

A DESCRIPTION AND ANALYSIS  
OF CRANIAL MATERIAL  
FROM THE GULF OF GEORGIA REGION

by

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A PAPER

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### I. INTRODUCTION AND STATEMENT OF PROBLEM

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ists of a description and analysis of cranial material from several recently-excavated sites in the Gulf of Georgia region. Archaeological analyses of these sites have suggested that the various components represent three distinct culture types--Locarno Beach, Marpole, and Developed Coast Salish--occupying the Gulf area sequentially over the past 3000 years (Borden 1950; Carlson 1960; Mitchell 1964; Willey 1966)<sup>1</sup>, and the investigation's major objective has been to determine whether or not the populations associated with these distinct cultures differed significantly from one another in their physical characteristics.

Previous research in physical anthropology for the Gulf of Georgia area has been limited, and mostly dates from the turn of the twentieth century or earlier, thus pre-dating the delineation of the three archaeological culture phases referred to previously. Boas (1891) outlined the physical characteristics of the Salish population of the 1890's. In 1895, he described a fragment of a skull found in a Fraser Valley burial mound by Hill-Tout. Hill-Tout (1895) himself commented

## I INTRODUCTION AND STATEMENT OF PROBLEM

The investigation undertaken in this paper consists of a description and analysis of cranial material from several recently-excavated sites in the Gulf of Georgia region. Archaeological analyses of these sites have suggested that the various components represent three distinct culture types--Locarno Beach, Marpole, and Developed Coast Salish--occupying the Gulf area sequentially over the past 3000 years (Borden 1950; Carlson 1960; Mitchell 1968; Willey 1966)<sup>1</sup>, and the investigation's major objective has been to determine whether or not the populations associated with these distinct cultures differed significantly from one another in their physical characteristics.

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on skeletal material from the Marpole midden. Oettinger (1928, 1930), in his discussions of the craniology of the north west coast, provided some brief descriptive anthropometric data for the area. Oschinsky (1960, 1961) did research on north west coast and Eskimo skeletons. His findings do not relate specifically to the coast Salish. However, several of the observations which he noted--for example, presence and form of foramina in the supraorbital region--as being characteristic of north west coast populations, were incorporated into the study. Heglar has examined the skeletal material from the mainland sites excavated by Borden. His findings are unpublished. Since specimens included in this study are drawn only from excavated sites for which a clear association with at least one of the three recently-established Gulf of Georgia culture phases can be demonstrated, the earlier material cannot easily be used as such cultural affiliations cannot be established for them.

As the research outlined above thus constitutes the first study of its kind in this area, a secondary objective has been to test the appropriateness of the various cranial attributes used, to single out those which seem most useful for future work in the region.

mainland near the Fraser River mouth at Marpole and Locarno Beach. Table 2 summarises these sites according

TABLE 1. Distribution of Specimens by Site, Component, Age, and Sex

II METHODS	Total number of	Adult males	Adult females	Juveniles
A. <u>Nature of sample</u>				
<p>The total sample consists of 47 skeletal specimens. In this study, the sample has been broken down into nine smaller groupings for purposes of analysis, according to age, sex, and cultural affiliation. The number of specimens which can be used when considering each attribute varies, as it was the rare case that an observation or measurement could be made on all specimens in the total sample owing to either their fragmentary nature or poor state of preservation.</p> <p>The basis for the selection of the specimens included in the total sample is the requirement that they be attributable, with reasonable certainty, to any one of the three Gulf of Georgia archaeological culture types (Locarno Beach, Marpole, or Developed Coast Salish) and, arising out of this qualification, that they come from excavated sites at which these components have been identified. Skeletal specimens from five sites meet these requirements. Three sites are located in the Gulf Islands at False Narrows, Gabriola Island; Montague Harbour, Galiano Island; and Cadboro Bay, Vancouver Island. Two sites are located on the lower mainland near the Fraser River mouth at Marpole and Locarno Beach. Table 1 summarizes these sites according</p>				

ARCHAEOLOGICAL SITES

TABLE 1. Distribution of Specimens by Site, Component, Age, and Sex

Culture type	Site	Total number of specimens	Adult males	Adult females	Juveniles
Locarno	Montague Harbour I	7	4	1	2
Beach	Locarno Beach	1	1	0	0
Marpole	Montague Harbour II	3	1	2	0
	False Narrows	23	10	5	8
	Marpole	9	5	4	0
Developed Coast	Montague Harbour III	3	1	2	0
	Salish	Cadboro Bay II	1	0	1
Total		47	22	15	10

