-parametric type of statistic was chosen.

The aim of the analysis is to examine soil pH (the variable) of a number of sections of strata (the samples) contained in each excavation unit when these strata can tentatively be grouped subjectively on the basis of their appearance or on the basis of their cultural contents. The class of test most appropriate for these aims is the one-way analysis of variance test. The non-parametric versions of this test are the Mann-Whitney test for samples grouped into two cases and the Kruskal-Wallis test for samples grouped into three or more cases. Both these tests (Mann and Whitney 1947:50-60; Kruskal and Wallis 1952:583-621) examine a single variable from each sample and rank the attributes of that variable from smallest to largest without respect to case. The samples are then segregated by case and the ranks are summed. These summed ranks provide a test statistic that can be compared with critical values of the chi-square distribution for the Kruskal-Wallis test and with quantiles of the normal distribution in the case of the Mann-Whitney test in order to determine whether the difference between the distribution functions of each case is due to chance. By comparing the appropriate critical value with the test statistic, where the degrees of freedom are equal to the number of cases minus one, it can be determined whether the probability of achieving the observed distribution function is less than or equal to the level of probability thought to be appropriate by the investigator. Both these tests deal with difference of location of cases on a relative scale. The rank sum of each case is a location parameter, but since it is difficult to visualize, the median is often used to indicate the distribution of variable attributes within a case.

The Kruskal-Wallis test is the non-parametric equivalent of the F-test. The asymptotic relative efficiency of the Kruskal-Wallis test in terms of the F-test, assuming normal distribution (i.e. assuming that conditions have been met under which the F-test could legitimately be applied), is between 0.864 and 0.955 (Siegel 1956:193; Conover 1971:262; Bradley 1968:132); when the distribution of variables is not normal, the lowest asymptotic relative efficiency is 0.864 and the highest is infinity. For this reason as well as those cited earlier, non-parametric tests were chosen.

On the basis of the population distribution of each case the Kruskal-Wallis and Mann-Whitney tests can estimate the probability that the cases in question are from the same or identical populations. The substantive hypothesis for each test states that there is a difference in location of population distributions for each case, and the null hypothesis states that there is no such difference in location of distribution functions.

Both the above tests were performed by computer using the U.B.C. BMD:P3S biomedical package of non-parametric statistics. This package was written by Steven Chasen of the UCLA Health Sciences Computing Facility and was updated for the U.B.C. computing center by Jason Halm (Halm 1975). The one-way analysis of variance option calculates a statistic for the Mann-Whitney and Kruskal-Wallis tests and provides a probability for a distribution that is assumed to be normal for the former test and that is assumed to have a chi-square distribution for the latter. The probability given by the former test is one-tailed; for testing a two-tailed hypothesis, the probability can simply be doubled because the distribution of test statistics is assumed to be normal. The probability given for the Kruskal-Wallis test is one-tailed; hypotheses being evaluated by the Kruskal-Wallis test are framed directionally (Conover 1971:258) to account for the fact that the chi-squared distribution never goes below zero, unlike a normal distribution.

The pH values of Lot 81 samples do not givenany indication of a major break between stratigraphic groups, nor is there any such indication from an inspection of the stratigraphy. It was decided to divide the ten samples into upper and lower groups of five strata each and test for differences of location using the Mann-Whitney test. The two-tailed test was required, and the level of significance was set at 0.05. This choice was made in order to provide a larger opportunity to avoid Type 1 error (rejecting the null hypothesis when it is true). The two-tailed probability obtained from this test was 0.9152, and since this value is larger than the chosen level of significance the null hypothesis is not rejected. These results confirm the subjective impression that the upper and lower groups of strata are similar in terms of the pH (Figure 30).

On Lot 73 there is some indication that a difference in location between groups of strata may exist on the basis of pH values. Also there may be a cultural boundary that is coincident with the break in pH values. Table XXXVII and Figure 30 depict the soil pH data for Lot 73. Inspection suggests that the P and T samples, and possibly the Q sample, have lower pH values than the samples from the overlying strata. Therefore a one-tailed test with direction predicted by the substantive hypothesis is appropriate. To be consistent with the level of significance set in the test of Lot 81 soil pH, the 0.05 level will again be used here. Experimentation produced the lowest probability when the pH of natural stratum Q was included with the pH values for strata P and T. This probability was 0.0003, which leads to the rejection of the null hypothesis. The substantive hypothesis, which states that the distribution function of the soil pH values from the upper strata is larger than the distribution function of the same values from the lower strata, is therefore supported. Even if the level of significance had been set at 0.001, the smallest probability usually selected by researchers,

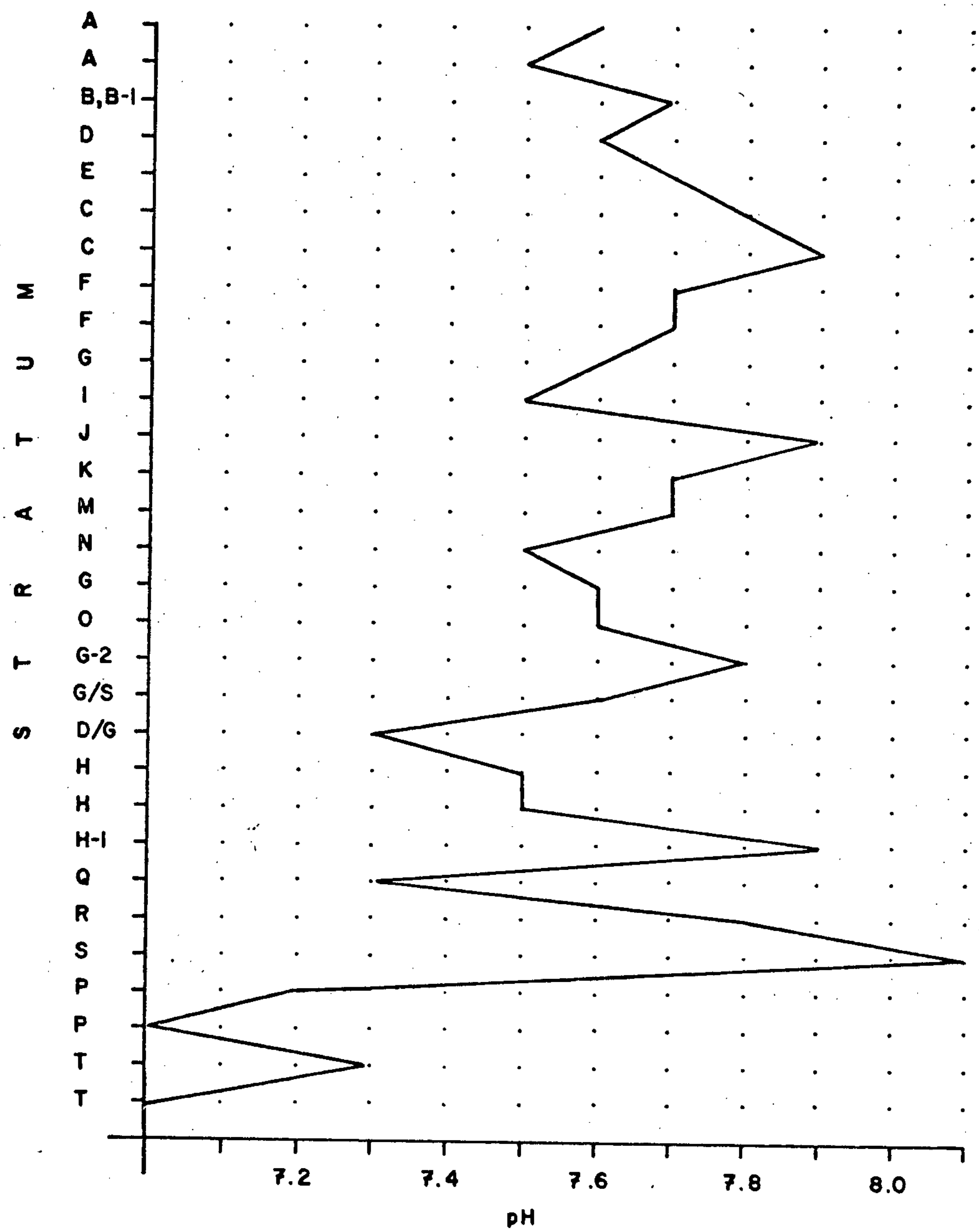

Figure 30. Soil pH, Lot 73, DiSe 7.

the substantive hypothesis would still have been supported. This test suggests that a soil pH boundary exists dividing natural strata Q, P, and T from the overlying strata. Similar tests within the overlying strata did not produce significantly different stratigraphic groups. Even if such groups had been detected, the extent of their differences would have been unclear because these subsequent tests constitute a simultaneous testing procedure. The probabilities obtained from such tests cannot be used in their absolute form and are useful only for ranking differences between cases (Conover 1971:259).

Granulometric Analysis

This analysis was carried out in the University of British Columbia Department of Geography sediment laboratory with assistance and advice offered by Dr. M. Church and Mr. H. Schreier. It was done in conjunction with the faunal sample analysis that is presented below.

A complicated procedure was required to obtain the granulometric data. The forty soil samples, each 2 liters in volume, were dried at 100°C for 24 hours and then split to a volume of 500 cc. Sample volume was preferred over sample weight because volume is less sensitive than weight to variation in matrix composition. The choice of 500 cc as the sample volume was based on both practical and intuitive grounds. The faunal material to be collected from the 500 cc volume seemed, on the basis of preliminary tests done on smaller volumes, to provide an accurate reflection of the range of species and their relative weights in the 2 liter field sample. Also, the hand separation of faunal material from inorganic material, as described below, and the subsequent separation and identification of faunal species, was exceedingly time consuming. Thus it was felt that a maximum volume of 500 cc could be satisfactorily treated.

