DENTAL MORPHOLOGY OF ONTARIO IROQUOIS OSSUARY POPULATIONS

THE DENTAL MORPHOLOGY
OF
THREE ONTARIO IROQUOIS OSSUARY POPULATIONS

By

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ABSTRACT

The major emphasis of this thesis is the statistical analysis of the biological affinity of Ontario Iroquois populations within the context of the Ontario Iroquois Tradition. The statistical comparison is based on a study of the dental morphology of the permanent crowns of three ossuary populations. A total of 64 dental morphological traits are considered. The three dental samples studied include two protohistoric Neutral ossuary populations and a protohistoric Huron ossuary population.

The results of the statistical analysis indicate a greater degree of biological affinity between the two protohistoric Neutral ossuary populations than between the Neutral ossuary populations and protohistoric Huron ossuary population. The dental morphological evidence parallels the present model of the Ontario Iroquois Tradition which is based on archaeological, ethnohistoric and linguistic studies. This model indicates a cultural divergence between the four Ontario Iroquois groupings - the Neutral, Huron, Erie and Petun - which occurred circa 1400 A.D.

Up until this point, dental studies of the Ontario Iroquois have been limited in number. This thesis indicates the potential of dental morphological analysis for making a major contribution to our current understanding of the

Ontario Iroquois. In addition, it hopefully provides a preliminary step towards a uniform framework within which future Ontario Iroquois studies can be carried out.

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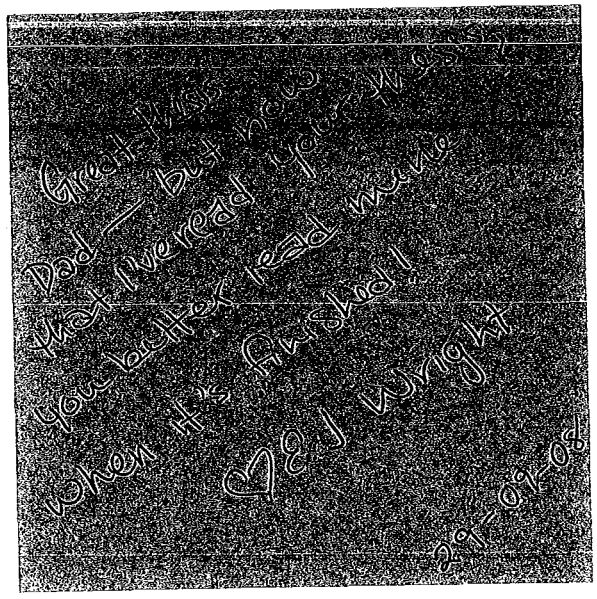

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Chapter I

INTRODUCTION

The following quotation outlines the Iroquois origins of the historically known Huron, Petun, Neutral and Erie as based on Ontario archaeology, as well as ethnohistoric and linguistic evidence:

> "The Ontario Iroquois Tradition is divided into three stages on the basis of the major processes that are apparently involved in the tradition. The Early Ontario Iroquois stage, which can be traced from approximately A.D. 1000 to A.D. 1300 represents the converging stage of the tradition. During this stage, two complexes, the Glen Myer branch in southwestern Ontario and the Pickering branch in southeastern Ontario were developing in relative isolation to one another. The Middle Ontario Iroquois stage is initiated by the conquest of the Glen Myer branch by the Pickering branch as well as by the uninterrupted development of the latter branch in southeastern Ontario. These events resulted in a widespread homgeneous complex called the Uren substage, which covered most of southern Ontario and a portion of southwestern New York. Developing directly out of the Uren substage with the addition of an elaborate pipe complex, is the Middleport substage. As these two substages (Uren and Middleport) do not appear to have a combined time span in excess of 100 years, the Middle Ontario Iroquois stage is regarded as the horizon stage of the tradition. The Late Ontario Iroquois stage involves divergence of the four historic tribes from a common Middleport substage beginning by A.D. 1400 and terminating with the destruction of the Huron, Petun, Neutral and Erie in the mid-17th century by the League of Five Nations. This stage is regarded as the divergence stage of the tradition." (J.V. Wright 1966:xii)

My general interest is the eventual correlation of the dental anthropological data of the Ontario Iroquois with the archaeological, ethnohistoric and linguistic evidence as presented by J.V. Wright in his Ontario Iroquois Tradition. At the present time, the dental research necessary to provide such a correlation is limited by a number of factors. Because of the limited amount of research that has been done in this area, very little is yet known about the dental morphology of the Iroquois. In addition to this, the work that has been done presents difficulties for cross-sample comparisons due to lack of standardization. Finally, our incomplete understanding of the genetic controls of dental morphology limits the kinds of interpretations which can be made when dealing with dental morphological data.

My goal here, and the main rationale for this thesis, is the construction rather, of a basic framework for approaching and studying the dental anthropology of the Ontario Iroquois. To this end, I will attempt to study the biological affinities of protohistoric Ontario Iroquois populations by a comparison of permanent dental crown morphology. Specifically, the permanent dental crown morphology of two protohistoric Neutral dental samples will be studied and compared in order to determine to what degree their established cultural affinity is supported by evidence of a parallel biological affinity. The dental sample from a protohistoric Huron ossuary will be used as

a control sample, and will be compared with the two protohistoric Neutral dental samples in order to validate the study and comparison of the two Neutral ossuary groups.

It is hoped that questions concerning biological relationships within the Neutral ossuary population, and between Neutrals and other protohistoric Ontario Iroquois ossuary populations (in this case, the Hurons) can be answered in terms of permanent crown morphology. Secondly, it is hoped that the answers received through the Neutral dental study in this thesis, may provide a deeper understanding of the Ontario Iroquois dentition in general. Finally, and of by far the greatest importance, it is hoped that this study may provide a framework for further dental studies of the Cntario Iroquois. Ultimately, it is hoped that dental anthropology may play its part along with ethnohistory, archaeology, and osteology in studying the sequences of the Ontario Iroquois Tradition.

Chapter II

METHODOLOGY

(i) The Methodology

The attempt to determine biological relationship is based on the comparison of populations with reference to a number of inherited traits, and the assumption that populations which share a large number of inherited traits are biologically more closely related than populations with fewer shared features (Simpson 1961:2-34). This assumption is maintained even though it is impossible in most cases to define or understand the exact genetic nature of these morphological traits. The deduction of possibly erroneous biological relationships is avoided by considering as many phenotypic traits as possible (Ehrlich & Holm 1964:156-162). By analyzing the distributions of these morphological traits, it should thus be possible to determine, to an extent, the genetic differences between populations.

The morphological traits of teeth have been used to study the biological relationships of skeletal populations for a number of reasons. Often the enamel crowns of teeth are the only part of a skeletal population to survive environmental conditions through time. In addition, of all the tissues, the dentition, as well as being used

in making inferences about past populations, can be used in making comparisons of living populations, thus giving a certain time depth to studies in biological relationships. Thirdly, the dentition offers a large number of morphological traits to work with. Finally, and of immense importance, is the fact that many of the dental morphological variations are determined by genetic factors (Anderson 1969a:76; Kraus 1957:424-426; Lasker 1950:191; Lasker & Lee 1957:401). In addition to the above references the following statements from Kraus (1969) and Moorrees (1957) affirm the genetic basis for dental morphology:

> "When we now contemplate the fact that potentialities for morphological variations in the human dentition are enormous, yet that persons with the same genetic constitution show no discordance in dental crwon features, we must come to the conclusion that 1) these traits are under very rigid genetic control and 2) the genes that determine their expression are more or less independent of each other." (Kraus et al. 1969:295)

> "The values of studying dentition in the light of racial and population differences as well as man's evolution stems from the theoretical consideration, so far uncontested, that many morphologic characteristics of the teeth (form, cusp numbers and groove formations) are genetically determined. This implies that related stocks of contemporary man will show a certain similarity in their dental characteristics, just as they show similarity in other genetically controlled attributes." (Moorrees 1957:5)

At present, there is sufficient evidence to prove that most of the normal dental trait variations are determined by genetic regulation and not other factors. Kraus

and Furr (1953) have demonstrated this with the mandibular first premolar. Ludwig (1957) has demonstrated it with the mandibular second premolar. Studies based on the development of fetal teeth show that the sequence of cusp calcification in molars is under strict genetic control (Kraus 1963; Kraus & Jordan 1965). Twin studies comparing the similarity of dental morphological traits in monozygotic twins with the similarity in dizygotic twins, indicate that the traits are genetically controlled (Korkhaus 1930a, 1930b). Conversely, dental morphology has been used to determine zygosity successfully. Kraus et al. (1959) used this method with triplets, and Lundstom (1963) also used this method, using specific traits on the molars, canines and incisors.