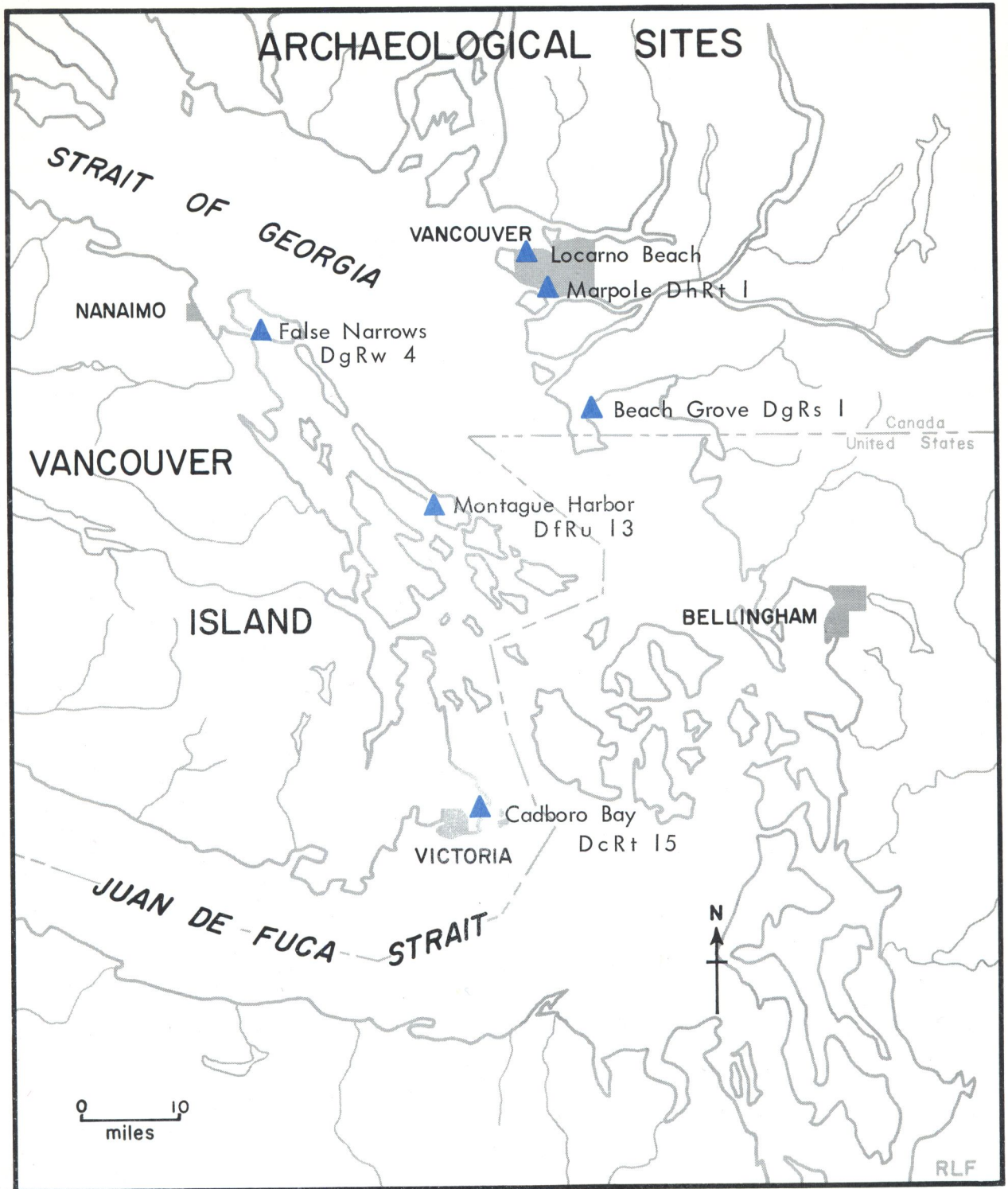


FIGURE 1. Location of sites referred to in study  
 For example, in the Marpole midden, Hill-Fout (1895)  
 identified two distinct physical populations--one

to cultural affiliations and number of specimens from each. Figure 1 shows the geographical location of each site.

There are sources of possible bias or error in the sample which may affect the ability of the investigator to generalize from the study:

1. There are ten specimens from the lower mainland as opposed to 37 from the Gulf Islands. The combining of these two groupings in the study could be biasing the sample geographically. The researcher is assuming that there are no significant physical differences between the two areas. If there are, the sample is biased in favour of the Gulf Islands' characteristics.
2. The attributing of each burial within a site to the archaeologically-established cultural affiliation of that site has been taken as a given by the investigator. Thus the reliability of the segregation of the specimens into culture groups in this study depends in large measure on the reliability of the archaeologically specified affiliations of the specimens. There is not complete agreement in archaeology about the actual cultural affiliations of the specimens. Much of the argument centres on the problem of intrusive burials. For example, in the Marpole midden, Hill-Tout (1895) identified two distinct physical populations--one

markedly dolicocephalic, the other brachycephalic and similar to present-day coast Salish peoples. On the basis of this evidence, he hypothesized that the former group represented a pre-Salishan population and that the latter constituted intrusive burials of the present-day inhabitants. Harlan Smith (1903) dug another part of the midden and found no such evidence of intrusive burials or of a separation in physical type.

3. All of the specimens in the sites are from midden burials. Other forms of burial occur in the Gulf area-- for example, cairn, tree, and cave burial; burial in rock shelters or in sheds; and possible cremation (Barnett 1939:263-264). The potential bias here is that the researcher is assuming that there would be no physical differences exhibited by specimens associated with different forms of burial if they belonged to the same culture type. There appears to be no ethnographic reason for assuming that there would be differences (Barnett 1955).

4. The actual excavations of each site involve only limited areas of the total site. These sections or test cuts are not randomly located. Thus the sample of skeletal specimens has been drawn from restricted portions of each midden. At Montague Harbour the excavations are actually widely dispersed, although

the western part of the site was not sampled. At False Narrows the burials all come from a small segment of a very large site (a corner of one house-lot out of 28 house-lots). There is only one specimen each from the Locarno Beach and the Cadboro Bay sites. At Marpole, the burials are predominately from the western part of the site. The Marpole midden sample also includes five finds from other than controlled excavations. The inclusion of these is not biasing the sample as no similar finds were reported for the four other sites. Thus, because of this aspect of the methods of excavation, there is a possibility that the specimens from each site are not representative of the site population. For example, most of the 30 specimens from False Narrows could be from one related family. This fact should not affect the ability of the investigator to test for similarities and dissimilarities among the three culture types. It could, however, affect any generalizations put forward concerning the over-all physical characteristics of the area. The description of the resulting populations or populations could be biased in favour of the physical characteristics of one or two families.

## B. Descriptive techniques

It was the original intention of the investigator to describe the entire skeleton. After examining the Locarno Beach culture specimens, however, it was decided to confine the study to a description and analysis of the skull and mandible. There is not enough of the infracranial skeleton preserved for the Locarno Beach specimens on which to make useful statements about the basic quantitative and qualitative attributes. Without this information for the Locarno Beach culture type, it is not worthwhile (for the purposes of this study) to collect these data for the Marpole and Developed Coast Salish culture types as cross-cultural comparisons cannot be made.

This discarding of the infracranial skeleton has limited the scope of the study, but not the validity of using the findings to demonstrate the degree of similarity or dissimilarity in physical type (Neumann 1952; Newman 1962).

### Selection of attributes:

Quantitative cranial attributes (22 in number) have been restricted to those which yield cranial indices, since well-documented methods for separating

out and describing populations on the basis of cranial indices have been established (Anderson 1962; Montagu 1960; Neumann 1952; Newman 1962). Mandibular metrical attributes (five in number) have been restricted to ones which provide a general description of and distinctions between populations--for example, the gonial angle (Anderson 1962; Montagu 1960). The investigator is aware that there may be additional metrical attributes that would provide a more exact method for demonstrating the uniqueness of the populations. For example, it might be that the diameter of the external auditory meatus might be significant in distinguishing among these three populations. For the following reasons the investigation of the additional attributes has not been attempted:

1. It is beyond the scope and intent of the study.
2. The state of preservation of many of the specimens is such that only basic observations are possible on them.

The qualitative dental and cranial attributes (37 in number) are standard ones (Anderson 1962). Two of the cranial attributes--suture patterns and the transverse palatine suture--were discarded in the course of the description as an adequate discussion of the significance of these attributes could not be found.

Sexing of the specimens has been based on the

skull, although where possible observations have been made on the pelvis. There are possible sources of error in employing such a method, although Krogman (1962: 149) states that 90 per cent accuracy can be achieved from sexing skeletons on the basis of the skull alone.

Age of the specimens is again based on the skull, with stress being placed on observations on the dentition and on degree of suture closure. Anderson (1962), Krogman (1962) and Montagu (1960) have excellent sections on these two tests of aging. For purposes of this study, distinction needed to be made only between adult and juvenile specimens. The criteria selected for adult status was the presence (in some form) of the third molar.

#### Description of specimens:

At the time when the study was made, the "proper" anthropometric equipment was not available, although the investigator had an adequate sliding caliper which was used for taking the majority of the measurements. Maximum length, breadth, and height of the skull, however, should be taken with a spreading caliper, which was not available. Therefore the accuracy of these three metrical attributes might be open to question.

TABLE 2. Comparison of the measurement of maximum length, breadth, and height of the cranial vault with a spreading caliper and without

Skull	Length	Breadth	Height	
1	with spreading calipers	18.1	14.8	14.6
	without	18.1	14.8	14.5
2	with spreading calipers	18.0	14.3	-
	without	18.0	14.3	-
3	with spreading calipers	17.6	13.5	-
	without	17.6	13.5	-
4	with spreading calipers	18.2	13.4	14.7
	without	18.2	13.4	14.7
5	with spreading calipers	17.1	14.7	16.5
	without	17.1	14.7	16.6

The equipment, however, has since arrived. In order to test the accuracy of these three measurements, the researcher took five skulls in the sample and remeasured maximum length, breadth, and basion-bregmatic height. The findings are summarized in Table 2. Maximum height tends to vary slightly (plus or minus one millimeter). This should not affect the study appreciably.