The 500 cc sample was then placed in a Tyler Canadian Standard sieve stack consisting of 8mm, 4mm, and 2mm mesh sizes plus pan and shaken by hand for about 30 seconds so as to reduce damage to fragile faunal elements as much as possible. The organic and inorganic constituents of all three screens were separated and the organic materials retained for subsequent analysis. The inorganic constituents of these sieves were added to the pan which contained sub-2mm organics and inorganics. The remaining sample was split again to a weight between 100 gm and 150 gm but as close to the latter as possible. This weight was chosen because the sieve stack through which the sample ultimately had to pass was designed to operate most efficiently with a sample of 100 to 150 gm. This size of sample is also the one commonly used by sedimentologists in conducting granulometric analyses (Church 1976,pers. comm).

To remove the sub-2mm organics a two part process was required. First, the sample was combusted at 800°C for two hours in order to reduce the charcoal content to ash (Cornwall

1958:154). Second, the cooled sample was placed in a beaker with 10% hydrochloric acid to remove the remaining organics, by this time only shell. When the shell was completely dissolved, the sample was washed through a .063mm net sieve, wash water containing the sediments was saved, and the sands and gravels retained by the sieve were put into a crucible and dried for 8 to 12 hours. The water and sediments were filtered through number 1 qualitative filter paper, the retained sediments and filter paper were combusted at 800°C for two hours, then the sediments were weighed. The dried sands and gravels were placed in a Tyler Canadian Standard sieve stack consisting of 8mm, 4mm, 2mm, 1mm, .500mm, .250mm, .125mm, .063mm mesh sieves and pan and were shaken for twenty minutes on a Fischer Wheeler sieve shaker. The contents of each sieve were weighed and recorded, and the contents of the pan and the contents of the filter paper were added to produce the total weight of sediment. Tables XXXIX and XL show the weights for each sample.

An inspection of these tables indicates that there are certain general regularities in the data. The .500mm or .250mm sieves almost always contain the greatest weight of material. Also, the .063mm sieve and pan usually contain the least weight of material.

Inspection alone, however, does not fully realize the present aim, which is to determine whether boundaries between groups of strata can be distinguished on the basis of grain

TABLE XXXIX

Weight (gm) of Granulometric Constituents by Excavation Unit and Natural Stratum, Lot 81, DiSe 7.

Mesh Size (mm)	Excavation Unit / Natural Stratum	3 F	3 E	3 B	3 C	3 A	3 C-2	3 C-1	3 G	3 F-1	3 D
8		15.6	31.1	9.4	16.9	11.4	14.5	11.6	30.9	14.5	4.4
4		14.6	9.9	12.7	20.4	7.8	12.7	12.1	12.2	2.3	8.0
2		7.4	6.4	5.2	8.5	3.5	5.4	9.5	4.6	1.2	7.3
1		3.2	3.3	2.2	4.7	2.2	4.3	4.5	4.5	1.3	6.8
.500		12.7	8.8	6.4	11.4	7.3	12.4	12.0	14.4	7.8	9.6
.250		20.8	19.7	19.1	28.5	22.1	30.2	30.6	20.5	16.8	16.9
.125		10.8	9.3	9.1	12.3	11.3	15.2	14.2	13.1	11.4	13.9
.063		3.0	2.1	2.0	2.6	2.5	3.1	3.1	3.6	4.6	9.2
pan		4.6	4.9	3.6	4.8	2.9	5.1	4.7	6.0	3.3	49.6
Total		92.7	95.5	69.7	110.1	71.0	102.9	92.3	109.8	62.2	125.7

TABLE XL

Weight (gm) of Granulometric Constituents by Natural Stratum, Soil Sample Data, Lot 73, DiSe 7.

Mesh Size (mm)	Excavation Unit Natural Stratum	2 H	2 S	2 H	2 Q	4 O	1 H-1	3 dark G	1 G-2	2 F	2 G
8		16.2	14.4	11.0	14.8	8.1	8.1	16.8	4.6	9.4	4.0
4		9.3	7.8	6.1	4.6	8.1	4.5	3.3	3.8	4.7	3.0
2		4.0	2.1	3.0	1.3	3.5	2.4	1.9	1.9	1.6	5.8
1		4.9	4.1	5.3	3.0	7.7	4.7	3.8	3.9	2.0	7.4
.500		26.4	38.7	38.9	41.2	35.2	24.2	21.6	17.6	10.0	26.4
.250		29.5	47.1	38.0	42.1	48.8	21.8	36.8	42.4	57.4	59.0
.125		5.6	5.0	5.6	1.8	7.2	4.5	5.1	6.2	8.8	7.4
.063		1.5	1.3	1.8	0.4	1.9	1.2	1.6	1.6	1.6	1.1
pan		3.5	1.8	2.8	0.9	2.6	1.9	3.0	3.0	1.8	1.8
Total		100.9	122.7	112.5	110.6	123.3	73.7	93.8	85.1	98.0	116.0

TABLE XL (continued)

Mesh Size (mm)	Excavation Unit / Natural Stratum	4 N	4 F	2 R	2 P	4 P	4 T	4 K	2 T	2 B, B-1	2 C
8		3.8	4.2	32.1	54.4	19.4	0.0	0.0	6.7	4.6	7.2
4		0.9	8.7	9.6	23.5	32.4	6.0	3.2	3.5	3.1	5.6
2		1.0	3.6	2.2	2.5	6.3	5.6	11.4	3.8	1.1	1.0
1		1.5	5.7	3.7	3.8	4.8	17.0	38.9	17.6	0.6	0.7
.500		10.8	18.9	35.1	30.5	30.1	70.7	41.5	56.3	2.8	2.9
.250		72.0	60.3	28.5	16.8	14.8	15.4	37.6	12.3	17.7	18.3
.125		7.6	7.3	1.7	1.5	2.0	0.9	2.5	1.5	14.5	11.9
.063		0.6	1.1	0.6	0.5	1.0	0.7	0.1	1.2	4.0	3.4
pan		0.9	1.5	1.1	0.5	1.5	1.5	0.2	1.3	2.1	1.8
Total		99.9	111.3	115.2	132.8	112.8	117.7	136.5	103.7	50.9	53.2

TABLE XL (continued)

Mesh Size (mm)	Excavation Unit / Natural Stratum	1 E	1 D	4 C	2 A	4 A	4 I	5 J	2 G shell	4 "G"	4 M
8		9.2	5.5	21.5	11.4	10.7	0.0	0.0	2.4	0.0	0.0
4		4.6	3.7	10.6	7.8	5.3	0.0	0.5	3.3	0.8	0.6
2		0.7	0.9	2.8	3.5	2.2	0.1	0.7	2.5	0.7	0.2
1		1.0	0.9	0.9	2.2	1.5	1.0	1.1	3.5	1.1	1.5
.500		3.5	4.6	3.6	7.3	7.9	8.6	9.4	21.9	10.8	11.4
.250		25.4	22.7	29.0	22.1	39.6	83.7	88.0	41.7	80.2	74.8
.125		11.6	11.0	11.3	11.3	6.9	5.2	7.4	7.1	8.7	14.3
.063		3.0	3.0	2.5	2.5	1.8	0.1	0.7	1.5	1.8	2.5
pan		1.7	4.3	1.5	2.9	2.7	0.3	0.9	2.7	2.4	1.4
Total		60.7	56.8	84.6	68.9	79.3	100.0	108.9	87.4	107.4	107.3

size data. The present data require a multivariate analytic tool, as opposed to the univariate analysis of soil pH.

A combination of two techniques was decided upon. Cluster analysis and multidimensional scaling were chosen because they provide results that are easy to visualize even though the procedures are sophisticated, and they provide clues from which the influence of important variables can be inferred.

Cluster analysis, as the name implies, examines a matrix of coefficients and, in a series of cycles, creates groups of coefficients and adds to them until all coefficients have been joined together. In each cycle the matrix is searched for the coefficient or group of coefficients whose values are most similar to groups defined by previous cycles. The most similar groups or coefficients are then joined and a new cycle begun. A number of these hierarchical grouping methods are available. The method chosen for the present study was Furthest Neighbor cluster analysis. This type of analysis takes its name from the work of Lance and Williams (1969:393), and it is the same as the Maximum Method of clustering (Johnson 1967:241-254) and Complete Linkage clustering (Sneath and Sokal 1973:222). During each cycle of Furthest Neighbor cluster analysis a new entity is admitted to a cluster at a level of similarity equal to that at which the new entity and cluster member with which it is most dissimilar can combine (Sneath and Sokal 1973:222). The result of this technique is the tendency for tight hyperspherical clusters to be created that join other clusters only at high coefficient values (Sneath and Sokal 1973:222). The production of relatively concise clusters, the relative simplicity of the technique (Matson 1974:102), and the insensitivity of the technique to matrix transformation providing the rank order of coefficient values remains unchanged (Johnson 1967: 49 cited in Matson 1974:102) recommend this technique for the present purposes.

The cluster analysis was performed on a matrix of city block distance coefficients. City block distance was chosen over Euclidian distance because the former satisfied the condition of triangle inequality, whereas the latter does not. This makes city block distance a genuine distance function even though both coefficients are variations of Minkowski r-metric distance. When r=1 Minkowski r-metric distance is the same as city block distance; when r=2 Minkowski r-metric distance is the same as Euclidian distance (Kruskal 1964a:117). Aside from the advantage of being a genuine distance function, city block distance is also preferable because its calculation depends only on the pair of cases being examined and because proportional differences, rather than absolute differences, between paired cases are produced (Sneath and Sokal 1973:126).