Though it is now generally accepted that dental morphological variation does have a genetic basis, information on the modes of inheritance and gene frequencies is lacking. Kraus has stated:

> "Although the evidence for genetic regulation of tooth structure is overwhelming, the exact mode of inheritance has not been determined for a single normal dental trait. Thus far, this potentially rich and promising area of human genetics has resisted all attempts at precise genetic analysis." (Kraus et al. 1969:11)

Similarily, Morris states:

> "Attempts to isolate simple Mendelian characters in the dentition have so far been denied investigators; although attempts have been made particularly with the auxilliary lingual maxillary molar cusps termed 'Carabelli's cusp' (Kraus 1951)." (Morris 1965:11)

This brings us back to the idea expressed at the beginning of this chapter - that is, it is possible to compare biological relationships between populations by the use of a large number of common inherited traits. In addition, we know that dental morphological traits are genetically controlled, although the modes of inheritance are unknown. Now it remains to evaluate the success of other dental morphological studies which have attempted to attain an understanding of the relationships between different populations.

Greene (1967) was able to prove with the use of dental morphological traits, that the archaeologically defined Meroitic, X-group and Christian populations in Sudanese Nubia were in fact all representative of the same base population. Furthermore, he was able to disprove the hypothesis that cultural changes which occurred between the Meroitic and X-group levels were associated with the introduction of a new biological population in the area. Morris (1965) was able to distinguish between two groups of southwestern North American Indians by comparing their permanent morphology. Hanihara (1963) demonstrated that the comparison of deciduous dental morphology of Japanese, American (both white and Negro), and Japanese-American hybrid populations showed differences in the frequency of occurrence of various traits. Synder et al. (1969), in their study of the Tarahumara Indians and Mestizos, stated

in their conclusions that meaningful comparisons between human populations can be made in terms of the phenotypic frequencies of dental traits even when some of the dental traits appear to be polygenic. Finally, Moorrees (1957) successfully achieved results in comparing Aleut dental samples. He states:

> "The dentition offers a distinct advantage for differentiating between Eastern and Western Aleuts because of the large number of independent characteristics that can be studied." (Moorrees 1957:7)

Thus it is apparent that it is possible for the anthropologist to use dental morphology to discriminate between populations. At present, while the modes of inheritance are unknown for dental morphological traits, such traits offer theoretical insights into human variability.

(ii) Problems in Methodology

Before the methodology of this thesis can be discussed in detail, a number of problems involved in the comparative study of dental morphology of populations should be examined. Such problems are even more prevalent in the study of skeletal populations.

To begin with, teeth are antimeres (an antimere being either member of the corresponding parts opposite each other on both sides of an organism's axis) and do not necessarily express bilateral symmetry in dental morpho-

logical variants (Kraus 1957:426). Morris (1965) in his study, observed that the ratio of bilateral asymmetry to bilateral symmetry varied from tooth group to tooth group. Furthermore, he noted that the frequency of bilateral asymmetry was much higher in the female than in the male (Morris 1965:204). Thus in order to compare the biological relationships of populations, it is necessary to compare the dental morphological variants of the right and left of the dental arcade independently.

In addition to the asymmetrical expression of morphological variants, it has been demonstrated that there are sexual differences in the degree of expression of certain traits (e.g. degree of shovelling in teeth) (Carbonell 1963:219; Hrdlicka 1920:451-456). These sexual differences should be accounted for wherever possible. Unfortunately, in the case of a disarticulated skeletal sample (e.g. an ossuary situation), the sexing of dental material is often impossible. One possible approach in this case is to combine sexes, assuming that the dental sample represents a random sample of that population in terms of sex (i.e. 50% males, 50% females) (Morris 1965: 244-245).

A major problem in the comparative study of dental morphology is the present lack of standardization in dental morphological research. This lack of standardization applies not only to methods of research and to

terminology, but to the subjective and arbitrary nature of non-metric observations. At present, because of this lack of standardization, conclusions based on the comparison of dental morphological studies by different investigators are, at best, tenuous.

Other specific problems relating to the analysis of the dentition of skeletal samples include: dental pathology (e.g. caries) and attrition (which erase key morphological traits), and post mortem loss of teeth from the individual dental arcades, which can lead to errors in sorting into tooth groups. The ideal sample thus would be composed of erupting or just erupted teeth. Finally, there is always the possibility of loss of dental data through careless excavation, cleaning, shipping, etc. of dental material.

In addition to these problems which can be encountered in all comparative studies of the dental morphology of skeletal populations, there are a number of specific problems which are encountered in the analysis of dental samples representing skeletal populations which originate in ossuaries (see Chapter V for a discussion of ossuary burials). Anderson (1963a) notes that in studying an ossuary population, one is in fact dealing with populations of individual bones and teeth, and not with a population of a people. This imposes a number of limitations when dealing with ossuary dental samples

which must be kept in mind both when conducting and evaluating research. First, it is impossible to know with any degree of certainty how representative the ossuary dental sample is of its associated village population (Anderson 1963a:30). Secondly, because of the very nature of ossuary burial practices, it can never be known if the dental sample size analysed is complete and thus fully representative of the ossuary dental population (Anderson 1963a:31). Finally - the inability to identify (in most cases) the dentition of individuals within the ossuary dental sample reduces the usefulness of the observations of dental morphology, as well as the ability to determine age and sex of individuals (Anderson 1963a:31).

(iii) Dental Terminology

Because contributions have come from dental anatomists, palaeontologists and anthropologists, the terminology of dental anthropology is not consistent. The terminology used in this study is drawn from several sources representing these various fields.

The human permanent dentition consists of four incisors, two canines, four premolars and four to six molars in each of the upper and lower jaws. These teeth occur in bilateral symmetry in each jaw. For either the right or left side of either the mandible or maxilla and starting from the median line, the permanent dental

arcade contains: a medial incisor, a lateral incisor, a canine, a first premolar, a second premolar, a first molar, a second molar and, usually, a third molar.

Terms used to indicate the orientation of teeth in relation to the median line of the dental arcade are: mesial, towards the median line; distal, away from the median line; mesial surface, that area of a tooth which faces towards the median line; and distal surface, that area of a tooth which faces away from the median line. Other terms of orientation include: buccal, towards the cheeks or lips; lingual, towards the tongue; occlusal, that area of a tooth that meets the teeth of the opposing jaw (in the case of canines and incisors, the occlusal area is called the incisal area), and the proximal surface, that area of a tooth which faces its adjoining tooth.

Each tooth is made up of two distinct areas: (i) the crown, or that portion of the tooth which is covered by enamel, and (ii) the root, or that portion which is covered by cementum. The neck (cervix) is the section of the tooth in the area of the junction of the crown and root. At the junction of the enamel and cementum areas (cementoenamel junction) is the cervical line.

The crowns of the teeth show a number of distinctive features. Cusps are any major elevation occurring on the occlusal surface. Fissures and grooves are shallow linear depressions or crevices occurring on the

crown surface. A pit is a sharp, pointed depression occurring at the junctions of intersecting grooves or at the end of a single groove. A fossa is a major depression found on the surface of a tooth. Ridges are linear elevations on a tooth. The elongated depression formed by the inclines of adjacent cusps or ridges meeting at an angle called a sulcus. A cingulum is a convexity on the crown near the cervical line. Finally, tubercles are the slightly rounded elevations occurring on the enamel surface of the teeth.

The terms used for molar cusps in this paper are given in relation to the individual tooth's normal orientation in the dental arcade. In the maxillary molars, the possible cusps are the mesiobuccal (paracone), the distobuccal (metacone), the mesiolingual (protocone), and the distolingual (hypocone). In the mandibular molars, the possible cusps are the mesiobuccal (protoconid), the distobuccal (hypoconid), the mesiolingual (metaconid), the distolingual (entoconid) and the distal (hypoconulid).

(iv) Statement of the Problem

In Practical Statistics (1971), Langley outlines the way in which the problem at hand must be stated for purposes of statistical analysis.

> "Now regardless of where an experiment is performed and regardless of its subject matter, all experiments have this in common: they are out to prove

> something . . .
>
> ". . . an experiment can only prove something which actually happens; no finite number of trials can ever prove something that won't happen, for there is always the possibility that it will happen on the very next trial. To permit a decisive conclusion, then, the question put to test by the experiment must therefore seek an affirmative (yes) answer . . .
>
> "In practice, the situation is handled as follows. Before an experiment is begun, it is tentatively assumed that the outcome will be negative (. . .). This tentative negative assumption is technically called a null hypothesis. This assumption is then put to the test by the experiment. If it is proven wrong (. . .) the result is clearly decisive; if it is not proved wrong (. . .), the result is said to be 'not proven' under the conditions of the experiment. It is important to realize that a null hypothesis can never be proven or established by any experiment; it can only be possibly disproved."
> (Langley 1971:108-109)

The aims of this study have been presented in the preceding sections. It is now necessary to restate them explicitly in terms of null hypotheses for statistical testing.