Problems in description centered on the state of preservation of the specimens. Wherever possible, reconstruction was done. Six skulls were substantially reconstructed.

The 64 attributes (27 quantitative, 37 qualitative) were recorded for each specimen on specially-prepared data sheets. Appendix A contains a list of the attributes used in this study and the investigator's definitions of those which were not precisely defined in the standard anthropometric works (Anderson 1962; Montagu 1960).

#### Qualitative attributes:

The dental and cranial observations were summarized according to sex, and cultural affiliation. This information appears in Appendix C. None of the resulting groups was large enough to test by chi-square. Therefore all that is presented are the expected frequencies for each attribute according to the two categories.

C. Analytical procedures

For purposes of analysis, attributes fell into quantitative and qualitative categories. Different procedures were followed for each.

Metrical attributes:

The total sample was broken down into nine categories according to age, sex, and cultural association. For each metrical within each of the above categories the range, mean, and standard deviation were calculated for samples of more than two. This information appears in tabular form in Appendix B.

Where inspection suggested that the separation of means might indicate differences between the culture types, the significance of the difference was tested, using the small sample method outlined by Moroney (1951).

Qualitative attributes:

The dental and cranial observations were summarized according to sex, and cultural affiliation. This information appears in Appendix C. None of the resulting groups was large enough to test by chi-square. Therefore all that is presented are the expected frequencies for each attribute according to the two categories.

### III ANALYSIS AND INTERPRETATION OF THE DATA

#### A. Quantitative attributes

In order to analyze the metrical attributes, the total sample of 47 specimens was broken down into nine categories according to age, sex, and cultural affiliation. Information concerning the number of specimens present in each of these categories appears in Table 1. The distinction was made between adult and juvenile because of the obvious correlation between age and the size of the attributes being measured. The distinction was made between adult male and female because of sexual dimorphism--particularly, for this study, in reference to the dimensions of the skull (Krogman 1962; Montagu 1960).

As observation of none of the quantitative attributes used in this study was possible on the two juvenile specimens from the Locarno Beach culture type, and as there were no juvenile specimens in the Developed Coast Salish culture type, the juveniles were eliminated as an analytical category for the metrical attributes.

Appendix B contains the calculated ranges, means, and standard deviations of each metrical attribute for adult males and females. The adult males have only five testable attributes (attributes with samples of more than two in each category). These are:

1. maximum length,

2. maximum breadth,
3. minimum breadth of ramus,
4. angle of the mandible,
5. cranial index.

There is only one Developed Coast Salish adult male. Thus the Marpole and Locarno Beach culture types alone can be compared according to these five attributes. The adult females have no testable categories.

The five attributes, which could be compared for the adult males, were tested for the significance of the difference between the means.

By inspection, the most widely differing attribute out of the five was noted to be cranial length. The difference between the two means is 1.4 cm. This difference was tested first. Table 3 provides the data on this attribute.

TABLE 3. Range, mean, and standard deviation of cranial length for Locarno Beach and Marpole adult males

	No.	Range	$\bar{x}$	$\sigma$
Locarno Beach	3	17.0-18.1	17.7	.5
Marpole	8	15.6-16.9	16.3	.5

Moroney's (1951: 232) small sample method was used to arrive at the significance of the difference between the two means. This method adjusts for the

bias in small samples by applying Bessel's correction. The resultant ratio was interpreted with Student's t distribution.<sup>2</sup>

In applying this method to cranial length, it was noted that the observed difference of 1.4 cm. could not have arisen by chance in more than one per cent of trials (.01 level of probability).

The only other widely differing attribute among the adult males is cranial index (difference of 8.2). Table 4 summarizes the data on the attribute.

TABLE 4. Range, mean, and standard deviation of cranial index for Locarno Beach and Marpole adult males

	No.	Range	$\bar{x}$	$\sigma$
Locarno Beach	3	79.5-81.8	80.8	1.0
Marpole	8	83.3-97.0	89.0	3.6

The difference between the two means is significant at the .01 level of probability.

The most reasonable interpretation for this dissimilarity between the means in cranial length and cranial index is the cultural practice of skull deformation in the Marpole culture type (Borden 1950).

This would distort the length of the skull and affect the cranial index. A method for demonstrating the validity of this interpretation would be to compare

the Marpole adult males which exhibit deformation with those which do not. This must wait until more specimens are available. In the sample for this study, only one adult Marpole male lacked skull deformation.

The three remaining testable attributes--maximum breadth of the vault, minimum breadth of the ramus, and angle of the mandible--appeared by inspection to exhibit a marked degree of similarity between their means. This was tested in each case for the significance of the difference. Table 5 contains the data for all three.

TABLE 5. Range, mean, and standard deviation of maximum cranial length, minimum breadth of ramus, and angle of the mandible for Locarno Beach and Marpole adult males

	No.	Range	$\bar{x}$	$\sigma$
<u>Locarno Beach</u>				
Maximum cranial breadth	3	13.8-14.8	14.3	.04
Minimum breadth of ramus	3	3.6-4.1	3.8	.2
Angle of the mandible	3	96-120	111.3	10.9
<u>Marpole</u>				
Maximum cranial breadth	8	13.7-15.5	14.5	.6
Minimum breadth of ramus	13	3.4-4.3	3.9	.3
Angle of the mandible	13	103-120	111.2	5.2

None of the three exhibited a significant difference in their means.

B. Qualitative attributes

In order to analyze the qualitative attributes, the total sample of 47 specimens was broken down into six categories according to sex and cultural affiliation. The distinction was made between male and female for the same reason as for the metrical attributes. The juveniles were pooled with the adults because the observations which were possible on them did not appear to differ with age. Appendix C contains a summary of the data collected for the qualitative attributes.

In it are noted three things:

1. the number of specimens in each category on which the observation of a given attribute was possible,
2. the number of specimens on which the given attribute was present (according to a predetermined scale--note Appendix A) or absent,
3. the number of specimens one would expect to have or not have the attribute, given the size of the sample.

By inspection, the only qualitative attribute which seemed to differ according to culture type was skull thickness. Table 6 summarizes the data on this attribute, for the adult males (no difference was noted for the females).

TABLE 6. Distribution of Locarno Beach, Marpole, and Developed Coast Salish adult males according to skull thickness

Number of specimens on which observation possible	4	14	1	19
Number on which found ++++	4	4	0	8
Expected frequency for ++++	2	6	0	8
Number on which found +++	0	10	0	10
Expected frequency for +++	2	8	0	10
Number on which found ++	0	0	1	1
Expected frequency for ++	0	1	0	1
	Locarno Beach	Marpole	Developed Coast Salish	Total

From the table there appears to be a trend towards a decrease in skull thickness. A measure of the significance of this trend was calculated by means of the Fisher Exact Probability Test outlined in Siegel.<sup>3</sup> Extreme skull thickness (++++) was tested against

marked (+++) skull thickness. The one Developed Coast Salish specimen was grouped with the Marpole specimens under the marked (+++) category. Significance was at the .05 level of probability.