Calculation of city block distance coefficients was based on the rank of sieve content weights for each sample.

Rank, instead of raw weight or relative frequency of weight, was used for calculating distance coefficients because a) the ranks can be treated as values of variables in the same way as weight or percent, and b) the rank order of weights adequately represents the different relative weight of each grain size without introducing spurious accuracy such as might be involved with the use of relative frequencies. The use of finely calibrated data such as relative frequencies may often mask clustering rather than facilitate it. The clustering program used in this analysis needs to know whether or not the input data are to be standardized. The ranks are unstandardized in the present test because each mesh size was considered to be as important as the next and because most variables occur in most of the cases.

The city block distance coefficient matrix was also used as input for multidimensional scaling analysis. Both non-metric and metric analyses were available, but the metric analysis provided the most readily interpretable results. Metric multidimensional scaling is similar to the metric analysis in that coefficients are ranked by magnitude and then an attempt is made to produce a configuration of points in n-dimensional hyperspace that has a monotonic relationship to the rank order of the distance coefficient magnitudes (Kruskal 1964b:1). In the metric version, however, the metric quality of the coefficients is permitted to affect the final configuration of points. The Torgerson B^* matrix consists of figures representing distances from a point of origin (centroid) of a configuration of points. Factoring this matrix produces principal axes that account for the observed configuration of points. The first axis produced has the greatest effect on the configuration of points, the second axis has the second greatest effect, and so on. The percentage of trace is a measure of stress or goodness of fit of the configuration of points to the axes produced. The closer to 100% the percentage of trace approaches, the more satisfactorily the configuration of points can be accomodated by the axes produced (Torgerson 1958:245-276). The advantage of scaling lies in two areas. First, it is another visual means of analyzing data that enables relationships between cases to be explored in more dimensions than those presented by a cluster analysis; second, the principal axis analysis with its associated percentages of trace for each axis enables the investigator to return to the original data with specific ideas as to which variables or groups of variables are having the greatest effect on the relationships between cases.

The following analysis will deal with the granulometric data from each lot separately. The clustering and scaling of these data will be presented first for Lot 81 and second for Lot 73.

The cluster analysis of Lot 81 samples is shown in Figure 31. The cluster analysis indicates that six of the ten samples form a cohesive cluster with the remaining four

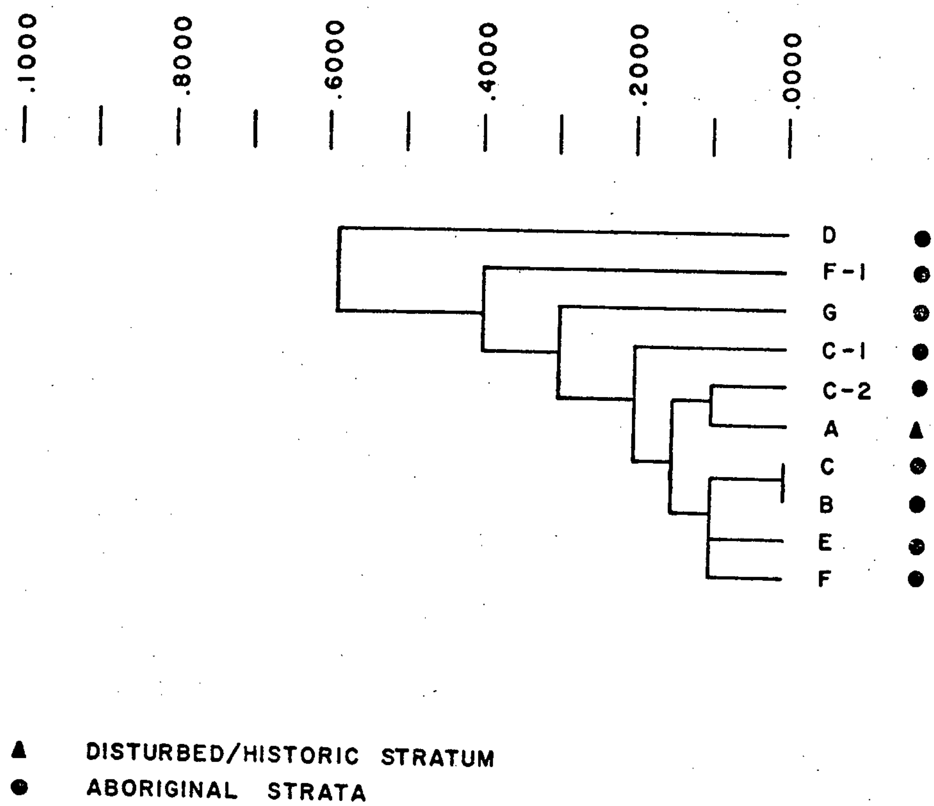

Figure 31. Furthest Neighbor Cluster Analysis. Granulometric Data, Lot 81, DiSe 7.

samples joining the cluster one at a time. Natural strata B and C are granulometrically identical and may have been judged different in the field due to soil color resulting from different moisture content. Natural strata F and F-1, however, are relatively different granulometrically as are C, C-1, and C-2 to lesser degrees. The extreme difference of natural stratum D is due to the high proportion of sediments and the low proportion of gravels 8mm and larger. This stratum is, in fact, very high in clay and is readily distinguishable from the other strata on the basis of color and texture. The impression given by this cluster analysis is one of relative homogeneity of granulometric constituents among strata with several strata showing minor variation and one stratum exhibiting marked variation. It is notable that natural stratum A, although heavily disturbed by bulldozing and spreading from another part of the site, is nonetheless granulometrically similar to the majority of the undisturbed strata.

The metric multidimensional scaling extracted 99.12% of trace by three roots. The first dimension accounted for 71.11% of trace; the second, for 17.80%; and the third, 10.20%. Since 10% trace is relatively low and since no meaningful interpretation could be produced for the third dimension, it has not been included in the following discussion. The configuration of points representing sample relationships for each pair of dimensions is presented in Figure 32. The

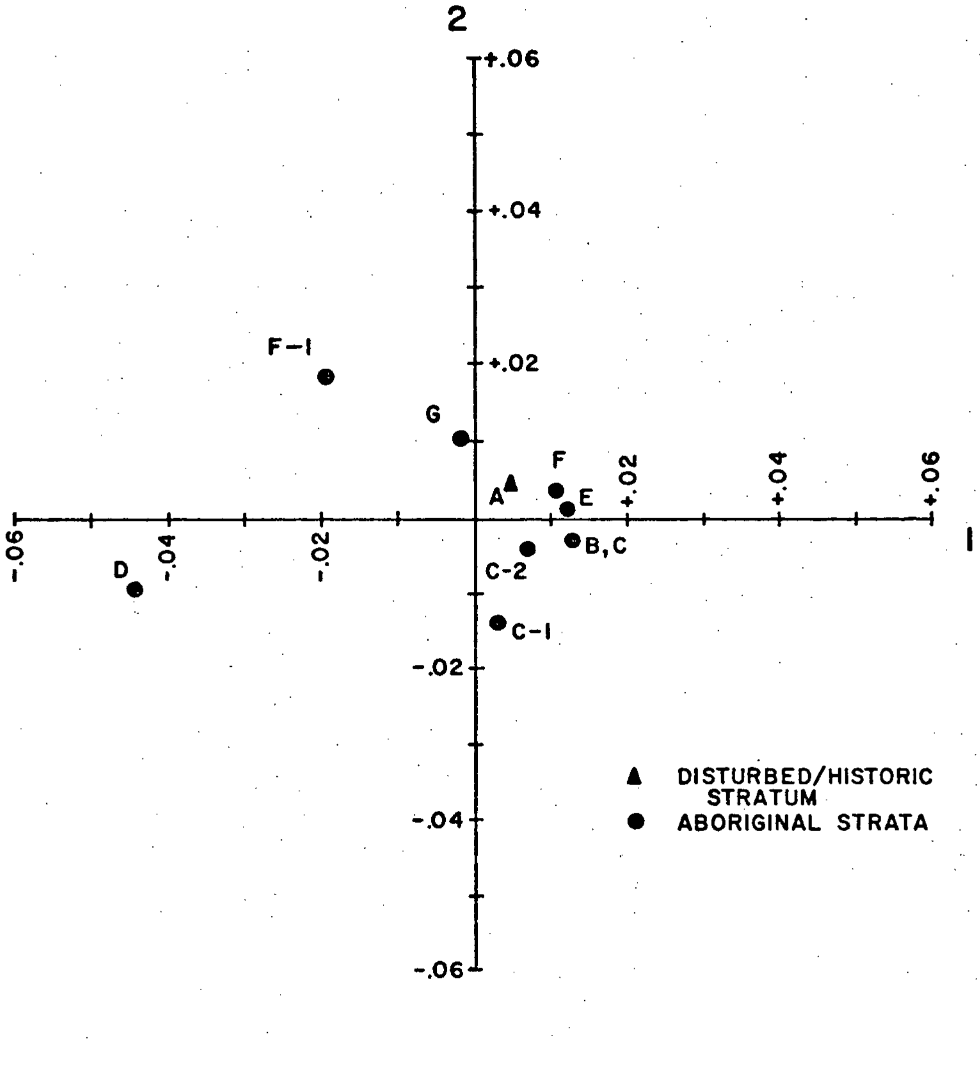

Figure 32. Metric Multidimensional Scaling based on Torgerson's B^* Matrix. Granulometric Data, Lot 81, DiSe 7.

samples show the greatest dispersal along dimension 1, which also accounts for the greatest percentage of trace. To identify this dimension, Table XXXIX was re-examined, and it was found that the samples are distributed along dimension 1 in approximately the same order as the magnitude of the combined weight of .063mm and pan constituents. Correlation of the combined weight of these constituents with the value for each sample along dimension 1 produces a Spearman's rank order correlation coefficient of +0.71. The samples with the greatest weight of pan constituents are on the negative side of the dimension, and those with least are on the positive side. Correlation of rank on dimension 1 with vertical location produced a Spearman's rho of only +0.46.