The first null hypothesis states: There is no statistically significant difference in the permanent crown morphology of dental samples representing what have been archaeologically defined as protohistoric Neutral ossuary populations of the Late Ontario Iroquois Stage of the Ontario Iroquois Tradition.

The second null hypothesis states: There is no statistically significant difference in the permanent crown morphology of dental samples representing what

have been archaeologically defined as protohistoric Neutral ossuary populations and a dental sample representing what has been archaeologically defined as a protohistoric Huron ossuary population, all of which belong to the Late Ontario Iroquois Stage of the Ontario Iroquois Tradition.

Chapter III

THE FRAMEWORK OF ANALYSIS

In order to test the null hypotheses of this study, it is necessary to establish the criteria for comparison. Thus, this chapter will present the analytic framework by which the data have been derived from the populations described in Chapter V. The basis of these comparisons is a classificatory system of a number of traits of the dental morphology of the crowns of the permanent dentition.

The dental traits compared in this study have been selected from a large number of dental traits that have appeared in the published literature of other workers in the field of dental anthropology (Kraus, Dahlberg, Greene, Moorrees, Morris, etc.) and have been adapted to suit the purposes of this study. However, since description of the dental morphological traits is to some degree, subjective and dependent on the interpretation of the individual researcher, the observations of different researchers are not always comparable. Thus to make comparisons of the above populations valid, this thesis uses a defined classificatory system of dental traits compiled and utilized by a single observer.

The classification of the various dental traits in

this study is by no means the most complete possible. It is simply a classification system which has undergone revision, deletion and addition as a result of experience working with dental collections. The result of the process has been the formulation of a framework adequate for this particular study.

The analytic framework is made up of 29 categories for the maxillary permanent dentition, and 35 categories for the mandibular permanent dentition. A category is composed of those variations or expressions of a particular dental morphological feature that can be found on a given area of a tooth. For example, there are four variations (pit, groove, slight tubercle and pronounced tubercle) on the mesiolingual surface of the maxillary molar crown that make up the Carabelli's trait category. Each variation or member within a category is related to the others within that category by virtue of the fact that the presence of one precluded the presence of the others within that category. The sum of the written descriptions of each of the variations within each category represents the range of dental morphology of a specific area of the tooth.

This approach was used by both Snyder *et al.* (1968) and Morris (1965) in their comparative studies of dentition. Dahlberg (1971) states that it is useful in studying polygenic traits, and according to him, almost all dental traits are of a polygenic nature (Dahlberg 1971:258,262).

The analytic framework presented on the following pages consists of written descriptions of the dental morphological trait variations of each category. Instead of sketches of the variations, references are given to large and explicit photographs that can be found in Dental Anatomy and Occlusion by Kraus, Jordan and Abrams (1969). The use of these photographs helps to eliminate the subjectivity of comparisons of dental morphological variations between populations by providing a standard reference for the investigator, the reader and others interested in dental analysis.

Maxillary Incisor

1. Lingual Shovel Shape (Carbonell 1963:211-234; Goldstein 1948:69-71; Hrdlicka 1920; Lasker 1950:195; Moorrees 1957:21-29; Morris 1965:26; Nelson 1938:286-288): This is represented by distal and mesial marginal ridges running cervico-occlusally on the lingual surface of the incisor and bordering the lingual fossa.
   - 1.1 No shovel shape: There is a faint trace or no trace of the marginal ridges.
   - 1.2 Semi-shovel shape: Ridges are present but under 1 millimeter in size above the midcenter of the lingual fossa (Carbonell 1963:213; Morris 1965: 26).

1.3 Marked shovel shape: Ridges are present and well elevated (1 millimeter or more above the midcenter of the lingual fossa (Carbonell 1963: 213; Morris 1965:26).

2. Lingual Fossa (Hrdlicka 1920:448; Lasker & Lee 1957: 406; Morris 1965:26): The surface of the lingual fossa varies.

2.1 Lingual fossa surface is relatively smooth.

2.2 Lingual fossa surface has slight ridges and grooves.

2.3 Lingual fossa surface has deeply defined grooves and thus well pronounced ridges.

3. Lingual Cervical Area (Carbonell 1963:211-234; Hrdlicka 1920:447-448; Kraus et al. 1969:19-22; Lasker 1950:196; Lasker & Lee 1957:406; Morris 1965: 26-27):

3.1 One or more tubercles are present in the lingual cervical area (see photographs: Kraus et al. 1969:19, Fig. 1-25C, Fig. 1-29A, 1-29B).

3.2 Narrow channels divide the lingual cervical area into ridges (see photograph: Kraus et al. 1969:19, Fig. 1-25B).

3.3 The mesial and distal marginal ridges that form the shovel shape appearance meet at the mid-line of the lingual cervical area and a groove is evident at the junction (see photographs: Kraus et al. 1969:22, Fig. 1-30A, 1-30B).

3.4 The mesial and distal marginal ridges forming the shovel shape appearance at the midline of the lingual cervical area with little or no separation present.

3.5 The mesial and distal marginal ridges do not meet at the midline and there are no projections or grooves present on the lingual cervical area.

4. Buccal Shovel Shape (Dahlberg 1948:141; Moorrees 1957:26; Morris 1965:27): Distal and mesial marginal ridges running cervico-occlusally may be present on the buccal surface of the tooth. Generally these buccal marginal ridges are not as pronounced as the lingual marginal ridges.

4.1 Buccal ridges present.

4.2 Buccal semi-shovel shape: The marginal ridges are observable but have a very slight elevation (under 0.5 millimeters above the buccal surface (Morris 1965:28)).

4.3 Marked buccal shovel shape: The marginal ridges are observable and have an elevation of 0.5 millimeters or more above the buccal surface (Morris 1965:26).

5. Buccal Ridges (Morris 1965:28): Additional, less well pronounced ridges running cervico-occlusally may be present on the buccal surface. These

generally occur on the medial area of the buccal surface.

5.1 Present.

5.2 Absent.

6. Anomalous Conditions of the Maxillary Incisors:

6.1 No anomalous conditions present.

6.2 Peg shaped incisor (Dahlberg 1948:146, 1963:158; Lasker 1950:194; Lasker & Lee 1957:407; Morris 1965:29): The tooth is generally semi-oval in cross section and small in size when compared to a normal incisor.

6.3 Supernumerary incisors (Dahlberg 1948:146; Goldstein 1948:73-74; Kraus et al. 1969:19; Lasker 1950:193; Morris 1965:29): The supernumerary incisor is generally smaller than a normal incisor (see photograph: Kraus et al. 1969:20, Fig. 1-27).

6.4 Barrel or semi-barrel shaped incisor (Dahlberg 1948:146, 1963:156; Morris 1965:28): This rare condition occurs where the lingual marginal ridges are so pronounced that they curve medially and are partially or totally fused together.

6.5 Trefoil incisor (Morris 1965:29): A wide and elevated partition divides the lingua fossa into two uneven lingual fossae.

Maxillary Canine

1. Mesial Incisal Style (Kraus et al. 1969:38; Morris 1965:31): A small style may occur mesially to the main apex of the canine.

   1.1 Present (see photographs: Kraus et al. 1969:40, Fig. 1-60, 1-61).

   1.2 Absent.

2. Main Incisal Apex (Kraus et al. 1969:38): The main canine apex can range from a very blunt apex to a nipple apex.

   2.1 Main cusp apex is blunt (see photograph: Kraus et al. 1969:39, Fig. 1-57A).

   2.2 Main cusp apex is nippled (see photograph: Kraus et al. 1969:39, Fig. 1-57B).

   2.3 Main cusp apex is intermediate (or typical in form) (see photograph: Kraus et al. 1969:39, Fig. 1-56).

3. Lingual Tubercles (Dahlberg 1948:148; Kraus et al. 1969:38): These tubercles arise from the cingulum. The tubercles may have a separate apex or the apex may fuse into the lingual surface of the canine. In some instances, pits may be present either with or without a lingual tubercle.