### C. Final interpretation of the analysis

During the course of the analysis, the investigator has searched for evidences of a separation in physical characteristics among the populations associated with the three established culture types for the Gulf of Georgia region. Within the limitations of this study, the results have shown that there are only three possible indicators of population distinctiveness. These are (1) cranial length, (2) cranial index, (3) skull thickness. However, although there are indications of population differences with respect to these attributes, not all the differences necessarily represent racial distinctions. Differences in cranial length and index could simply reflect the cultural practice of head deformation. This leaves skull thickness as the only possible indicator of a biological separation.

The three populations showed marked similarity in three out of the five testable metrical attributes and in 36 out of the 37 qualitative observations. There is thus greater evidence of association among the three populations than of dissociation.

#### IV CONCLUSIONS

The major objective of this study as outlined in the introduction, has been to determine whether or not the populations associated with the archaeologically-established culture phases for the Gulf of Georgia region were significantly different from one another in their physical characteristics. On the basis of the description and analysis of the sampling of skeletal specimens used in this study, it is now possible to set up hypotheses concerning the physical traits of the inhabitants of the Gulf of Georgia region.

##### Hypothesis I

The Gulf of Georgia region was occupied by one physically homogeneous population associated over time with the three archaeologically-established culture phases for the area--Locarno Beach, Marpole, and Developed Coast Salish. There are geographical and temporal limitations to the application of this hypothesis. Geographically, it applies only to the south-central Gulf of Georgia region and temporally only to specimens found within the 3000 year time span from Locarno Beach on. Whether or not this hypothesis, then, actually reflects the total Gulf

of Georgia population can only be determined by future research.

In the analysis section it was noted that skull thickness seemed to be the only probable indicator of a biological separation among the three populations. There appears to be a trend toward thinner skulls, a trend which further research might document more precisely. This finding does not necessarily destroy confidence in Hypothesis I. Skull thickness could be varying temporarily within the one physical population. Future research might demonstrate that skull thickness is affected by the cultural practice of head deformation.

If future investigations support the hypothesis of one continuing physical population for the area, it could have important implications for theories concerning the antecedents of the coast Salish variant of north west coast culture. It would tend not to support any thesis that relied, in accounting for the presence of new cultural traits in the area, on the migration of a physically different (from the previous inhabitants) population into the Gulf of Georgia region-- for example, Borden's (1951) thesis which hypothesizes a migration of interior peoples into the Gulf area to account for the complex of culture traits which appear to be introduced some time after Locarno Beach.

TABLE 7. Physical characteristics of the adult male and female populations inhabiting the Gulf of Georgia region (continued)

Attribute	Adult male			Adult female		
	$\bar{x}$	$\sigma$	$\sigma_M$	$\bar{x}$	$\sigma$	$\sigma_M$
<u>Metrical</u>						
Maximum length	16.7	.8	.2	16.0	1.4	.5
Maximum breadth	14.5	.5	.2	14.5	.7	.2
Basion-bregmatic height	14.9	.7	.2	14.1	.6	.1
Minimum frontal breadth	9.9	.9	.08	9.6	.6	.2
Total facial height	11.9	.8	.3	11.3	.6	.2
Upper facial height	7.1	.4	.1	6.8	.6	.2
Facial width	13.1	1.0	.4	11.8	.5	.2
Nasal height	5.1	.3	.08	4.9	.3	.1
Nasal breadth	2.3	.1	.04	2.3	.2	.05
Orbital height	3.8	.3	.07	3.7	.2	.05
Orbital breadth	4.1	.3	.09	3.8	.2	.05
Maxillo-alveolar length	5.9	.6	.1	5.3	.2	.06
Maxillo-alveolar breadth	6.3	.4	.1	6.1	.3	.09
Length of mandible	11.0	.8	.2	11.3	.5	.07
Bicondylar width	12.3	.8	.3	12.1	.4	.2
Height of mandibular symphysis	3.3	.3	.07	2.9	.2	.06

TABLE 7. Physical characteristics of the adult male and female populations inhabiting the Gulf of Georgia region (continued)

Attribute	Adult male			Adult female		
	$\bar{x}$	$\sigma$	$\sigma_M$	$\bar{x}$	$\sigma$	$\sigma_M$
<u>Metrical</u> (continued)						
Minimum breadth of ramus	3.9	.3	.06	3.9	.3	.07
Angle of mandible	111.5	6.5	1.6	113.7	5.5	1.6
Cranial module	15.3	.5	.2	15.0	.7	.2
Cranial index	86.7	4.6	1.3	88.8	8.8	2.9
Cranial l-h index	90.1	6.1	1.8	89.7	12.1	3.9
Cranial b-h index	102.9	4.7	1.4	98.1	8.9	2.2
Total facial index	93.9	6.6	2.5	95.3	3.0	1.3
Upper facial index	54.8	3.4	1.3	57.0	4.4	1.8
Nasal index	49.2	4.9	1.6	54.4	6.0	2.4
Orbital index	93.6	9.3	2.8	97.0	9.6	3.9
Maxillo-alveolar index	114.7	5.3	1.4	114.7	4.3	1.1
<u>Qualitative</u>						
Number of teeth	32			32		
Shovel-shaped incisors	+			+		
Abnormalities of enamel	Enamel extensions			Enamel extensions		
Hypercementosis	-			-		

TABLE 7. Physical characteristics of the adult male and female populations inhabiting the Gulf of Georgia region (continued)

Attribute	Adult male	Adult female
<u>Qualitative</u> (continued)		
Attrition	++++	++++
Occlusion	Distorted from extreme amount of attrition	
Molar cusp pattern	+4 or Y-4	+4 or Y-4
Infection	-	-
Peridontal disease	+++-++++	+++-++++
Vault form	Sphenoid	Sphenoid
Skull thickness	+++-++++	++-+++
Sagittal crest	-	-
Form of pterion	"H" form	"H" form
Frontal slope	+--+	+--+
Brow ridges	Separated; V-shaped	Separated; V-shaped
Bossing	-	+
Facial build	"Rugged"	"Moderate"
Projection of zygoma	++	+--+
Prognathism	-	-
Supraorbital region	Large; pierce bone	Large; pierce bone
Shape of orbit	Rectangular	Rectangular
Nasal bones	Hour-glass shaped	Hour-glass shaped

TABLE 7. Physical characteristics of the adult male and female populations inhabiting the Gulf of Georgia region (continued)

Attribute	Adult male	Adult female
<u>Qualitative</u> (continued)		
Nasal aperture	Piriform	Piriform
Shape of palate	Parabolic	Elliptical-parabolic
Mastoid process	Thick	Thin
Mandibular fossa	Medium	Medium-deep
Occipital region	Ridge; $\frac{1}{2}$ way	Mound; $\frac{1}{2}$ way
Form of chin	Square	Round
Gonial angle	+++ eversion	+++ eversion
Mental foramen	At base of 2nd Pm; and back	extends downwards
Genial tubercles	//; ++ prominence	//; ++ prominence
Cranial anomalies	Wormian bones	Wormian bones
Cranial deformation	Fronto-occipital in some Marpole and Developed Coast	Salish specimens
Trephination	One	-

### Hypothesis II

Further cranial remains found in association with the three culture phases will conform to the description offered in Table 7.