By the same procedure it was determined that dimension 2 reflected the weight of 2mm sieve contents (Spearman's rho of +0.73), the samples with the least material 2mm or larger being at the positive side of the scale and those with most of this material being at the negative end of the scale. This seeming paradox is a result of giving the largest weight or relative frequency a rank value that is interpreted by the program as lowest. The reduced percentage of trace for dimension 2 probably accounts for the relatively low rank order correlation coefficient between the weight of 8mm sieve contents and the position on dimension 2.

The Lot 73 data were clustered, and the dendrogram is presented in Figure 33. Two major divisions appear in the

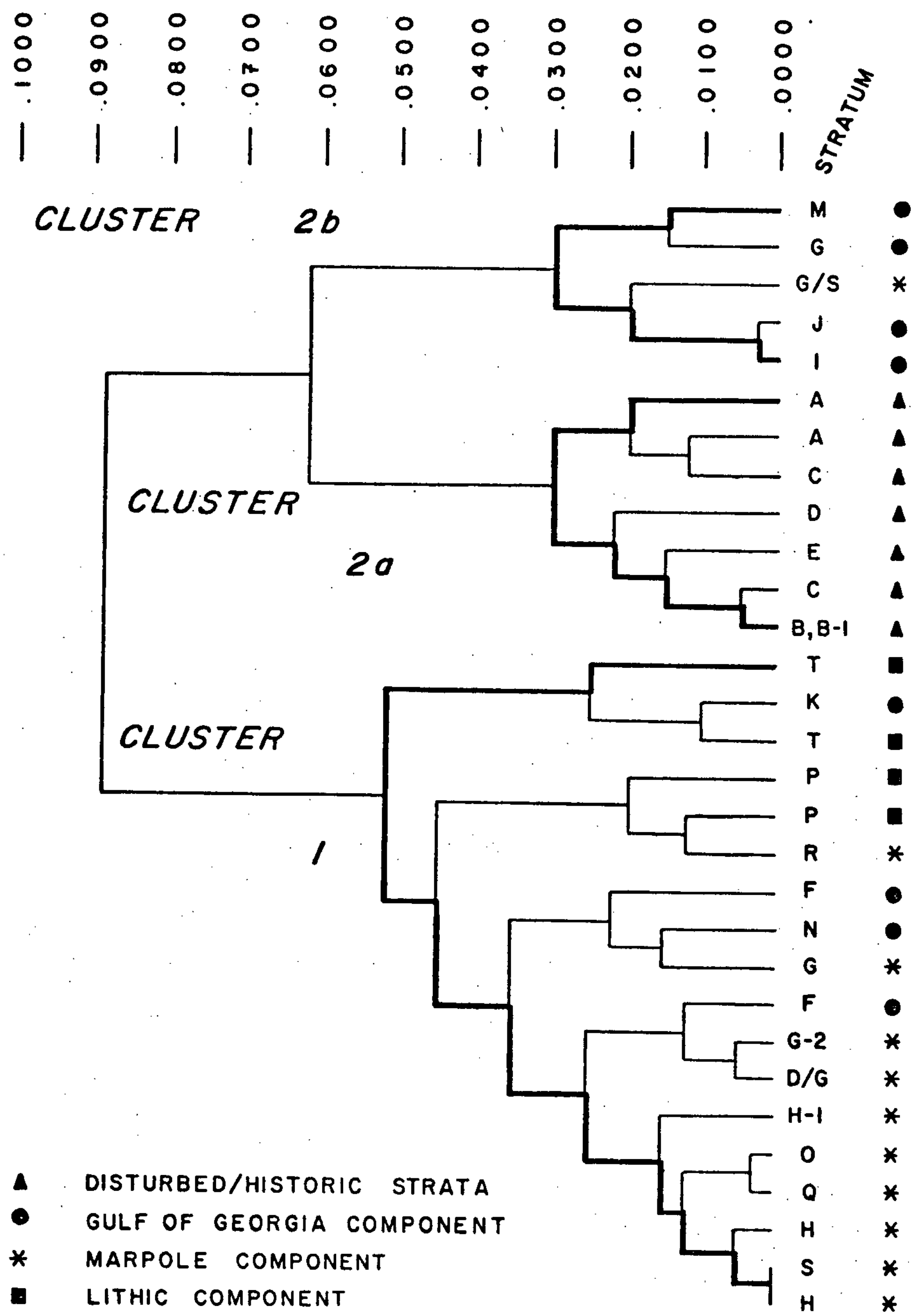

Figure 33. Furthest Neighbor Cluster Analysis. Granulometric Data, Lot 73, DiSe 7.

data, with the smaller division having two subdivisions. For descriptive purposes the larger major cluster will be called cluster 1, and the smaller major one cluster 2. The subdivisions of cluster 2 will be called a and b, with 2a containing seven strata and 2b containing five. Examination of the profiles indicates that the strata in cluster 2a are all adjacent and that four of five strata in cluster 2b belong to the group of thin strata separating natural stratum F from natural stratum G/O at the east end of the trench. Natural stratum F is stratigraphically between the strata contained in clusters 2a and 2b. With the exception of natural strata F and G with shell, the strata in cluster 2 are uppermost in the site and, as will become apparent in subsequent analyses, they contain the largest concentrations of shell of all the strata. In cluster 1, all strata are adjacent except for natural stratum F, which is partly adjacent to natural stratum G/O, and natural stratum K, which is adjacent to strata in cluster 2b. Field assessment of matrix color and texture suggested that natural strata P and T were substantially unlike the other strata, and analysis of soil pH data also suggested this distinction. The granulometric data, however, do not suggest such a division. Instead, natural stratum T appears to be similar in granulometric content to natural stratum K with which it has no physical, cultural, or chronological connection, and natural stratum P seems to be most like the adjacent natural stratum R. The physical properties

Cluster	Stratum
2a	A
2a	B & B-1
2a	D
2a	E
2a	C
1	F
2b	"G"
2b	I
2b	J
1	K
2b	M
1	N
1	G/O
1	G-2
2b	G with shell
1	dark G
1	H
1	H-1
1	Q
1	R
1	S
1	P
1	T

Figure 34. Cluster membership by natural stratum, Lot 73, DiSe 7.

of natural stratum N initially suggest that it is a member of the strata in group 2b, but its granulometric consistency, combined with its proximity to natural stratum G/O suggest otherwise, as shown in the dendrogram. The membership of natural stratum F in cluster 1, especially in close association with members of the G stratigraphic complex, is a surprise because a field assessment of this stratum's affiliation found it most like the strata in cluster 2a.

The lack of close relationship between samples G and O is also surprising because they are in fact samples from what appeared in the field to be the same stratum. As a result of field procedure, it was labelled differently in excavation units 2 and 4. The two samples of natural stratum F are not as uniform as expected, and to a lesser extent neither are the two C samples. The last of these can be explained by the fact that natural stratum C is in fact a series of heavy shell lenses that are contiguous and difficult to separate until seen in profile, therefore differences in granulometric constituents are to be expected to some degree. No similar explanation can be offered for samples from G/O and F since no stratigraphic distinctions were observed within them. The grouping of sample O with strata underlying it, and the grouping of G with strata overlying it definitely suggests a distinction, but none was observed during either excavation or profiling. Why the two F samples are not more closely related and why they cluster with strata of the G complex instead of with each other cannot be easily explained. The relationships of the F samples suggests that some natural strata have more internal variability than others, and that sometimes this variability is considerable. This reasoning may also account for the G and O samples, the variation between them being greater than that between each one and the other strata with which they group.

A field assessment of the cultural relationships between these strata indicated that strata above the surface of natural stratum G belong to a Gulf of Georgia component or later, that the P and T strata, with the possible inclusion of any or all of natural strata Q, R, and S, belonged to a Lithic component, and that the strata between these two boundaries belonged to a Marpole component. With this breakdown in mind, the eighteen samples in cluster 1 are seen to be members of the Marpole and Lithic components except for the two F samples, K, and possibly N. Cluster 2 contains only one natural stratum that was not thought to belong to the Gulf of Georgia component, namely G with shell.