   3.1 A single lingual tubercle is present without pits (see photograph: Kraus et al. 1969:40, Fig. 1-62).

3.2 A single lingual tubercle is present with pits (see photograph: Kraus et al. 1969:40, Fig. 1-62).

3.3 Two or more lingual tubercles are present without pits.

3.4 Two or more lingual tubercles are present with pits.

3.5 Lingual tubercles are absent and pits are present.

3.6 Both lingual tubercles and pits are absent.

Maxillary Premolars

1. Mesial Accessory Buccal Cusplet (Kraus et al. 1969:60; Morris 1965:33): This is a bulging or distinct cusplet on the mesiobuccal angle on the occlusal surface of the premolar.

1.1 Present (see photograph: Kraus et al. 1969:60, fig. 1-970).

1.2 Absent.

2. Distal Accessory Cusplet (Kraus et al. 1969:60; Morris 1965:33): This is a bulging or distinct cusplet on the distobuccal angle on the occlusal surface of the premolar.

2.1 Present (see photograph: Kraus et al. 1969:60, Fig. 1-97).

2.2 Absent.

3. Buccal Ridges (Morris 1965:34): Ridges running cervico-occlusally on the buccal surface of a premolar.

3.1 Present

3.2 Absent.

4. Distal Transverse Ridge (Kraus et al. 1969:60): A ridge occurring on the distal side of the occlusal surface of a premolar. It lies between the buccal occlusal triangular ridge and the distal marginal ridge and is bordered with both a distal and mesial groove.

4.1 Present (see photographs: Kraus et al. 1969:60, Fig. 1-96A, 1-96B).

4.2 Absent.

5. Inclination of the Buccal Cusp Ridges (Kraus et al. 1969:57, 60): The outline of the buccal cusp can range from a sharp-conical inclination to a very blunt inclination.

5.1 The buccal cusp inclination is sharp-conical in outline (see photographs: Kraus et al. 1969:58, Fig. 1-89A, 1-89B).

5.2 The buccal cusp inclination is very blunt in outline (see photographs: Kraus et al. 1969:58, Fig. 1-89B: 60, Fig. 1-98A).

5.3 The buccal cusp inclination is intermediate (typical in outline) (see photographs: Kraus et al. 1969:49, Fig. 1-75: 50, Fig. 1-76).

6. Inclination of the Lingual Cusp Ridges (Kraus et al. 1969:57): The outline of the lingual cusp can range

from a sharp-conical inclination to a very blunt inclination.

6.1 The lingual cusp inclination is sharp-conical in outline.

6.2 The lingual cusp inclination is very blunt in outline.

6.3 The lingual cusp inclination is intermediate (typical) in outline.

7. Buccal/Lingual Cusp Relationship (Morris 1965:37): The main buccal and lingual cusp tips may lie directly in line or the main lingual cusp tip may lie either mesially or distally to a line drawn bucco-lingually through the main buccal cusp tip.

7.1 The main lingual cusp lies mesially to the buccal cusp.

7.2 The main lingual and buccal cusps lie directly in line.

7.3 The main lingual cusp lies distally to the buccal cusp.

8. Relative Size of Buccal and Lingual Cusp Masses (Morris 1965:38): This is a visual comparison of the buccal and lingual cusp masses of a premolar.

8.1 The buccal cusp mass is greater than the lingual cusp mass.

8.2 The buccal and lingual cusp masses are approximately of the same size.

9. Relative Size of the First Maxillary Premolar to the Second Maxillary Premolar (Morris 1965:39): This observation is limited to premolars in the maxilla.

9.1 The first maxillary premolar is larger than the second maxillary premolar.

9.2 The first maxillary and second maxillary premolars are approximately of the same size.

9.3 The first maxillary premolar is smaller than the second maxillary premolar.

Maxillary Molar

1. Cusps (Dahlberg 1948:164-168; Greene 1967:11-12; Lasker & Lee 1957:410; Moorrees 1957:32; Morris 1965:39): Maxillary molars have three constant cusps, mesiobuccal, mesiolingual, and distobuccal, and one cusp, the distolingual which demonstrates extreme variation in size.

1.1 The distolingual cusp is absent. The cusp number is 3.

1.2 The distolingual cusp is present but less than one-half the size of any of the other three cusps. The cusp number is 3+.

1.3 The distolingual cusp is present, still smaller than any other cusp, but one-half or larger the size of any of the other three cups. The cusp

number is 4-.

1.4 The distolingual cusp is present and of the same size as any of the other three cusps. The cusp number is 4.

2. Carabelli's Trait (Meredith & Hixon 1954; Dahlberg 1948:168-170; Dietz 1944; Kraus 1951; Shapiro 1949; Lasker 1950:195; Moorrees 1957:36-38; Morris 1965: 39-40): Carabelli's trait ranges from a pit to a tubercle occuring on the lingual surface of the mesiolingual cusp of the maxillary molar.

2.1 A pronounced tubercle with an independent apex is present. This is known as Carabelli's cusp (see photographs: Kraus et al. 1969:89, Fig. 1-143C: 90, Fig. 1-144B).

2.2 A slight tubercle with apex fused into the lingual surface is present (see photographs: Kraus et al. 1969:89, Fig. 1-143D: 90, Fig. 1-144B).

2.3 A groove or grooves are present (see photographs: Kraus et al. 1969:89, Fig. 1-143A: 90, Fig. 1-144C).

2.4 A pit or pits are present (see photographs: Kraus et al. 1969:89, Fig. 1-143B).

2.5 Carabelli's Trait is absent.

3. Buccal Enamel Extension (Anderson 1969a:92; Lasker & Lee 1957:411-412; Nelson 1937:289): An enamel

expansion may extend apically from the crown cervix on the buccal surface.

3.1 Buccal enamel extension is absent.

3.2 Buccal enamel extension is present but not over 1.5 millimeters in length (Melbye: pers. comm.).

3.3 Buccal enamel extension is present and over 1.5 millimeters in length, but not between the roots (Melbye: pers. comm.).

3.4 Buccal enamel extension is present, over 1.5 millimeters in length, and between the roots (Melbye: pers. comm.).

4. Lingual Enamel Extension (Anderson 1969a:92): An enamel expansion may extend apically from the crown cervix on the lingual surface.

4.1 Lingual enamel extension is absent.

4.2 Lingual enamel extension is present but not over 1.5 millimeters in length (Melbye: pers. comm.).

4.3 Lingual enamel extension is present and over 1.5 millimeters in length, but not onto the roots (Melbye: pers. comm.).

4.4 Lingual enamel extension is present, over 1.5 millimeters in length and onto the root (Melbye: pers. comm.).

5. Anterior Transverse Ridge (Kraus et al. 1969:90): This ridge resembles a cusp-like prominence running diagonally between the mesial marginal ridge and the

mesiobuccal cusp from the mesiobuccal corner of the occlusal surface.

5.1 The anterior transverse ridge is present and very prominent is size so that the mesial triangular fossa is almost obliterated (see photograph: Kraus et al. 1969:91, Fig. 1-145B).

5.2 The anterior transverse ridge is present and moderate in size.

5.3 The anterior transverse ridge is present and only slightly developed in size (see photograph: Kraus et al. 1969:91, Fig. 1-145A).

5.4 The anterior transverse ridge is absent.

6. Size of Oblique Ridge (Kraus et al. 1969:90; Morris 1965:45): This is a marginal ridge marking the distal border of the trigon and is made up of the triangular ridge of the distobuccal cusp and of the distal ridge of the mesiobuccal cusp. It varies in size.

6.1 Oblique ridge is pronounced and elevated one millimeter or more above the occlusal surface (Morris 1965:45) (see photograph: Kraus et al. 1969:90, Fig. 1-146B).

6.2 Oblique ridge is present but small in size (under one millimeter above the occlusal surface (Morris 1965:45) (see photograph: Kraus et al. 1969:91, Fig. 1-146A).

6.3 Oblique ridge is absent.

7. Oblique Ridge Continuity (Kraus *et al.* 1969:90): The oblique ridge, as well as varying in size, may be affected in continuity by the distal groove at the oblique ridge's midpoint.

   7.1 Oblique ridge is continuous and not interrupted by the distal groove (see photograph: Kraus *et al.* 1969:91, Fig. 1-147A).

   7.2 Oblique ridge is partially interrupted by the distal groove (see photograph: Kraus *et al.* 1969:91, Fig. 1-147B).

   7.3 Oblique ridge is bisected by the distal groove (see photograph: Kraus *et al.* 1969:91, Fig. 1-147C).

   7.4 Oblique ridge is absent.

8. Mesial Marginal Ridge Tubercles (Kraus *et al.* 1969:90): The mesial marginal ridge may have one or more tubercles separated by grooves. These grooves supposedly act as spillways for the occlusal surface (Kraus *et al.* 1969:90).