The population is predominately brachycranial (broad-headed); leptoprosopic (narrow-faced); and

hypsicnch (narrow orbits). The cranial module is 152mm. Newman (1962) gives this as being characteristic of the aboriginal population shortly after the time of contact. Characteristic of the population is the presence of shovel-shaped incisors; foramina above the orbits which pierce the orbital bone; markedly everted gonial angles (average,  $112^{\circ}$ ); and a trend toward a decrease in skull thickness. Anomalies characteristic of the population are extreme attrition of the teeth accompanied by periodontal disease; head deformation with some culture types; and wormian bones in the lambdoidal suture.

#### Assessment of confidence in these hypotheses:

A statement of confidence is expressed for the metrical attributes by the standard error of the mean.

There are sources of possible error or bias which were outlined earlier in the study. These could invalidate both hypotheses to varying extents. There could be additional observations and measurements which might separate the three populations according to physical type. Some of the attributes included in this study could become significant in separating out the population if the sample were larger. Given these limitations and possible invalidations of the

two hypotheses, on the basis of this limited analysis of a small amount of data, the investigator is more confident in postulating the existence of one physical population than in two or more.

A subsidiary objective of the paper was to single out from the various attributes used in the study those which would be useful for future work in the region. This information appears in Appendix D.

#### Future work

The following is an outline of work which the investigator would now like to see undertaken:

1. A description and analysis of the infracranial skeleton should be done. Before it will be possible to generalize from this data, much additional work will have to be done. For example, a basis for calculating stature for the region will have to be worked out.
2. The present sample must be added to extensively-- from sites used in this study; from sites in other parts of the Gulf area; from graveyards of the present inhabitants. The collection of numerous specimens will enable future workers to test the accuracy of the hypotheses put forward here.

3. A series of minute investigations into the variability of attributes uses--hopefully additional ones will be found to expand on the ones used here--and the various methods for recording them should be undertaken.

4. Regional standards should be arrived at for attributes, and for sexing and aging specimens.

5. The physical traits of populations occupying surrounding areas should be determined so that the distinctive characteristics of the Gulf of Georgia inhabitants can be ascertained.

6. Within the Gulf of Georgia population itself, the relationship of certain attributes to each other should be examined, for example the relationship of the gonial angle to the degree of mandibular and palatine torus.

7. In the future, as many measurements and observations as possible should be taken in the field before the specimen is removed from the ground.

## NOTES

<sup>1</sup> For a brief discussion of the sites associated with the three culture phases, see Borden (1950) and Mitchell (1968).

<sup>2</sup> Calculated by arriving at the best estimate of the standard error for the difference of the means:

$$\hat{\sigma}_w = \hat{\sigma} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

Then Student's  $t$  is calculated as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\hat{\sigma}_w}$$

<sup>3</sup> Significance level is calculated by using a table of critical values of  $D$  in the Fisher Test. Can be used where  $N = 30$  or less and neither of the totals in the right hand margin is larger than 15.

### Cranial indices calculated from these attributes

1. Cranial module
2. Cranial index
3. Cranial length-height index
4. Cranial breadth-height index
5. Total facial index
6. Upper facial index
7. Nasal index
8. Orbital index
9. Maxillo-alveolar index

### Quantitative dental and cranial attributes

As many attributes as possible were evaluated--relative to the total sample--according to presence or absence of the trait. Presence of a trait was scored according to degree in the following manner:

++++ -- extreme  
+++ -- marked  
++ -- moderate  
+ -- slight

(Anderson 1960)

APPENDIX A

Quantitative and qualitative attributes used in describing the skeletal specimens:

Quantitative cranial attributes

1. Maximum cranial length
2. Maximum cranial breadth
3. Basion-bregmatic height
4. Minimum frontal breadth
5. Total facial height
6. Upper facial height
7. Facial width
8. Nasal height
9. Nasal breadth
10. Orbital height
11. Orbital breadth
12. Maxillo-alveolar length
13. Maxillo-alveolar breadth
14. Length of mandible
15. Bicondylar width
16. Height of mandibular symphysis
17. Minimum breadth of ramus
18. Angle of mandible

Cranial indices calculated from these attributes

1. Cranial module
2. Cranial index
3. Cranial length-height index
4. Cranial breadth-height index
5. Total facial index
6. Upper facial index
7. Nasal index
8. Orbital index
9. Maxillo-alveolar index

Quantitative dental and cranial attributes

As many attributes as possible were evaluated-- relative to the total sample--according to presence or absence of the trait. Presence of a trait was scaled according to degree in the following manner:

++++ -- extreme  
+++ -- marked  
++ -- moderate  
+ -- slight

(Anderson 1960)

## Dental

Number of teeth  
Tooth form  
Abnormalities of enamel  
Hypercementosis  
Attrition  
Occlusion  
Molar cusp pattern  
Dental caries  
Tooth loss  
Infection  
Peridontal disease

## Cranial

Vault form  
Skull thickness  
Sagittal crest



Specimens displaying a greater tendency for the skull to be dome-shaped than is illustrated in the above diagram were characterized as possessing a sagittal crest.

Form of pterion  
Frontal slope  
Brow ridges  
Bossing  
Facial build  
Projection of zygoma  
Prognathism  
Supraorbital region  
Shape of orbit  
Nasal bones  
Nasal aperture  
Shape of palate



elliptical



parabolic



hyperbolic

Mastoid process  
Mandibular fossa

This was determined by measuring the depth from the lowest point of the auditory meatus to the shallow notch on the anterior rim of the fossa.

Occipital region  
Form of chin  
Gonial angle  
Mental foramen  
Genial tubercles

CHARACTER	Total Adult Male Population			Locarno Youth		
	No.	Range	$\bar{x}$	S.	$\sigma$	Range
Cranial anomalies	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Cranial deformation	13	15.6-18.1	16.7	1.0	.15	17.0-18.1
Trephination	13	15.6-18.1	16.7	1.0	.15	17.0-18.1
<u>Attributes used for sexing the specimens</u>						
Size of the skull	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Form of the skull	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Brow ridges	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Muscle markings	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Mastoid process	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
<u>Attributes used for aging the specimens</u>						
Tooth eruption	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Suture closure	13	15.6-18.1	16.7	1.0	.22	17.0-18.1
Nasal breadth	12	2.1-2.5	2.3	.1	.04	2.3
Orbital height	12	2.3-2.5	2.4	.1	.07	2.4
Orbital width	11	2.7-4.7	3.1	.3	.09	3.2
Maxillo-alveolar length	15	3.0-4.3	3.7	.3	.14	3.7
Maxillo-alveolar breadth	15	2.8-3.6	3.2	.4	.10	3.3
Length of mandible	14	2.7-4.8	3.6	.8	.21	3.5-4.8
Biangular width	9	10.7-11.4	11.1	.8	.27	10.7-11.4
Height of mandibular symphysis	17	2.7-4.1	3.3	.3	.07	3.3-4.1
Minimum breadth of maxilla	17	3.2-4.3	3.6	.3	.06	3.6-4.1
Angle of mandible	17	90-120	112.5	5.5	1.5	90-120
Cranial module	11	14.1-16.1	15.3	.7	.18	15.3-16.1
Cranial index	12	79.5-97.0	86.7	4.8	2.3	86.7-97.0
Cranial l-b index	11	81.0-97.0	89.1	5.1	1.8	89.1-97.0
Cranial b-h index	11	95.7-113.2	104.5	7.7	1.6	104.5-113.2
Total facial index	7	84.9-104.3	94.9	6.0	2.3	94.9
Upper facial index	7	48.6-59.8	54.3	2.4	1.3	54.3
Nasal index	9	41.2-59.8	49.2	2.9	1.0	49.2
Orbital index	11	75.6-97.5	86.6	8.3	2.8	86.6
Maxillo-alveolar index	15	107.5-135.5	114.7	7.3	1.4	114.7