The scaling analysis of these data produced the results shown by paired dimensions in Figure 35. Again, three roots were extracted that accounted for 97.32% of trace. Dimension 1 accounted for 50.36% of trace, dimension 2 for 39.59%, and dimension 3 for 7.37%. This last dimension will be excluded from further discussion for reasons previously noted. The distribution of samples in dimension 1 appeared to correspond

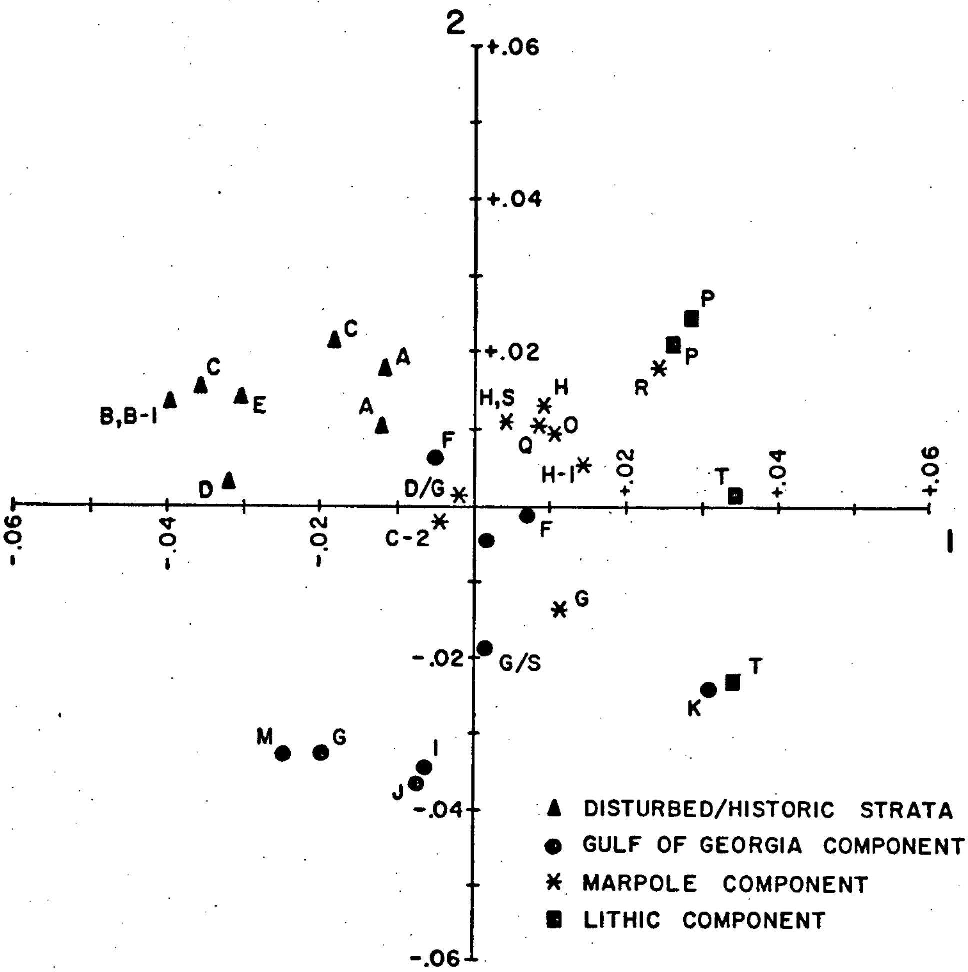

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Figure 35. Metric Multidimensional Scaling based on Torgerson's B^* Matrix. Granulometric Data, Lot 73, DiSe 7.

to the weight of .125mm sieve contents in each sample. This relationship produced a Spearman's rho of +0.83, and the summed weights of the .125mm and .063mm sieves produced a rho of +0.82. It is clear that the amount of fine sand in each sample, relative to each other sample, has the greatest effect on the relationships between samples. It is interesting to note, too, that vertical stratigraphic order and order along dimension 1 are also correlated at +0.82. This phenomenon suggests that the higher the midden pile becomes, the larger the proportion of the finer grades of sand among the natural soil constituents. This point will be developed later.

Dimension 2 appears to relate to the coarser sand grades. It was determined that the order of samples on dimension 2 had the highest Spearman's rho (+0.74) with the combined weights of the .250mm, .500mm, and 1mm sieve contents. No satisfactory correlations could be found for the order of samples on dimension 3. This may be the result of this dimension having a low percentage of trace, i.e. the dimension may represent a variable or group of variables that have relatively little effect on the relationships between samples.

These analyses both indicate that the finest grades of soil constituents are most important in determining relationships between strata. On Lot 81 the finest grain sizes used for this analysis were important probably because natural stratum D, a solid clay stratum, contained large amounts of the finest material examined here and was so obviously different from the surrounding matrices. On Lot 73 there were no lenses or strata of clay, but the finest grades of sand were nonetheless most important. On both lots the .063mm sieve contents had a substantial effect on sample relationships. Whereas dimension 2 on Lot 81 seemed to represent 8mm sieve contents, it apparently represents a combination of slightly lighter materials on Lot 73. Since it doubtful that natural stratum D, the clay stratum on Lot 81, is the result of natural deposition, it is not surprising that the sorting of materials in that stratum and adjacent strata is poor. Consequently, natural strata C-1, C-2, and D appear at the end of dimension 2 representing most 8mm sieve contents while non-adjacent strata are at the other end of the dimension. The sorting of materials in these other strata presumably was more complete. On Lot 73 the .250mm, .500mm, and 1mm sieve contents are represented by dimension 2. These constituents are derived from strata that contain much more thoroughly sorted granulometric constituents. It is probably fair to say that some or all of these constituents would be important in analyzing relationships between soil samples when no unsorted strata are involved.

APPENDIX II

BURIALS

Introduction

The human skeletal material was analyzed by Valerie C. Patenaude (now Sivertz) in conjunction with a directed studies course in human paleopathology under the direction of Dr. Braxton Alfred of the University of British Columbia. Table XLI presents a summary of her findings. Ten burials were recovered from DiSe 7, all of them from Lot 73. Burial 6 lay half in the trench and half out so it was pedestalled and left in situ. Consequently, the information on this burial was gathered in the field, not in the laboratory. Burial 2 consists of scattered human remains from natural stratum K, excavation unit 5. These remains indicate the presence of only one individual and it has been assumed here that they represent the same individual.

Burials

Table XLI shows that Burial 1 (Figure 36) and Burial 2 were found in strata thought to comprise Component III. Burial 7 (Figure 37b) is the only burial found in natural stratum P. Burial 9 (Figure 38) was recovered from an obvious intrusion into natural stratum P; the person is

TABLE XLI

DiSe 7 Burials

burial number	1	2	3
figure number	36		40
excavation unit	73-5	73-5	73-5
arbitrary level	65	63	59-60
natural stratum	F	K	O
lowest elevation	6.39m	-	5.70m
lowest depth below surface	0.60m	-	1.25m
coordinates to center			
-north	217.50m	-	217.60m
-west	56.41m	-	52.70m
age	old adult	young adult	-
sex	female	-	-
burial condition			
-scattered	no	yes	no
-complete	yes	no	yes
-articulated	yes	no	yes
-flexed	yes	no	yes
bone condition			
-excellent	-	-	-
-good	yes	-	-
-fair	-	yes	-
-poor	-	-	yes
spinal orientation	NE-SW	-	E-W
lying on right side	-	-	yes
lying on left side	yes	-	-
eyes facing	SE	-	N
skull deformation	yes	no	no
pathology	yes	no	no
cairn	yes	no	yes
inclusions			
-artifactual	no	no	no
-other	no	no	no

TABLE XLI (continued)

burial number	4	5	6*
figure number	39	37	
excavation unit	73-2	73-3	73-4
arbitrary level	59	58	59-58
natural stratum	G	G	GX/P
lowest elevation	5.80m	5.80m	5.75m
lowest depth below surface	1.20m	1.12m	1.05m
coordinates to center			
-north	216.16m	217.65m	216.14m
-west	58.30m	56.55m	55.45m
age	juvenile 18mo-2yr	adult	adult
sex	male?	male	-
burial condition			
-scattered	no	no	no
-complete	yes	yes	yes
-articulated	yes	yes	yes
-flexed	yes	yes	yes
bone condition			
-excellent	-	yes	yes
-good	yes	-	-
-fair	-	-	-
-poor	-	-	-
spinal orientation	E-W	NNE-SSW	N-S
lying on right side	yes	yes	-
lying on left side	-	-	yes
eyes facing	N	W	W
skull deformation	no	no	?
pathology	no	yes	?
cairn	yes	yes	?
inclusions			
-artifactual	yes	yes	-
-other	no	yes	-

* not excavated

TABLE XLI (continued)

burial number	7	8	9
figure number	37	37	38
excavation unit	73-4	73-4	73-3
arbitrary level	58-57	58-57	56
natural stratum	P	O/P	P
lowest elevation	5.63m	5.63m	5.51m
lowest depth below surface	1.40m	1.45m	1.43m
coordinates to center			
-north	216.46m	216.30m	217.35m
-west	55.49m	54.30m	56.78m
age	old adult	adult	juvenile 18mo-2yr
sex	male	male	female?
burial condition			
-scattered	no	no	no
-complete	yes	yes	yes
-articulated	yes	yes	yes
-flexed	yes	yes	yes
bone condition			
-excellent	-	-	-
-good	yes	-	yes
-fair	-	-	-
-poor	-	yes	-
spinal orientation	E-W	E-W	E-W
lying on right side	yes	-	yes
lying on left side	-	yes	-
eyes facing	S	N	N
skull deformation	no	no	no
pathology	yes	no	no
cairn	yes	yes	no
inclusions			
-artifactual	no	no	no
-other	no	no	yes

TABLE XLI (continued)

burial number	10
figure number	
excavation unit	73-4
arbitrary level	59
natural stratum	O/P
lowest elevation	5.86m
lowest depth below surface	1.21m
coordinates to center	
-north	218.00m
-west	54.35m
age	fetus
sex	?
burial condition	
-scattered	no
-complete	no**
-articulated	yes
-flexed	yes
bone condition	
-excellent	yes
-good	-
-fair	-
-poor	-
spinal orientation	E-W
lying on right side	-
lying on left side	yes
eyes facing	S
skull deformation	no
pathology	no
cairn	no
inclusions	
-artifactual	no
-other	no

** skull missing

Figure 36. Burial 1, Lot 73, DiSe 7.