   8.1 Mesial marginal ridge is solid with no tubercles.

   8.2 Mesial marginal ridge has only one tubercle.

   8.3 Mesial marginal ridge has two tubercles (see photograph: Kraus *et al.* 1969:92, Fig. 1-148A).

   8.4 Mesial marginal ridge has three to five tubercles (see photograph: Kraus *et al.* 1969:92, Fig. 1-148B).

8.5 Mesial marginal ridge has six or more tubercles.

9. Distal Marginal Ridge (Kraus et al. 1969:90): The distal marginal ridge, while seldom having tubercles, may have one or more grooves near its midpoint.

9.1 Tubercles are present on the distal marginal ridge.

9.2 A single groove is present on the distal marginal ridge (see photograph: Kraus et al. 1969:92, Fig. 1-149).

9.3 Two or more grooves are present on the distal marginal ridge.

9.4 Distal marginal ridge is solid.

9.5 Distal marginal ridge is absent.

10. Buccal Groove Termination (Kraus et al. 1969:90; Morris 1965:44): The buccal groove termination on the buccal surface can vary.

10.1 The buccal groove terminates either in a pit or abruptly (see photograph: Kraus et al. 1969:92, Fig. 1-152).

10.2 The buccal groove blends smoothly into the buccal surface.

11. Lingual Groove Termination (Kraus et al. 1969:90; Morris 1965:45): The lingual groove termination on the lingual surface can vary.

11.1 The lingual groove terminates either in a pit or abruptly.

11.2 The lingual groove blends smoothly into the

lingual surface.

11.3 This category is not applicable in the case of three cusped teeth since the groove is then absent.

11.4 The lingual groove is absent on applicable teeth.

Mandibular Incisor

1. Lingual Shovel Shape (Hrdlicka 1920:458; Moorrees 1957:21-23; Morris 1965:46): Though the mandibular incisor shovel shape is not as pronounced as maxillary incisor shovel shape, distal and mesial marginal ridges running cervico-occlusally and bordering on the lingual fossa can be present.

1.1 Shovel shape: Ridges are present and over 0.5 millimeters above the lingual fossa (Morris 1965:46).

1.2 Semi-shovel shape: Ridges are present but under 0.5 millimeters above the lingual fossa (Morris 1965:46).

1.3 Shovel shape is absent.

2. Lingual Dental Tubercle (Morris 1965:46): A tubercle with its tip blending into the lingual fossa may be present in the cervical area.

2.1 Present.

2.2 Absent.

3. Medial Lingual Ridges (Morris 1965:46): These ridges run cervico-occlusally in the medial area of the lingual fossa. The ridges are very slight in relief.

   3.1 Present.

   3.2 Absent.

4. Buccal Shovel Shape (Morris 1965:46-47): Distal and mesial marginal ridge may be present on the buccal surface although the relief is slight.

   4.1 Present

   4.2 Absent.

5. Mesial Marginal Ridge on the Buccal Surface (Morris 1965:47; Snyder 1969): The mesial marginal ridge may be present on the buccal surface without the distal marginal ridge being present as in the case of buccal shovel shape.

   5.1 Present

   5.2 Absent.

Mandibular Canine

1. Buccal Styles (Kraus et al. 1969:46; Morris 1965:48): These styles have independent apices and may occur on either the mesiobuccal or the distobuccal angles or even on both of the occlusal angles.

   1.1 A buccal style is present on the mesiobuccal angle (see photograph: Kraus et al. 1969:47,

Fig. 1-72C).

1.2 A buccal style is present on the distobuccal occlusal angle.

1.3 Buccal styles are present on both the mesiobuccal and distobuccal angles (see photograph: Kraus et al. 1969:47, Fig. 1-72B).

1.4 Buccal styles are absent.

2. Mesial Buccal Ridge (Morris 1965:48): This ridge runs cervico-occlusally on the mesial side of the buccal surface.

2.1 Present.

2.2 Absent.

3. Medial Buccal Ridge (Morris 1965:48): This ridge runs cervico-occlusally on the medial area of the buccal area.

3.1 Present.

3.2 Absent.

4. Distal Buccal Ridge (Morris 1965:48-49): This ridge runs cervico-occlusally on the distal side of the buccal area.

4.1 Present.

4.2 Absent.

5. Mesial Lingual Ridge (Dahlberg 1948:148; Hrdlicka 1920:459; Kraus et al. 1969:46; Morris 1965:49): This ridge runs cervico-occlusally on the mesial border of the lingual surface.

5.1 Mesial lingual ridge is present with prominent relief - 1 millimeter or more above the lingual surface (Morris 1965:49).

5.2 Mesial lingual ridge is present with slight relief - under 1 millimeter above the lingual surface (Morris 1965:49).

5.3 Mesial lingual ridge is absent.

6. Medial Lingual Ridge (Kraus et al. 1969:46; Morris 1965:49): The ridge runs cervico-occlusally on the medial area of the lingual surface and varies in prominence.

6.1 Medial lingual ridge is present and pronounced (0.5 millimeters or more above the lingual surface (Morris 1965:49)) (see photograph: Kraus et al. 1969:46, Fig. 1-71).

6.2 Medial lingual ridge is present but has a slight relief (under 0.5 millimeters above the lingual surface (Morris 1965:49)).

6.3 Medial lingual ridge is absent.

7. Distomedial Lingual Ridge (Morris 1965:49-50): this ridge runs cervico-occlusally and is just medial to the distal lingual ridge.

7.1 Distomedial lingual ridge is present.

7.2 Distomedial lingual ridge is absent.

8. Distal Lingual Ridge (Dahlberg 1948:148; Hrdlicka 1920:459; Kraus et al. 1969:46; Morris 1965:50):

This ridge runs cervico-occlusally on the distal lingual border.

8.1 Present.

8.2 Absent.

9. Lingual Dental Tubercle (Morris 1965:50): The tubercle is found in the cervical region of the lingual surface.

9.1 Present.

9.2 Absent.

Mandibular Premolar

1. Buccal Styles (Morris 1965:51; Kraus et al. 1969:72, 74): The buccal styles may occur on the distal, mesial or both sides of the buccal cusp and have independent apices.

1.1 A buccal style is present on the distal side of the buccal cusp (see photograph: Kraus et al. 1969:72, Fig. 1-116).

1.2 A buccal style is present on the mesial side of the buccal cusp.

1.3 Buccal styles are present on both the mesial and distal sides of the buccal cusp (see photograph: Kraus et al. 1969:73, Fig. 1-120).

1.4 Buccal styles are absent from the sides of the buccal cusps.

2. Mesial Buccal Ridges (Kraus & Furr 1953:562; Morris

1965:51-52): The ridge runs cervico-occlusally on the buccal surface of the buccal cusp.

2.1 Present.

2.2 Absent.

3. Medial Buccal Ridge (Morris 1965:51): The ridge runs cervico-occlusally on the medial area of the buccal surface of the buccal cusp.

3.1 Present.

3.2 Absent.

4. Distal Buccal Ridge (Kraus & Furr 1953:562; Morris 1965:52): The ridge runs cervico-occlusally on the distal border of the buccal surface of the buccal cusp.

4.1 Present.

4.2 Absent.

5. Mesial Occlusal Margin (Kraus & Furr 1953:559-560; Morris 1965:52): The mesial occlusal margin runs from the buccal to lingual cusp of the premolar. This margin may or may not be interrupted by a sulcus.

5.1 Mesial occlusal margin is interrupted by a sulcus.

5.2 Mesial occlusal margin is uninterrupted by a sulcus.

6. Distal Occlusal Margin (Kraus & Furr 1953:560; Morris 1965:52):

6.1 Distal occlusal margin is interrupted by a sulcus.

6.2 Distal occlusal margin is uninterrupted by a sulcus.

7. Lingual Grooves (Kraus et al. 1969:72; Kraus & Furr 1953:558; Morris 1965:52): This groove or grooves may or may not be present on the lingual surface of the lingual cusp running cervico-occlusally.

7.1 One lingual groove is present (see photographs: Kraus et al. 1969:72, Fig. 1-115C, 1-115A, 1-115D).

7.2 Two lingual grooves are present (see photograph: Kraus et al. 1969:72, Fig. 1-115B).

7.3 Three or more lingual grooves are present.

7.4 Lingual grooves are absent.

8. Lingual Cusps (Kraus et al. 1969:72; Kraus & Furr 1953:559; Ludwig 1957:268; Morris 1965:53): The number of lingual cusps can vary from one to three or more. A cusp is defined here as having an independent apex.