APPENDIX B

POPULATION	Total Adult Male Population					Locarno Beach (A.M.P.)					Marpole (T.A.P.) Male					Developed Coast Salish (T.A.M.P.)				
	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$
Maximum length	12	15.6-18.1	16.7	.8	.22	3	17.0-18.1	17.7	.5	.29	8	15.6-16.9	16.3	.5	.11	1	17.1			
Maximum breadth	12	13.7-15.5	14.5	.5	.15	3	13.8-14.8	14.3	.04	.02	8	13.7-15.5	14.5	.6	.15	1	14.7			
Basion-bregmatic height	11	13.6-16.5	14.9	.7	.22	2	13.6-14.6	14.1			8	14.4-15.4	14.9	.4	.11	1	16.5			
Minimum frontal breadth	12	8.9-10.9	9.9	.9	.08	2	9.3-9.7				9	9.5-10.9	10.1	.4	.14	1	8.9			
Total facial height	10	10.7-13.8	11.9	.8	.26	1	11.7				9	10.7-13.8	12.0	.9	.28					
Upper facial height	10	6.5-7.9	7.1	.4	.13	1	6.9				9	6.5-7.9	7.1	.4	.14					
Facial width	7	11.8-14.8	13.1	1.0	.39	1	12.4				6	11.8-14.8	13.2	1.1	.42					
Nasal height	9	4.7-5.5	5.1	.3	.08	1	5.0				8	4.7-5.5	5.1	.3	.07					
Nasal breadth	12	2.1-2.5	2.3	.1	.04	1	2.3				11	2.1-2.5	2.3	.2	.06					
Orbital height	12	3.3-4.2	3.8	.3	.07	1	3.9				10	3.3-4.2	3.8	.3	.09	1	3.7			
Orbital breadth	11	3.7-4.7	4.1	.3	.09	1	3.8				9	3.7-4.3	4.0	.2	.07	1	4.7			
Maxillo-alveolar length	15	5.0-6.1	5.9	.6	.14	1	5.2				14	5.0-5.9	5.5	.3	.09					
Maxillo-alveolar breadth	15	5.8-7.0	6.3	.4	.10	1	5.8				14	5.8-7.0	6.3	.4	.10					
Length of mandible	14	9.5-12.0	11.0	.8	.21	2	9.5-12.0	10.7			11	10.1-12.0	11.1	.7	.21	1	11.0			
Bicondylar width	9	10.7-13.4	12.3	.8	.27	2	10.7-12.0	11.4			7	11.8-13.3	12.6	.6	.22					
Height of mandibular symphysis	17	2.9-4.0	3.3	.3	.07	2	2.9-3.4	3.2			14	2.9-3.6	3.3	.3	.08	1	3.5			
Minimum breadth of ramus	17	3.4-4.3	3.9	.3	.06	3	3.6-4.1	3.8	.2	.12	13	3.4-4.3	3.9	.3	.07	1	4.0			
Angle of mandible	17	96-120	111.5	6.5	1.6	3	96-120	111.3	10.9	6.0	13	103-120	111.2	5.2	1.4	1	116			
Cranial module	11	14.4-16.1	15.3	.5	.15	2	14.4-15.8	15.1			8	14.6-15.6	15.2	.3	.08	1	16.1			
Cranial index	12	79.5-97.0	86.7	4.6	1.3	3	79.5-81.8	80.8	1.0	.55	8	83.3-97.0	89.0	3.6	.91	1	85.8			
Cranial l-h index	11	80.0-97.0	90.1	6.1	1.8	2	80.0-80.6	80.3			8	85.8-97.0	91.7	4.3	1.1	1	96.5			
Cranial b-h index	11	96.1-112.2	102.9	4.7	1.4	2	98.5-98.6	98.6			8	96.1-109.0	102.9	3.9	.98	1	112.2			
Total facial index	7	84.9-104.3	93.9	6.6	2.5	1	94.5				6	84.9-104.3	93.8	7.2	.34					
Upper facial index	7	48.6-59.8	54.8	3.4	1.3	1	55.5				6	48.6-59.8	54.7	3.6	1.5					
Nasal index	9	41.8-59.8	49.2	4.9	1.6	1	45.6				8	41.8-56.5	49.6	5.0	1.3					
Orbital index	11	76.6-106.1	93.6	9.3	2.8	1	97.5				9	76.7-104.5	94.9	8.8	2.9	1	78.7			
Maxillo-alveolar index	15	107.5-125.5	114.7	5.3	1.4	1	111.0				14	107.5-125.5	114.9	5.4	1.5					

POPULATION	Total Adult Female Population					Locarno Beach (T.A.F.P.)					Marpole (T.A.F.P.)					Developed Coast Salish (T.A.F.P.)				
	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$
Maximum length	9	15.6-18.2	16.0	1.4	.48						7	13.3-17.6	15.8	1.3	.48	2	18.2-15.6	17.1		
Maximum breadth	9	13.4-15.3	14.5	.7	.23						7	13.5-15.2	14.5	.6	.22	2	13.4-15.3	14.4		
Basion-bregmatic height	8	13.2-14.9	14.1	.6	.14						6	13.2-14.9	14.1	.5	.21	2	13.4-14.7	14.0		
Minimum frontal breadth	12	8.6- 9.8	9.6	.6	.16						10	8.6-10.8	9.5	.7	.23	2	9.6-10.4	10.0		
Total facial height	6	10.5-11.9	11.3	.6	.22						5	10.5-11.9	11.2	.6	.25	1	11.7			
Upper facial height	7	5.9- 7.8	6.8	.6	.24						6	5.9-7.8	6.8	.5	.20	1	7.1			
Facial width	6	10.9-12.4	11.8	.5	.22						5	10.9-12.4	11.3	.7	.30	1	12.4			
Nasal height	7	4.6- 5.5	4.9	.3	.12						6	4.6- 5.5	5.0	.3	.13	1	4.8			
Nasal breadth	9	2.0- 2.5	2.3	.2	.05						8	2.0-2.5	2.3	.2	.14	1	2.4			
Orbital height	8	3.4- 4.1	3.7	.2	.05						6	3.4-4.1	3.7	.2	.09	2	3.6-3.6			
Orbital breadth	8	3.4- 4.2	3.8	.2	.05						6	3.4-4.2	3.8	.2	.09	2	3.9-3.9			
Maxillo-alveolar length	12	5.0- 5.8	5.3	.2	.06	1	5.5				8	5.0-5.8	5.6	.4	.10	2	5.2-5.4	5.3		
Maxillo-alveolar breadth	12	5.5- 6.5	6.1	.3	.09	1	6.0				8	5.5-6.4	6.1	.3	.07	2	5.8-6.5	6.1		
Length of mandible	12	9.8-12.5	11.3	.5	.07						10	9.8-12.4	11.1	.7	.23	2	11.9-12.5	12.1		
Bicondylar width	5	11.8-12.8	12.1	.4	.17						5	10.8-12.8	12.1	.4	.38					
Height of mandibular symphysis	12	2.5- 3.3	2.9	.2	.06						11	2.5- 3.2	2.9	.2	.07	2	3.0-3.3	3.1		
Minimum breadth of ramus	12	3.4- 4.3	3.9	.3	.07						10	3.6- 4.3	3.9	.2	.07	2	3.4-4.1	3.8		
Angle of mandible	12	103-123	113.7	5.5	1.6						10	110-123	112.9	5.5	1.8	2	114-121	117.5		
Cranial module	8	14.0-16.2	15.0	.7	.17						6	14.0-16.2	15.0	.7	.30	2	14.7-15.5	15.1		
Cranial index	9	72.7-101.0	88.8	8.8	2.9						7	76.7-101.0	89.9	6.8	2.6	2	72.0-98.3	85.1		
Cranial l-h index	8	79.5-102.9	89.7	12.1	3.9						6	87.0-102.9	92.0	6.2	2.5	2	79.5-86.0	82.8		
Cranial b-h index	8	87.4-118.0	98.1	8.9	2.2						6	89.5-102.9	96.6	4.1	1.7	2	87.4-118.0	102.7		
Total facial index	5	92.1-102.9	95.3	3.0	1.3						4	92.1-100.0	95.5	3.4	1.7	1	94.4			
Upper facial index	6	52.6-66.1	57.0	4.4	1.8						5	52.6-66.1	57.2	4.8	2.2	1	56.1			
Nasal index	6	43.6-61.5	54.4	6.0	2.4						7	43.6-58.2	53.8	5.7	2.1	1	50.0			
Orbital index	6	88.0-108.0	97.0	9.6	3.9						8	88.0-117.0	99.7	9.6	2.4	2	108.0-108.0			
Maxillo-alveolar index	8	109.0-123.1	114.7	4.3	1.1	1	109.1				11	110-123.1	113.9	4.9	1.5	2	110.0-117.0	113.5		