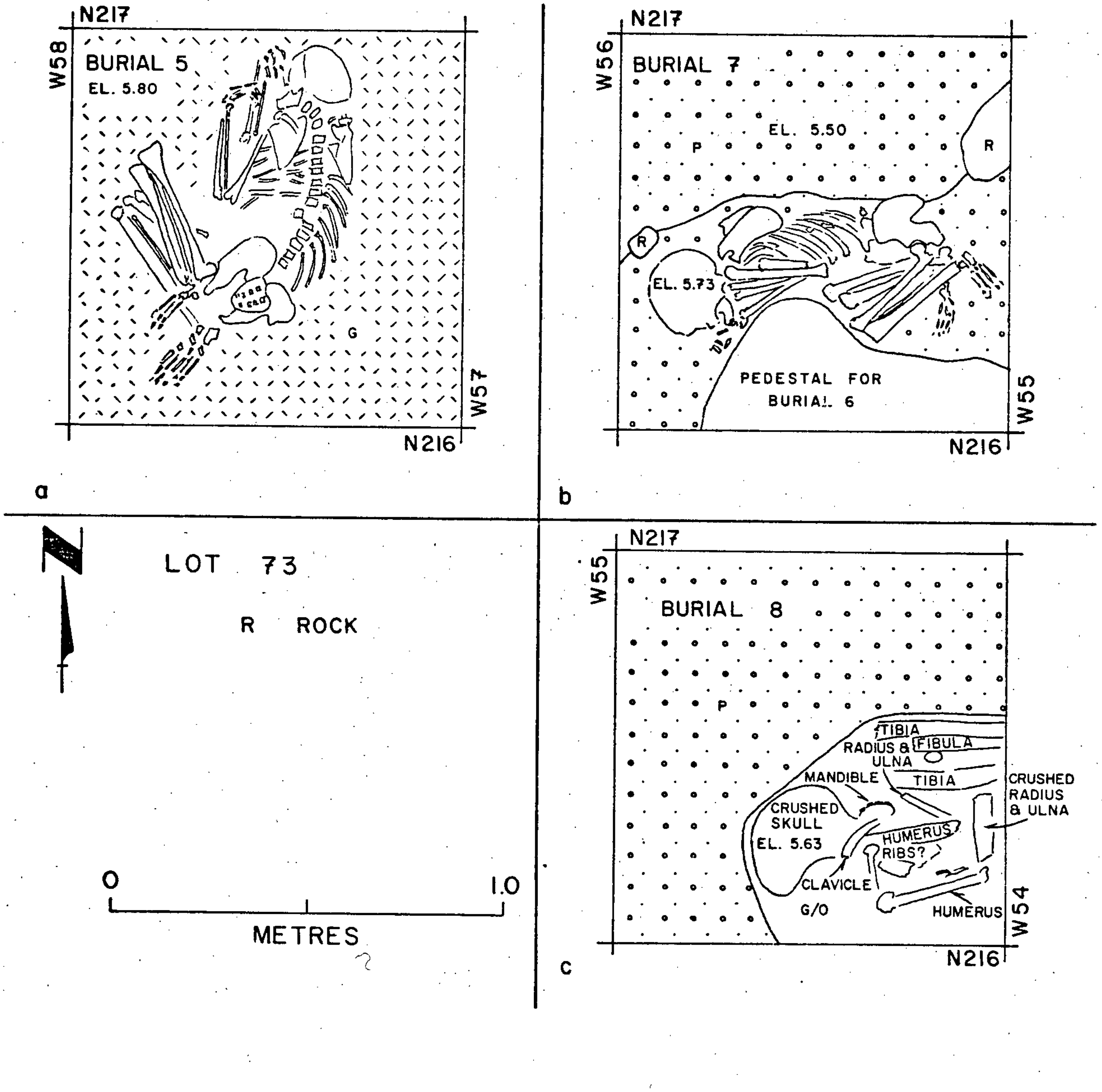

Figure 37. Burials, Lot 73, DiSe 7.
a. Burial 5
b. Burial 7
c. Burial 8

Figure 38. Burial 9, Lot 73, DiSe 7.

thus thought to have lived subsequent to the deposition of this matrix. Burials 6, 8 (Figure 37c), and 10 were all found at the junction of natural strata G/O and P in excavation unit 4, therefore these individuals probably lived at about the same time as the person from Burial 9.

Of the nine burials whose age could be approximated, Burial 10 appears to be a fetus or a newborn child. Burials 4 (Figure 39) and 9 are infants in the eighteen month to two year age range, and the remainder are adults. There is some suggestion that Burial 2 was a young adult, but the scattered condition of the remains makes this judgement tentative. Burials 1 and 7 are thought to be old adults on the basis of tooth wear and the condition of bone joints.

The sex of six individuals could be established, but there is some question about the certainty of this assignment for Burials 4 and 9. Three of the remaining four burials are males. If all six burials are included, four are male and two are female.

Among the nine complete and articulated burials, six had an east to west spinal orientation and all were in the tightly flexed position (Figure 40). The burials are equally divided between lying on the left and right sides. Surprisingly, skull deformation of the Cowichan type (Boas 1891:95) was noted only for Burial 1. This was also the most recent burial.

Cairns were a common feature of burials at Deep Bay. Six burials were covered by cairns, but it is possible that

Figure 39. Burial 4, Lot 73, DiSe 7.

Figure 40. Burial 3, Lot 73, DiSe 7.

Burials 4 and 5 (Figure 37a) shared the same cairn. Profiles indicate that Burial 1 was placed in a shallow pit and then covered with a cairn. There is also a suggestion of this procedure in the profile beside Burial 4, and Burial 5 appears to have been placed in a shallow depression partially excavated into natural stratum P. No other instances of this procedure were noted, possibly because of the difficulty of distinguishing small scale disturbance of this nature in a coarse and relatively homogeneous matrix such as a coastal shell midden. Burial 9, however, was placed in a grave excavated into natural stratum P, but no cairn was placed on top of it. Instead, the remains were surrounded by moderate sized cobbles as if the grave perimeter had been lined with them.

Artifact inclusions with burials are rare. Burial 1 had a well made pendant (artifact #1110) in the throat region. Burial 4, as has already been indicated in the artifact descriptions, had a zoomorphic bone pendant, a large well made celt, a number of shell disc beads, and dentalia associated with it. In addition, some fragments of native copper, possibly tube beads, were found with the individual. Cedar bark wrapping that enclosed the copper fragments also enclosed some of the shell disc beads and dentalia shells. A recent specimen from DhQk 1 (Castlegar), now stored in the Museum of Anthropology at the University of British Columbia, consists of copper tube beads separated by dentalia shells and clam shell disc beads on a braided fiber string. This suggests a potentially wide range in both space and time for this form of adornment.

A small celt (artifact #1326) and two antler composite toggling harpoon valves were associated with Burial 5 but more unusual was the presence of a double cairn above this burial. The uppermost cairn contained the skull, five vertebrae, right mandible, right humerus, right femur, left and right innominates, and seven unidentifiable bone fragments of a small adult dog. The remains were not articulated and the skull was inverted. The use of dogs by the Coast Salish for producing fleece and for assistance in the hunt is ethnographically documented (Barnett 1975:96, 97, 119, 256). Although wool dogs are reported (Stern 1934:89), Barnett (1975:96) expresses uncertainty as to the distinctness of a hunting breed from a wool bearing breed. Suttles (1951: 103) reports that a single dog species was used for both wool production and hunting. Indeed, the maintenance of two distinct breeds of dogs would imply an advanced level of animal husbandry. It is interesting to speculate that, despite its small size, the canid with Burial 5 may have been a hunting dog that was dismembered in action, possibly by a bear. The skull of the adult male labelled Burial 5 is crushed; initially soil pressure was thought to have caused this condition, but an unfortunate encounter with a bear may have produced similar results. On the other hand, the inclusion of a celt and composite toggling harpoon valves with the individual would not necessarily imply hunting prowess.

Burials 4 and 5 were found at approximately the same elevation in the same natural stratum, and they were only 75 cm apart. The area covered by the Burial 5 cairn reached toward Burial 4 and several cobbles were found above this burial. Thus an extension of the Burial 5 cairn or a partial separate cairn may have covered Burial 4. Without additional evidence to clarify this situation the large cairn should be regarded as covering Burial 5 only, and Burial 4 should be regarded as having been covered by what may have been intended as a cairn.

Burial 4 was only generally articulated. The person lay face up with the cranium split up the back and flattened, with the face in the middle. The mandible lay upside down on top of the face, and the sternum lay on top of the mandible. The ribs were spread out as if opened at the sternum, and the spine was contorted. Although the arms and legs were in the positions typical of a flexed burial--that is, elbows bent with hands to the face or throat and knees to the chest and feet close to the pelvis--one innominate was completely disoriented. This disorientation of skeletal elements is not found in other burials at the site, but it is reminiscent of the condition of the dog in the nearby cairn. The possibility of a relationship between the two burials is raised again but, on the other hand, the great difference in artifact inclusions with each person might suggest that each burial event was separate.

Three burials exhibit pathological bone conditions. Burial 1 had a congenitally dislocated hip and a right leg that was noticeably shorter and frailer than the left. As a result of these conditions the pelvis was deformed, especially around the right acetabulum. The vertebral column was also deformed, probably as a result of efforts to keep the torso vertical while walking with one short leg. Burial 5 also had a laterally deformed vertebral column (scoliosis). Burial 7, the earliest burial at the site, showed pronounced effects of arthritis on the proximal and distal condyles of the radii and ulnae. The condition was more noticeable on the right side.

APPENDIX III

LITHIC DEBRIS

Introduction

This brief description of lithic debris presents only weight of flakes by natural stratum and excavation unit for Lot 81 and Lot 73. This abbreviated analysis is justified on the grounds that almost all of the lithic debris is undifferentiated shatter (D. Pokotylo,pers. comm) and that detailed analysis of lithic debris is beyond the scope of this study. Thus, little relevant information can be gained by a detailed analysis of these data.