8.1 One lingual cusp is present (see photograph: Kraus et al. 1969:71, Fig. 1-114B).

8.2 Two lingual cusps are present (see photograph: Kraus et al. 1969:71, Fig. 1-114C).

8.3 Three or more lingual cusps are present.

8.4 Lingual cusps are absent (see photograph: Kraus et al. 1969:71, Fig. 1-114A).

9. Occlusal Ridges on the Buccal Cusp (Kraus et al.

1969:72; Kraus & Furr 1953:560; Ludwig 1957:267; Morris 1965:53): One or more ridges can occur on the occlusal surface of the buccal cusp. The main occlusal ridge (the transverse occlusal ridge) is sometimes bifurcated and is then counted as two occlusal ridges. The distal and mesial marginal ridges are not counted as occlusal ridges.

9.1 Five or more occlusal ridges are present.

9.2 Four occlusal ridges are present.

9.3 Three occlusal ridges are present.

9.4 Two occlusal ridges are present.

9.5 One occlusal ridge is present.

9.6 Occlusal ridges are absent.

10. Transverse (Main) Occlusal Ridge on the Buccal Cusp Bifurcation (Kraus & Furr 1953:560; Ludwig 1957:267; Morris 1965:53): The transverse occlusal ridge may be single or bifurcated.

10.1 Transverse occlusal ridge is single.

10.2 Transverse occlusal ridge is bifurcated.

10.3 Transverse occlusal ridge is absent.

11. Size of the Transverse Occlusal Ridge on the Buccal Cusp (Kraus et al. 1969:72; Kraus & Furr 1953:562; Morris 1965:54): The size of the transverse occlusal ridge may be prominent (wide and well elevated above the occlusal buccal cusp surface) or slight (narrow and little elevation above the cusp surface) or the

ridge may be absent.

11.1 Transverse occlusal ridge is prominent.

11.2 Transverse occlusal ridge is slight.

11.3 Transverse occlusal ridge is absent.

12. Relative Position of the Lingual Cusp to the Buccal Cusp (Kraus et al. 1969:72; Kraus & Furr 1953:558; Ludwig 1957:267-268; Morris 1965:54-55): The position of the main lingual cusp is taken in relation to the apex of the buccal cusp.

12.1 Main lingual cusp is mesial to the buccal cusp.

12.2 Main lingual cusp is distal to the buccal cusp.

12.3 Main lingual cusp is aligned with the buccal cusp.

13. Independence of the Lingual Cusp (Kraus & Furr 1953: 561-562; Ludwig 1953:268; Morris 1965:55): The apex of the lingual cusp may be independent or fused to the occluso-lingual surface of the buccal cusp.

13.1 Lingual cusp apex is independent.

13.2 Lingual cusp apex is fused to the occluso-lingual surface of the buccal cusp.

14. Sagittal Sulcus (Kraus et al. 1969:71; Kraus & Furr 1953:558; Ludwig 1953:269-271; Morris 1965:55): The sagittal sulcus runs along the mesiodistal occlusal length of the premolar between the buccal and lingual cusps and may or may not be interrupted by occlusal ridges from the occlusal surfaces of both

the buccal and lingual cusps.

14.1 Sagittal sulcus is uninterrupted (see photograph: Kraus et al. 1969:71, Fig. 1-113B).

14.2 Sagittal sulcus is interrupted by occlusal ridges (see photograph: Kraus et al. 1969:71, Fig. 1-113A).

Mandibular Molar

1. Molar Fissure Pattern (Melbye: pers. comm.; Morris 1965:58; Morris 1970:98): Three main types of fissure patterns are found on mandibular molars. Each of the three patterns are determined by the four "main" cusps. The "main" cusps are defined as the mesiobuccal, mesiolingual, distolingual and distobuccal cusps.

1.1 Molar "Y" fissure pattern is present. The mesiolingual and distobuccal cusps are adjacent to each other and the distolingual and mesiobuccal cusps are thus separated from each other.

1.2 Molar "+" fissure pattern is present. The mesiobuccal, distobuccal, mesiolingual and distolingual cusps are all adjacent to each other at a central point.

1.3 Molar "λ" fissure pattern is present. The mesiobuccal and distolingual cusps are adja-

cent to each other and the distobuccal and mesiolingual are thus separated from each other.

2. Variation of the Distal Cusp (Melbye: pers. comm.; Morris 1970:98): The fifth cusp of the mandibular molar, the distal cusp can be absent or can be present in a range of sizes.

2.1 Distal cusp is absent.

2.2 Distal cusp is present and is smaller than one-half the size of any of the other four "main" cusps.

2.3 Distal cusp is present and is still smaller than any of the other four "main" cusps but is one-half or larger in size.

2.4 Distal cusp is present and is equal in size to any of the other four "main" cusps. It is considered a fully developed cusp.

3. Tuberculum Sextum (Kraus et al. 1969:110): The tuberculum sextum is an accessory cusp on the distal margin of the occlusal surface between the distal cusp and the distolingual cusp.

3.1 Present (see photograph: Kraus et al. 1969:111, Fig. 1-182).

3.2 Absent.

4. Tuberculum Intermedium (Kraus et al. 1969:110): The tuberculum intermedium is an accessory cusp present on the lingual margin of the occlusal

surface between the mesiolingual and the disto-lingual cusps.

4.1 Present (see photograph: Kraus *et al.* 1969, Fig. 1-183).

4.2 Absent.

5. Bolk's Paramolar Cusps Complex (Protostylid) (Dahlberg 1954:60; Dahlberg 1948:160; Lasker & Lee 1957:414; Morris 1965:60): The Bolk's paramolar cusp complex occurs on the mesiobuccal surface and can be present as one of several variations.

5.1 An accessory cusp with an independent apex is present on the mesiobuccal surface (Bolk's paramolar cusp).

5.2 A bulge with no independent apex is present on the mesiobuccal surface.

5.3 A groove is present on the mesiobuccal surface.

5.4 A pit or pits are present on the mesiobuccal surface.

5.5 All variants of the Bolk's paramolar cusp complex are absent on the mesiobuccal surface.

6. Buccal Developmental Groove Termination (Kraus *et al.* 1969:110; Morris 1965:61): The buccal developmental groove termination on the buccal surface can vary or can be absent.

6.1 The buccal developmental groove terminates either in a pit or abruptly (see photographs:

Kraus et al. 1969:111; Fig. 1-181A, 1-181B, 1-181C).

6.2 The buccal developmental groove blends smoothly into the buccal surface.

6.3 The buccal developmental groove is absent.

7. Buccal Enamel Extension (Anderson 1969a:92; Lasker & Lee 1957:411-412; Nelson 1938:289): An enamel extension may extend apically from the crown cervix on the buccal surface.

7.1 Buccal enamel extension absent.

7.2 Buccal enamel extension is present but not over 1.5 millimeters in length (Melbye: pers. comm.).

7.3 Present, over 1.5 millimeters in length and not between the roots (Melbye: pers. comm.).

7.4 Buccal enamel extension is present, over 1.5 millimeters in length and between the roots (Melbye: pers. comm.).

8. Lingual Enamel Extension (Anderson 1969a:92): An enamel expansion may extend apically from the crown cervix on the lingual surface.