POPULATION	Total Juvenile Population				
	No.	Range	$\bar{x}$	$\sigma$	$\sigma_M$
Maximum length					
Maximum breadth					
Basion-bregmatic height					
Minimum frontal breadth	2	9.2-11.2	10.2		
Total facial height	1	10.3			
Upper facial height	1	6.5			
Facial width	1	9.7			
Nasal height	1	4.8			
Nasal breadth	1	2.3			
Orbital height	1	3.4			
Orbital breadth	1	3.8			
Maxillo-alveolar length	3	4.2-5.3	4.9	.5	.28
Maxillo-alveolar breadth	3	5.1-6.0	5.7	.4	.18
Length of mandible	3	7.8-9.9	8.9	.9	.50
Bicondylar width	1	13.4			
Height of mandibular symphysis	5	2.2-3.0	2.6	.3	.15
Minimum breadth of ramus	5	2.7-4.1	3.6	.5	.21
Angle of mandible	4	112-125	117.5	1.1	.60
Cranial module					
Cranial index					
Cranial l-h index					
Cranial b-h index					
Total facial index	1	92.7			
Upper facial index	1	58.6			
Nasal index	1	48.0			
Orbital index	1	89.5			
Maxillo-alveolar index	3	111.3-121.7	116.9	4.3	2.5

APPENDIX C

F = frequency  
 EF = expected frequency

Dental attributes

For the dental traits, male and female have been grouped together as no differences on the basis of sexual dimorphism were noted.

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
Number of teeth	4			34			3		
Adult males 32		4	4		34	34		3	3
Shovel-shaped incisors	6			8			2		
+		6	6		8	8		1	1
-								1	1
Abnormalities of enamel	6			35			3		
+		3	3		4	5		0	0
-		3	3		31	30		3	3
Hypercementosis	8			34			3		
+		2	2		1	3		0	1
-		6	6		33	30		3	3
Attrition	8			33			3		
++++		5	6		27	26		1	0
+++		1	1		0	0		2	2
++		2	1		6	7		0	0
Occlusion	1			18			1		
Good		0	0		7	8		0	0
Bad		1	1		11	11		1	1
Molar cusp pattern	4			15			2		
Y-4		4	3		6	7		1	1
+4		0	1		9	8		1	1

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
Infection	8			34			3		
+		0	0		0	0		0	0
-		8	8		34	34		3	3
Peridontal disease	7			34			3		
+		5	5		28	28		3	3
-		2	2		6	6		0	0
<u>Cranial attributes</u>									
<u>Adult males</u>									
Vault form	3			8			1		
Sphenoid		3	3		8	8		1	1
Skull thickness	4			14			1		
++++		4	2		4	5		1	1
+++		0	2		10	7		0	1
++		0	0		0	1		1	0
Sagittal crest	3			9			1		
+		0	0		0	0		0	0
-		3	3		9	9		1	1
Form of pterion	2			7			1		
"H" form		2	2		7	7		1	1
Frontal slope	3			7			1		
++++		0	0		0	0		0	0
+++		0	1		3	2		0	0
++		0	0		2	2		0	0
+		3	1		2	4		1	1
Brow ridges	3			10			1		
Separated		3	3		10	10		1	1
V-shaped		3	3		10	10		1	1

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
Bossing	2			9			1		
+		0	0		3	3		0	0
-		2	2		6	6		1	1
Facial build	1			11			1		
++++		0	0		0	0		0	0
+++		1	1		8	8		0	0
++		0	0		3	3		0	0
+		0	0		0	1		0	0
Projection of zygoma	1			6			1		
++++		0	0		0	0		0	0
+++		1	0		1	2		0	0
++		0	1		5	4		1	0
+		0	0		0	1		0	0
Prognathism	0			8			0		
++		0	0		1	1		0	0
+		0	0		3	3		0	0
-		0	0		4	4		0	0
Supraorbital region	3			10			1		
pierce +		3	2		5	6		1	1
bone -		0	1		5	5		0	0
large		3	2		5	6		1	1
small		0	1		5	5		1	0
Shape of orbit	0			9			1		
rectangular		0	0		7	7		1	1
square		0	0		2	2		0	0
Nasal bones	0			3			0		
hour-glass shaped		0	0		3	3		1	1
Nasal aperture	0			4			0		
piriform		0	0		4	4		0	0

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
Shape of palate	1			14			0		
Elliptical		0	0		2	2		0	0
Parabolic		1	1		10	10		0	0
Hyperbolic		0	0		2	2		0	0
Mastoid process thick	2			14			1		
		2	2		14	14		1	1
Mandibular fossa	3			15			1		
shallow		0	1		5	4		0	0
medium		3	2		8	7		0	1
deep		0	0		2	2		1	1
Occipital region	3			8			1		
$\frac{1}{2}$		2	2		5	5		1	1
$\frac{2}{3}$		1	1		3	3		0	0
ridge		3	3		6	6		1	1
mound		0	0		2	2		0	0
Form of chin	2			14			1		
square		2	2		10	10		1	1
round		0	0		4	4		0	0
Gonial angle	3			13			1		
+++		1	1		13	12		1	1
++		2	2		0	0		0	0
Mental foramen at base of 2nd PM; extends downwards and back	3			15			1		
		3	3		15	15		1	1
Genial tubercles	2			14			1		
//		2	2		14	14		1	1
++ prominence		2	2		14	14		1	1
Cranial anomalies	3			9			1		
Wormian bones									
+		0	1		6	5		1	1
-		3	2		2	3		0	0