Lot 81

Table XLII presents the weights of lithic remains on Lot 81. In treating the lithic debris it was decided to simply count and weigh the flakes from each analytical unit. There are no lithic remains in natural stratum A of excavation unit 4 and only one flake in the same stratum in excavation unit 1. Almost half the lithic remains in excavation unit 3 come from the disturbed and historic stratum, but this finding is not supported from excavation unit 2, where only 22% of the lithic remains are in the upper stratum. The percentages of lithic debris from each excavation unit found in natural stratum B in units 2 and 3 are also noticeably

TABLE XLII

Weight of Lithic Debris (gm) by Excavation Unit and Natural Stratum, Lot 81, DiSe 7.*

Natural Stratum	Excavation Unit			
	1	2	3	4
A	38.4	12.7	251.8	0.0
B	-	39.8	133.8	-
C	-	5.0	25.2	-
C-1	-	-	0.1	-
C-2	-	-	0.0	-
D	-	-	8.5	-
E	-	-	3.9	-
F	-	-	0.0	-
F-1	-	-	81.8	-
G	-	-	0.0	-

* blanks indicate natural stratum not present in the excavation unit.

different. This may reflect the small amount of debris from excavation unit 2. Natural stratum F-1 of excavation unit 3 contains the only appreciable remaining amount of lithic detritus.

Lot 73

Table XLIII presents the weights of lithic debris found in each natural stratum of each excavation unit on Lot 73. One pattern is immediately evident. In excavation units 1 through 4 natural stratum P contains the largest percentage of lithic debris. The lithic debris from strata of the lithic component comprise 92.95% of all lithic debris in excavation unit 1, 96.40% in unit 2, 91.91% in unit 3, and 80.46% in unit 4. The lack of lithic debris in this stratum in unit 5 is a result of its being stratigraphically beyond the clay floor feature. Also, the sandy group of strata between F and G/O generally contain very low relative frequencies of lithic debris compared to other shell midden strata. The distribution of flakes in excavation unit 5 is atypical, possibly because so few items of debris were recovered here (99.8gm, flakes).

The great abundance of chipping debris from deposits that represent a series of beach surfaces calls to mind the large number of cobbles with numerous flakes removed in regular patterns that lie on the beach west of the site. Many of these cobbles are basalt, but a number are also of coarser grained igneous rock. The lithic debris from the P

TABLE XLIII

Weight of Lithic Debris (gm) by Excavation Unit and Natural Stratum, Lot 73, DiSe 7.*

Natural Stratum	Excavation Unit				
	1	2	3	4	5
A	0.8	26.4	45.4	5.0	1.2
B, B-1	3.7	0.0	-	-	-
D	0.0	0.0	-	-	-
E	0.0	-	-	-	-
C	-	8.1	50.1	5.1	-
F	57.1	0.0	45.8	7.3	42.8
"G"	-	-	0.0	11.0	0.0
I	-	0.0	27.7	0.9	0.0
J	-	0.0	0.0	0.0	1.1
K	-	0.0	0.0	252.7	5.5
M	-	-	10.7	0.2	0.0
N	-	0.0	10.4	1.9	24.7
G/O	66.1	8.0	21.0	160.8	24.5
G-2	6.1	-	-	-	-
G & shell	19.2	47.2	167.0	-	-
dark G	-	-	0.0	-	-
H	65.6	46.6	-	-	-
H-1	19.1	13.6	0.0	-	-
Q	-	28.7	-	-	-
R	18.3	2.4	-	-	-
S	0.0	0.0	-	-	-
P	2634.3	4680.7	3903.4	1573.3	0.0
T	0.0	95.9	112.9	0.0	0.0
P-1	746.9	36.2	278.0	258.6	0.0
T-1	0.0	0.0	0.0	-	-
P-2	0.0	35.1	20.0	-	-
T-2	0.0	17.8	-	-	-
P-3	0.0	-	-	-	-

* blanks indicate natural stratum not present in the excavation unit.

and T strata at the site is mostly from coarse grained igneous rocks, although some basalt is present, and the cores found in these strata are equally divided between basalt and coarse igneous rock. The main difference between the beach and the P and T strata lies in the absence of flakes on the beach and their abundance in the excavations. Given the present evidence, it is impossible to tell whether either of these locations represents a possible raw material source or work area.

APPENDIX IV

CLAM SHELL SEASONALITY

Introduction

The object of this analysis was to obtain information on the approximate season of death of clams whose remains were found in the midden. This information enables one to infer the time of year during which the site was most likely to have been occupied. The use of mollusc remains for this purpose has been pioneered in New Zealand (Shawcross 1967; Coutts 1970:874; Saxon and Higham 1969:303-311) and California (Weide 1969) and the technique has been applied locally with some success (Ham 1974; Ham and Irvine 1975; Keen 1976). The following analysis applies aspects of the seasonal dating technique that are appropriate to the Deep Bay data.

Analysis

Prodigious quantities of shell were collected in the field; much of it was not appropriate for seasonal dating but the remaining shell was still of such a quantity as to make unfeasible a 100% sample. To overcome this problem the following steps were taken: 1) only butter clam remains were analyzed, 2) a 10% random sample was drawn of analytical units containing butter clam remains, and 3) where the quantity of shell in one of these analytical units was still cumbersome a random sample of the entire quantity was drawn from the unit.

Limiting the analysis to a single clam species, in this case butter clam (Saxidomus giganteus), has both advantages and disadvantages. Personal experience and the work of Keen (1976:74) indicates that this species is easiest to interpret in terms of winter and summer growth ring distinctions. Also, butter clams tend to have a robust shell, especially toward the lip, that enables the valves to withstand deposition, recovery, preparation, and analysis. Basket cockle is also robust but it is less easy to interpret in cross section than butter clam (see Ham and Irvine 1975,Fig.3c, Fig.5c). A further advantage to the use of butter clam is its frequency, this species being found in all 26 analytical units above natural stratum P. Although it is possible that some fragments of horse clam (Tresus sp.) have been included with the butter clam remains, the separation of these two species in the faunal sample analysis is thought to be quite reliable. Even if all the shell identified as butter clam in several analytical units were in fact all horse clam thereby making the number of sampled analytical units in which butter clam was present equal to the number of such units in which little neck clam or basket cockle was present (23 and 21 respectively), the robustness and interpretability of butter clam shells still favors their examination. Ham (1974:36-37) and Ham and Irvine (1975:371-372) note that clam species with different ecological characteristics display different seasons of death at the Glenrose site. Clams living relatively deep within sand and gravel beaches seemed to have been collected in summer whereas those living up to six inches deep in muddy beaches seemed to have been collected in winter (Ham 1974: 36-37; Ham and Irvine 1975:371-372). It was suggested that higher low tides during the day in winter inhibited the collection of some species, primarily butter clam and horse clam (Ham 1974:36-37; Ham and Irvine 1975:371-373). One important aspect of this argument is omitted, however, and that is the position within the intertidal zone preferred by the clam species in question. Little neck clams are found mainly around the half-tide mark but they occur to the sub-tidal mark (Quayle 1970:59). Butter clams, which are closely associated ecologically with little neck clams (Fraser and Smith 1928:272), are most abundant in the lower third of the intertidal zone (Quayle 1970:63); and basket cockles are exposed only at low tides (this is a rather ambiguous descriptive term but it is probably safe to assume that it means below the half-tide mark) (Ricketts and Calvin 1948:180). Personal observation also associates at least <u>Tresus capax</u> with butter clam and little neck clam. Therefore it would seem that if one species were available during winter daytime low tides all species would be available at the same time. The difference between digging six inches or twelve inches to obtain clams seems minor. Given the ethnographic reports of clams being collected on a year round basis with intensive collection of some species for storage during summer (cf. Gunther 1927:206; Suttles 1951:67-69; Stern 1934:47), and given at least some archaeological support for this position (Keen 1976:56), it does not seem unreasonable to examine only butter clam shells to determine seasonality. Their availability may have fluctuated throughout any given year but the availability of the other important clam species fluctuated in direct proportion; fewer clams may have been gathered in winter than in summer but the proportion of one clam species relative to the next would remain the same regardless of season if summer clam storage patterns were disregarded.

Disadvantages of selecting butter clam or any other single species for seasonality analysis seem relatively few. The responses of butter clam to environmental phenomena such as temperature and disturbance may not be the same as the responses of other species therefore the complete spectrum of molluscan growth response to these phenomena cannot be observed with a single species. There may also be cultural preferences for one species over another that change through time thereby limiting the usefulness of a single species. If this situation exists we are presently unaware of it. Also, the beach matrix at a site may change through time, as in the Glenrose case, thereby potentially affecting the species of clam that can and cannot live under the changed conditions. The changing beach matrix may also be a symptom of terrestrial changes as well (e.g. the Glenrose and St. Mungo sites) where deltaic build up may alter the natural environment of the site sufficiently to necessitate changes in the nature of the activities and the seasonal occupation of a site (Boehm 1970:75). Thus, reliance on a single species could provide data that were incomplete at best. The abundance and frequency of occurrence of butter clam remains at Deep Bay suggests that changes in environment and cultural preference have not played an important part in the availability of butter clam or any other clam species. As for differential environmental effect on different clam species, the degree to which clam species vary in this regard is not presently known. It is thought that the disadvantage of not examining the range of clam species in order to account for various growth phenomena is outweighed by the sample homogeneity to be achieved by the examination of a single species.