8.1 Lingual extension is absent.

8.2 Lingual extension is present but not over 1.5 millimeters in length (Melbye: pers. comm.).

8.3 Lingual enamel extension is present, over 1.5 millimeters in length and not between the roots (Melbye: pers. comm.).

8.4 Lingual enamel extension is present and over 1.5 millimeters in length and between the roots (Melbye: pers. comm.).

Chapter IV

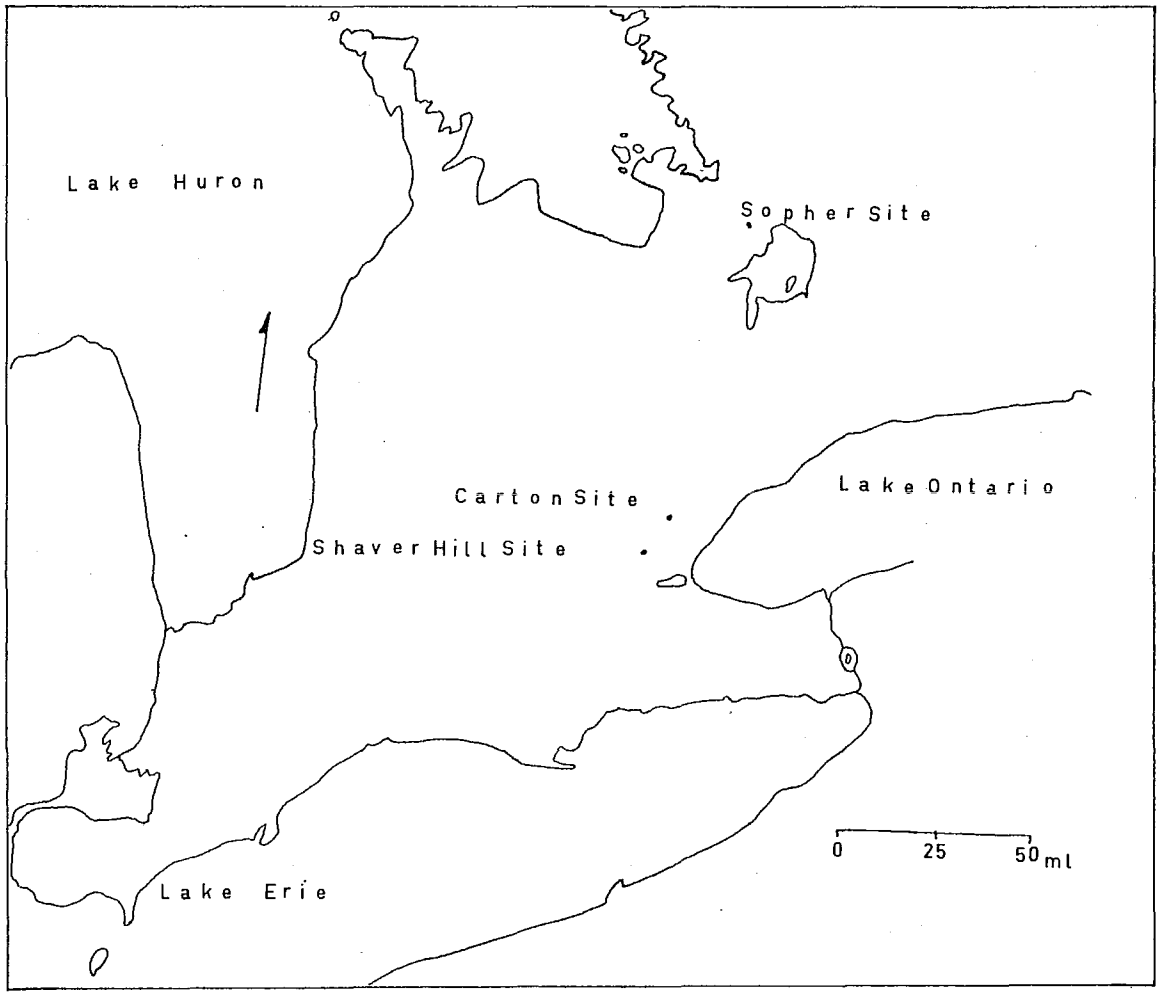
THE OSSUARY POPULATIONS

A: The Neutrals of Shaver Hill and Carton

(i) Archaeological Background

According to J.V. Wright (1966:66), both the Huron-Petun branch and the Neutral-Erie branch of the Late Ontario Iroquois Stage evolved out of the Middleport sub-stage of the Middle Ontario Iroquois Stage circa 1400 A.D. Within the Neutral-Erie branch, which seemed to Wright to maintain its Middleport ancestry more completely than the Huron-Petun branch, the Erie division evolved out of the Middleport sub-stage in southwestern New York, and the Neutral division evolved out of this same sub-stage in southwestern Ontario (Wright 1966:67).

In the Hamilton-Brantford area of southwestern Ontario (in which the protohistoric Neutral ossuaries, Shaver Hill and Carton are located - see map #1), a sequence of three periods of Neutral occupation has been suggested by I.T. Kenyon (pers. comm.): (i) the late prehistoric period which begins when the Neutral-Erie and Huron-Petun can be clearly differentiated from one another, dating circa 1400



MAP #1: APPROXIMATE LOCATIONS OF OSSUARY SITES

A.D. to 1500 A.D., (ii) the protohistoric (or protocontact) period which shows the first indications of European trade goods in the area, dating circa 1550 A.D. to 1620 A.D., and (iii) the historic (contact) period which represents the period in which the Neutrals became historically known (1620 A.D.) until their destruction as a nation, dating circa 1650 A.D. A short hiatus exists between the late prehistoric and the protohistoric period, which requires further fieldwork to allow tighter definition.

Representative of the material culture of the late prehistoric period in the Hamilton-Brantford area is a high incidence of rim sherds with low collars, decorated with horizontal neck decoration (Wright 1966:86; I.T. Kenyon: pers. comm.). Throughout this period, the occurrence of Middleport rim sherds (Ontario Horizontal, Middleport Crisscross) decreases rapidly while the ceramic types such as Lawson Incised and Lawson Opposed increase in frequency (I.T. Kenyon: pers. comm.). The pipe assemblage of this period is represented by plain trumpet and ring barrel types (I.T. Kenyon: pers. comm.). Traits present in the bone and lithic industries in the late prehistoric period, but absent in later periods, are side-notched isosceles points, notched and perforated net-sinkers, slate pebble pendants, antler tine chisels, worked beaver incisors and beads made from the distal part of deer phalanges (Wright 1966:87). Groundstone celts, large crude end scrapers, isosceles

triangular points, cylindrical antler flakers and bone beads and awls also occur and are carried over into the later periods to a certain extent (Wright 1966:86-87).

In the early and late protohistoric period, changes continue to occur in the material culture of the Neutrals in the Hamilton-Brantford area. The predominant type of rim sherd of this period is a low collared rim with oblique decoration, which resembles the Lawson type rims that were becoming more prevalent towards the end of the late prehistoric period (I.T. Kenyon, pers. comm.). A few rim sherds with vertically impressed finger width grooves on the neck are also found (I.T. Kenyon, pers. comm.). Traits in the bone industry include large bone tubes, and fluted, unilateral single barbed harpoon heads (Wright 1966:86-87). Marine shell ornaments, such as columella pendants, mask-like gorgets and worked marine shells appear in the protohistoric period and last in the historic period. Other major changes occur at this time which survive into the historic period. Shell beads begin to replace the ones made of bone, with glass beads appearing circa 1580 A.D., and the ground stone celt begins to disappear in the face of the iron trade (I.T. Kenyon, pers. comm.).

In the historic period, the Lawson-like ceramics begin to disappear and collarless rims with decorations restricted to the lip or lip edge (such as Dutch Hollow Notched) appear (I.T. Kenyon, pers. comm.). A greater range of decorating techniques (suture stamp, dentate stamp

and punctation) are found on the ceramics beginning late in the protohistoric period (I.T. Kenyon, pers. comm.). The pipe complex undergoes stylistic changes with the decorated acorn pipe becoming more popular and the coronet pipe changing from the earlier punctate style to an incised style (I.T. Kenyon, pers. comm.). Lithic vasiform pipes appear throughout the late prehistoric to the historic period. As is to be expected, after the protohistoric, the incidence of European trade goods increases with the result that some bone and lithic artifacts are replaced with European trade duplicates. However, the lithic and bone industries become more diversified during the historic period (I.T. Kenyon, pers. comm.).

Neutral village sites tend to be located on easily defensible points of land, sometimes on the bends of streams, but away from large bodies of navigable waters (Ridley 1961: 61; Wright 1966:66). Most village sites were located on or adjacent to land whose soil had very high agricultural potential (I.T. Kenyon, pers. comm.). Villages were often pallisaded and contained longhouses between 20 and 100 feet in length (Noble 1970 ; 1972). The density of habitation sites in the Hamilton-Brantford area, apparently increased through time until the historic period when a clustering pattern of a number of small satellite villages (smaller than 1.5 acres in size) occur around one large habitation site (between 5 and 15 acres in size) at a distance of 0.2

to 0.9 miles (I.T. Kenyon, pers. comm.). The large habitation site seems to have represented a "capital" village while each of the small habitation sites represented a satellite community which served as seasonal or short term occupational sites I.T. Kenyon, pers. comm.). Noble (1972) and I.T. Kenyon (pers. comm.) have suggested that each cluster of sites may represent a political unit of the Neutral Nation. Furthermore, preliminary analysis indicates that each cluster of historic Neutral sites had its own distinguishable ceramic tradition. Between 5 to 8 site clusters appear to be present during the historic period (I.T. Kenyon, pers. comm.; Noble 1972; White 1972).

While corn represented the most important crop throughout the entire sequence, squash, beans and tobacco were also cultivated (Ridley 1961:61; Wright 1966:91). Hunting and fishing also played an important role in the subsistence pattern of the Neutrals (Ridley 1961:61; Wright 1966:91).