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
<u>Adult females</u>									
Vault form	0			8			2		
sphenoid		0	0		8	8		2	2
Skull thickness	1			9			2		
+++		1	0		2	3		0	0
++		0	1		6	6		2	1
+		0	0		1	1		0	0
Sagittal crest	0			8			2		
-		0	0		8	8		2	2
Form of pterion	0			7			1		
"H" form		0	0		7	7		1	1
Frontal slope	0			9			2		
+++		0	0		0	0		1	1
++		0	0		5	5		0	0
+		0	0		3	3		0	0
-		0	0		1	2		1	0
Brow ridges	1			11			2		
Separated		1	1		11	11		2	2
V-shaped		1	1		11	11		2	2
Bossing	0			5			2		
+		0	0		5	5		2	2
Facial build	1			8			2		
++		1	1		8	8		1	1
+		0	0		0	0		1	1
Projection of zygoma	1			5			1		
++		1	1		2	3		1	0
+		0	0		3	3		0	0
Prognathism	0			8			2		
++		0	0		2	2		0	0
+		0	0		3	3		0	0
-		0	0		3	3		2	2

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
Supraorbital region	1			10			2		
pierce +		1	1		8	9		0	1
bone -		0	0		2	3		2	1
large		1	1		8	9		0	1
small		0	0		2	3		2	1
Shape of orbit	0			6			2		
Rectangular		0	0		5	5		2	2
square		0	0		1	1		0	0
Nasal bones	0			6			1		
hour-glass shaped		0	0		6	6		1	1
Nasal aperture	0			3			1		
piriform		0	0		3	3		1	1
Shape of palate	1			9			2		
elliptical		1	0		5	5		0	1
parabolic		0	0		4	5		2	1
Mastoid process	1			11			2		
thin		1	1		11	11		2	2
Mandibular fossa	1			9			2		
shallow		0	0		3	3		0	0
medium		1	0		4	4		0	1
deep		0	0		2	3		2	1
Occipital region	0			6			2		
$\frac{1}{2}$		0	0		5	5		1	1
$\frac{2}{3}$		0	0		1	1		1	1
ridge		0	0		3	3		0	0
mound		0	0		3	3		2	2
Form of chin	0			10			2		
square		0	0		1	1		0	0
round		0	0		9	9		2	2

Attribute	LB			M			DCS		
	No.	F	EF	No.	F	EF	No.	F	EF
Gonial angle	0			11			2		
+++		0	0		6	6		1	1
++		0	0		5	5		1	1
Mental foramen	0			11			2		
at base of 2nd PM; extends downwards and back		0	0		11	11		2	2
Genial tubercles	0			9			1		
//		0	0		9	9		1	1
++ prominence		0	0		9	9		1	1
Cranial anomalies	0			9			2		
wormian bones									
+		0	0		5	5		1	1
-		0	0		4	4		1	1

APPENDIX D

Useful descriptive devices for the Gulf of Georgia area are:

1. Observations of:

tooth form (shovel-shaped incisors)  
attrition  
periodontal disease  
supraorbital region (size, form, and arrangement of foramina)  
cranial anomalies (wormian bones)  
cranial deformation (fronto-occipital)

2. Calculation of:

cranial module (152mm. average)

CARLSON, ROY L.

1960 Chronology and Culture Change in the San Juan Islands, Washington. American Antiquity, Vol. 25, No. 4, pp. 562-85. Salt Lake City.

HILL-TOUT, CHARLES

1895 Later Prehistoric Man in British Columbia. Transactions of the Royal Society of Canada, Vol. IV, pp. 103-122. Ottawa.

KROGMAN, W.M.

1962 The Human Skeleton in Forensic Medicine. Charles C. Thomas, Springfield.

MITCHELL, D.H.

1968 Microblades: A Long-standing Gulf of Georgia Tradition. American Antiquity, Vol. 33, No. 1, pp. 11-15. Salt Lake City.

MONTAGU, M.F.A.

1960 A Handbook of Anthropometry. Charles C. Thomas, Springfield.

REFERENCES CITED

- ANDERSON, J.E.  
 1962 The Human Skeleton. National Museum of Canada, Department of Northern Affairs and National Resources, Ottawa.
- BARNETT, H.G.  
 1939 Culture Element Distributions:IX, Gulf of Georgia Salish. University of California Anthropological Records, Vol. 1, No. 5. Berkeley.
- 1955 The Coast Salish of British Columbia. University of Oregon Press, Eugene.
- BORDEN, CHARLES E.  
 1950 Preliminary Report on Archaeological Investigations in the Fraser Delta Region. Anthropology in British Columbia, No. 1, pp. 13-27. Victoria.
- 1951 Facts and Problems of Northwest Coast Prehistory. Anthropology in British Columbia, No. 2, pp. 35-52. Victoria.
- CARLSON, ROY L.  
 1960 Chronology and Culture Change in the San Juan Islands, Washington. American Antiquity, Vol. 25, No. 4, pp. 562-86. Salt Lake City.
- HILL-TOUT, CHARLES  
 1895 Later Prehistoric Man in British Columbia. Transactions of the Royal Society of Canada, Vol. IV, pp. 103-122. Ottawa.
- KROGMAN, W.M.  
 1962 The Human Skeleton in Forensic Medicine. Charles C. Thomas, Springfield.
- MITCHELL, D.H.  
 1968 Microblades: A Long-standing Gulf of Georgia Tradition. American Antiquity, Vol. 33, No. 1, pp. 11-15. Salt Lake City.
- MONTAGU, M.F.A.  
 1960 A Handbook of Anthropometry. Charles C. Thomas, Springfield.

- MORONEY, M.J.  
1951 Facts From Figures. Cox and Wyman Limited,  
London.
- NEUMANN, G.K.  
1952 Archaeology and Race in the American Indian.  
in Archaeology of the Eastern United States,  
pp. 13-34, University of Chicago Press,  
Chicago.
- NEWMAN, M.T.  
1962 Evolutionary Changes in Body Size and Head  
Form in American Indians. American Anthro-  
pologist, Vol. 64, No. 2, pp. 237-243. Menasha.
- OETTEKING, BRUNO  
1928 Craniology of the Northwest Coast of North  
America. Proceedings of the 22nd Inter-  
national Congress of Americanists, pp. 241-5.  
Rome.
- 1930 Craniology of the North Pacific Coast.  
American Museum of Natural History Memoirs,  
Vol. 15, Pt. 1, Jesup North Pacific Expedition  
Memoirs, Vol. 11, Pt. 1. New York.
- OSCHINSKY, L.  
1960 On Certain Dental Characters of the Eskimo  
of the Eastern Canadian Arctic. Anthropologica,  
Vol. 2, No. 1.
- 1961 A Short Note on Upper Lateral Incisor Tooth  
Crowding Among the Eskimos. Anthropologica,  
n. s. Vol. 3, No. 1.
- SIEGEL, S.  
1956 Nonparametric Statistics. McGraw-Hill,  
New York.
- SMITH, HARLAN  
1903 Shell Heaps of the Lower Fraser River, British  
Columbia. Memoirs of the American Museum of  
Natural History, Vol. 3, No. 4. New York.
- WILLEY, G.R.  
1966 An Introduction to American Archaeology,  
Volume I. Prentice-Hall, New Jersey.