The faunal sample analysis of 26 analytical units indicated that butter clam was found in all 26 of these units. Since these analytical units are samples of natural strata it can be inferred with considerable safety that if the sampled analytical unit contains butter clam remains the natural stratum from which it was sampled also contains butter clam remains. This means that 53 of a possible 63 analytical units on Lot 73 probably contain butter clam shells and that eight analytical units on Lot 81 also probably contain butter clam shells. On Lot 73 it was decided to take a 10%

sample of analytical units containing butter clam shells for seasonality analysis. The analytical units were divided into the disturbed and historic group, the Gulf of Georgia group, and the Marpole group, each containing 14, 21, and 18 analytical units respectively. These figures represent 26.4%, 39.6%, and 34.0% respectively of all analytical units containing the desired species. Five samples, or 9.4% of all analytic units, were drawn using a table of random numbers. The percentage of units in each group was multiplied by the number of units sampled and the result was rounded to a whole number. This procedure provided for one analytical unit from the disturbed and historic group and two each from the Gulf of Georgia and Marpole groups. The analytical units chosen were natural stratum A in excavation unit 5, natural stratum F in excavation unit 3, natural stratum I in excavation unit 4, natural stratum G-2 in excavation unit 1, and natural stratum G/O in excavation unit 5. A similar procedure on Lot 81 produced natural stratum B in excavation unit 2 and natural stratum A in excavation unit 3 for analysis.

In spite of this sampling procedure the quantity of shell remains in natural stratum F, excavation unit 3, still consisted of nineteen bags (14 lb. heavy type) twelve of which were full and seven of which were approximately half full. Most of the shells in these bags were butter clam. It was decided to take a 20% sample or four bags from this total, 36.8% of the partially full bags and 63.2% from the full bags. Rounded to a whole number this procedure gave three full bags and one partially full bag for analysis.

All butter clam valves and valve fragments with part or all of the lip intact were removed from the sampled analytical units. The shells were then washed in warm water to remove the dirt and dried. They were then cut with a hack-saw at right angles to the long axis of the valve at approximately the mid-point of the long axis. This technique produces a cross section that is at right angles to the growth rings at the lip. Where two cross sections from a single valve were produced only one was retained for analysis since two seasonal estimates from the same valve would bias the results. The cross sections were then filed smooth, the valves dipped for five seconds in 10% hydrochloric acid, rinsed in water, and dried. They were then examined under a X10-X30 power Nikon binocular microscope and the width of the growth increments were measured using Mitutoyo vernier calipers. The point of reference from which measurements were made was the dense concentration of growth rings that is usually relatively narrow and that usually stands out from the thicker summer growth rings. Where no precise winter check ring was evident but where winter growth rings were obvious measurement was taken from the center of the aggregation of winter growth rings.

A preliminary examination of the shells indicated that the growth increments, in butter clams at least, are often erratic thereby making tables of average valve breadth growth of only theoretical interest (e.g. Craig and Hallam 1963:738). Also, this erratic growth pattern makes estimates based on growth only in the previous year unreliable (e.g. Ham and Irvine 1975:365; Tables I-V). In an effort to develop some criterion on which the most recent growth increment could be compared to some standard it was decided to measure from the fifth-to-last to the second-to-last growth increments. The last growth increment was then calculated as a percentage of the four previous years. The fifth-to-last growth ring was arbitrarily selected because lip fragments and broken valves usually had at least five growth increments visible.

The growth rate in clams is not uniform throughout the year. The least growth occurs in mid-winter; this produces the winter check ring. Spring and summer account for the majority of shell growth because of optimal temperature and food supply conditions (Quayle and Bourne 1972:8). Keen (1976:29) divides the growth year into quarters. The first quarter includes the winter check ring and up to twenty-five percent of the average annual growth; the second quarter is early summer, the third quater is late summer, and the fourth quarter is autumn and early winter before the winter check ring. This means of grouping the percentage of average annual growth subsequent to the last winter check ring has the advantage of being readily interpretable in terms of season. A problem is encountered, though, when a clam is harvested toward the middle or end of a good growth year that was preceded by a number of bad growth years. In this instance the last growth increment can exceed 100% of the average annual growth of previous years. It is unclear whether the few instances of this phenomenon should be assigned to the fourth or first growth quarter therefore they have been kept separate in this analysis.

The numbers of valves falling into each quarter or into the over 100% category were counted for each analytical unit and these totals are expressed as percentages of the total number of valves from each analytical unit in Table XLIV. At least half of all valves in each analytical unit are found in the first quarter. This suggests that winter or early spring is the time of year during which most butter clams were gathered. It may be inferred one step further that the most likely period of site occupation was between mid-winter and spring. With two exceptions over two-thirds of all valves fall into the first growth quarter. The two exceptions are both analytic units from the Gulf of Georgia component and these two units are the only ones to contain valves whose last growth increment exceeds 100% of the average annual growth of the previous four years. Also, these two analytic units contain higher percentages of valves in the third and fourth quarters than any of the other units. These phenomena may suggest two things. One, the presence of clams in the ">100%" category may suggest that ecological

TABLE XLIV

Relative Frequencies of Butter Clam Valves in each Growth Percentage Category, DiSe 7.

lot	excavation unit	natural stratum	component	N	growth percentage category 0.0-24.9%	25.0-49.9%	50.0-74.9%	75.0-99.9%	>100.0%
81	2	B	unknown	15	80.0	20.0	00.0	00.0	00.0
81	3	A	disturbed/ historic	44	68.2	25.0	6.8	00.0	00.0
73	5	A	disturbed/ historic	29	69.0	20.7	6.9	3.4	00.0
73	3	F	Gulf of Georgia	70	50.0	21.4	18.6	7.1	2.8
73	4	I	Gulf of Georgia	13	53.8	00.0	15.4	15.4	15.4
73	1	G-2	Marpole	32	78.1	12.5	6.2	3.1	00.0
73	5	G/O	Marpole	16	81.2	18.8	00.0	00.0	00.0

conditions for good clam growth were less prevalent during the time period of the Gulf of Georgia component. Clams harvested in a good year would therefore show relatively large amounts of growth relative to previous years thus loading up the over 100% category as well as the third and fourth quarters when in fact they were gathered earlier in the year. Two, a cultural change may have taken place, the role of the Deep Bay site altering somewhat in the annual subsistence round. Instead of being as intensively occupied during the first quarter a decreased emphasis was placed on first quarter occupation and an increased emphasis was placed on late seasonal occupation. The shift in emphasis of occupation may relate to the most recent stages in the development of the spit itself. Possibly inter-group conflict and the establishment of a fortification at the site contributed to the apparent shift in seasonal exploitative emphasis.

APPENDIX V

COMPOSITION OF TRANSFORMED ARTIFACT CLASSES, LOT 73, DiSe 7.

Transformed Artifact Class	Original Artifact Class
utilized flake	heavy duty utilized flake medium duty utilized flake light duty utilized flake
microblade	microblade microblade core
obsidian flake	obsidian flake
quartz crystal flake	quartz crystal flake
unifacially retouched flake	heavy duty unifacially retouched flake medium duty unifacially retouched flake
bifacially retouched flake	medium duty bifacially retouched flake light duty bifacially retouched flake retouched slate fragment
biface	heavy duty biface light duty biface
cobble/flake core	cobble/flake core
large chipped stone point	unilaterally shouldered point base bilaterally shouldered point base side notched point base flat base, contracting edge point base point tip fragment broad, symmetric leaf shaped point parallel edged point

Appendix V (continued)

Transformed Artifact Class	Original Artifact Class
triangular point	triangular stemmed point triangular unstemmed point
chopping tool	unifacial chopping tool bifacial chopping tool
abrasive stone	coarse texture abrasive stone medium texture abrasive stone fine texture abrasive stone abrasive stone/saw edge retouched abrasive stone
thin ground slate point	tip fragment, thin ground slate point medial fragment, thin ground slate point thin triangular ground slate point thin corner notched ground slate point thin basal notched ground slate point
thick ground slate point	thick ground slate point thick ground slate point base
ground slate knife	medium thick ground slate knife thin ground slate knife
ground slate fragment	bifacially bevelled ground slate fragment unifacially bevelled ground slate fragment bifacially abraded slate fragment unifacially abraded slate fragment
celt	celt
saw	saw
ground stone pendant	ground stone pendant
stone disc bead	stone disc bead

Appendix V (continued)

Transformed Artifact Class	Original Artifact Class
incised slate	incised slate
split bone awl	split bone awl polished bone awl
bone point	heavy duty bone point light duty mammal bone point bird bone point polished bone rod
wedge base bone point	wedge base bone point
unilaterally barbed bone point	unilaterally barbed bone point
ulna tool	ulna tool
bird bone whistle	bird bone whistle
bone bipoint	mammal bone bipoint bird bone bipoint
worked tooth	worked sea mammal bone tooth
bone pendant	zoomorphic bone pendant
bead	mammal bone bead bird bone bead
bone chisel/wedge	mammal bone chisel/wedge sea mammal bone wedge
worked bone fragment	worked bone fragment
sea mammal bone implement	sea mammal bone implement
unilaterally barbed antler point	unilaterally barbed antler point
antler point	antler point
antler ring	antler ring
antler wedge	antler wedge

Appendix V (continued)

Transformed Artifact Class	Original Artifact Class
antler foreshaft	antler foreshaft
antler tine flaker	antler tine flaker
antler composite toggling harpoon valve	antler composite toggling harpoon valve
antler fragment	adzed antler fragment abraded antler fragment
incised antler tine	incised antler tine
shel disc bead	shell disc bead
pecten shell	pecten shell
dentalium shell	dentalium shell
shell ring	shell ring
<u>Mytilus californianus</u> shell implement	<u>Mytilus californianus</u> shell implement
ochre	ochre
mica	mica
wood	wood
copper	copper