Known Neutral burial practices included the ossuary, or communal secondary form of burial (Noble 1968). Excavated Neutral ossuaries were often lined and separated into two chambers by a layer of clay. Disarticulated bones were placed within both pit chambers (Ridley 1961:61). Noble (1968:79) states that double level ossuaries are probably a definitive characteristic of Neutral-Erie ossuaries; none occur in the Huron-Petun branch.

(ii) Ethnohistoric Background

This brief review of the ethnohistory of the Neutrals is derived from the primary sources of the Jesuit Relations (Thwaites 1896-1901), Champlain's journals (Grant 1967, 1970) and the journal of Gabriel Sagard Theodat (Wrong 1939). Secondary sources include the thorough works of G.K. Wright (1963) and M.E. White (1969, 1972). All ethnohistoric documentation deals with the historic period (circa 1620-1650) of the Neutral Nation.

The name Neutral is of European origin, for the French called these Indians "Nation Neutre" because at the time of Champlain (1615), they were at peace with both the Iroquois Confederacy and the Hurons, who were sworn enemies. Geographically located between these two nations (J.R. Vol. VIII:247), the Neutrals were called "Attiwandaronk" by the Hurons, a term which means " People of a slightly different language" (J.R. Vol. VIII:247).

The Neutral Nation was described as being 30 to 40 leagues south and slightly west of the Huron Nation (J.R. Vol. XXI:189-191; Vol. XXXIII:63; Vol. XXXVIII:235) and extending for 40 to 50 leagues (or about 150 miles) in length from the first Neutral village to the Niagara River (J.R. Vol. XXI:189-191; Vol. VIII:304,305; Vol. XXXVIII:235). It was also stated that the Neutrals were reported to have been found on both side of the "Niagara Gorge" (J.R. Vol. I: 22). Archaeology, however indicates that the primary centre

was in the Hamilton-Brantford area.

The Neutral Nation was, in fact, a confederacy made up of separate tribes or political units living in village clusters in each tribal area (White 1972:67). White (1969, 1972) has attempted to give the names and locations of the postulated Neutral tribes based on early maps and records, and on archaeological investigation. She states that a minimum of five tribes made up the Neutral confederacy (White 1972:71), and from archaeological evidence, Noble (1972) has suggested another three tribes. The Attira-genrega (Attionandaronk) subdivision was historically located in the Brantford-Hamilton area (White 1972:71). The Ahondironon subdivision was thought to be historically located south of the Hamilton area along the Grand River both above and below the town of Caledonia and at the town of Cayuga (White 1972:72). The Antouronon subdivision was thought to be located inland along the north side of Long Point Bat (White 1972:71). The Niagagarega subdivision was located on the Niagara River in the Grand Island area (White 1972:72). The fifth subdivision was the Kakouagoga who are thought to have been located in the southern areas of Welland County in Ontario, and Erie County, New York (White 1972:72). Two unidentified subdivisions are also thought to have been located in the Milton and Westover areas respectively (Noble, pers. comm.). Mention is also made of the Wenroe Nation (Wenrohrouons) who were once

allied with the Neutral Confederacy (Robinson & Conacher 1952:254; J.R. Vol. XVII:25) but who later joined the Hurons (Ridley 1973).

The Neutral confederacy was made up of about 40 villages in 1640 A.D. according to Brébeuf, who visited the Neutrals with Chaumonot in that year (J.R. Vol. XXI:189-191; Vol. VIII:304; Vol. XX:95, 105). The population in 1634 was estimated at more than 30,000 people (J.R. Vol. VII:225), and by 1641, the Neutral population had fallen to an estimated 12,000 people (4,000 warriors), because famine, sickness and warfare had been unusually severe over the preceding three years (J.R. Vol. XXI:191).

The language of the Neutrals was noted as being similar to other Iroquoian type languages. Sagard stated that both the Petuns and Neutrals spoke a language similar to the Hurons (Wrong 1939:9). The Jesuit Relations note that the Neutral language differed from that of the Hurons in some aspects (J.R. Vol. XX:105; Vol. XXI:189) which we now recognize as dialectical differences. The Neutrals are supposed to have spoken a dialect similar to the Eries and the Seneca since all three could understand one another (J.R. Vol. XXI: 314, 315).

The style of clothing of the Neutrals showed little variation from the styles worn by the Hurons (J.R. Vol. XXI: 195, 197). The Neutrals wore less clothing than the Hurons since it was observed that many either wore only a loin cloth,

or no loin cloth at all (J.R. Vol. XXI:197). Neutral women wore more modest clothing than did the men, being covered from the waist to the knees (J.R. Vol. XXI:197). Body decoration, either by painting or tattooing was very popular among the Neutrals (J.R. Vol. I:279). It was observed that every Neutral seen had had some part of his body tattooed (J.R. Vol. XXXIII:251) and that some individuals were literally decorated "from head to toe" (J.R. Vol. XXI:197). Lalemant observed that as many as a thousand different designs would be tattooed on a person by pricking charcoal into the skin following a previously drawn pattern on the skin, and that the tattooed heads and chests resembled the engraved ornamentation of French armour (J.R. Vol. XXI: 197).

The Neutral were sedentary, living in pallisaded villages with women practicing agriculture by growing corn, beans and squash in abundance (J.R. Vol. XXI:195, 197). The men were known to be skillful hunters and the lands of the Neutrals were rich in game (J.R. Vol. XXI:195, 197). Their meat supply was plentiful all year round since hunting could successfully be carried out all winter because of the limited snow fall (J.R. Vol. XXI:195, 197). Game and fowl hunted included deer, moose, wildcat, bear, wolf, beaver, black squirrel, wild goose, and wild turkey (J.R. Vol. XXII: 195, 197). While the Neutrals seem to have lived in a land of plenty, it was noted in historical times that famine did

occur especially when the staple crop of corn failed. In the famine years of 1639 and 1640, it was recorded that parents were selling their children as slaves for corn to eat (J.R. Vol. XV:157), that many people were driven from their lands by the famine (J.R. Vol. XX:69) and that with the famine came misery, sickness and death (J.R. Vol. XX: 47-49; Vol. XXII:91).

The Neutrals were said to have been highly superstitious and this seems to be borne out by their tolerance of the actions of people who either were, or acted like lunatics (J.R. Vol. XXI:197-201). Lalemant noted that a great many of these real or supposed lunatics occurred in the land of the Neutrals and that such lunatics were able to commit all sorts of acts with no fear of counteraction, since the people believed that they were acting under the order of a demon inside of them and that to halt a lunatic's activity would offend the demon (J.R. Vol. XXI:199, 201). Supposedly, the lunatics validated their actions by stating that they were only carrying out the wishes of their demons so that they, as hunters, would be assured of successful hunting (J.R. Vol. XXI:199, 201).

Another characteristic of the Neutrals observed by the Jesuits was their cruel conduct in warfare. It seems that while all the Iroquoian groups were noted for their cruelty in warfare, the Neutrals practiced it to an extreme. While remaining at peace with their Iroquoian neighbours

both to the north and south, they did conduct perennial and bloody warfare with the Algonkian Fire Nation (Atsistaehronons) who lived to the west (Michigan) (J.R. Vol. III: 195; Vol. XXVII:25, 27; Wrong 1939:158). Not only did the Neutrals torture and burn captured men, as did other Iroquoian groups, but they also tortured the women (J.R. Vol. XXII:195), something no other matrilineal Iroquois group is known to have done.

While seemingly overly cruel to their enemies, the Neutrals were known to be very reverent and emotional with their dead kindred. Lalemant noted that the Neutrals showed even greater concern for their dead than did the Hurons. He states:

> "Our Hurons immediately after death carry the bodies to the burying grounds and take them away from it only for the Feast of the Dead. Those of the Neutral Nation carry the bodies to the burying ground only at the very latest moment possible when decomposition has rendered them insupportable; for this reason, the dead bodies often remain during the entire winter in their cabins; and having once put them outside upon a scaffold that they may decay, they take away the bones as soon as possible and expose them in view, arranged here and there in their cabins, until the Feast of the Dead. These objects which they have before their eyes, renewing continually the feeling of their losses, cause them frequently to cry out and to make most lugubrious lamentation, the whole in song". (J.R. Vol. XXI:199).

Another custom of the Neutrals associated with their reverence for the dead was the resuscitation of the dead (J.R. Vol. XXI:209, 210). When a person of outstanding merit died, the deceased person's memory was kept alive by

having the dead person replaced by a living person. A council was held and a person, who had outstanding qualities like the deceased person would be chosen. Gifts and greetings were given to him and feasts were held in honour of him, but all in deference to him as the deceased person he represented. He would, from that point on, be treated, addressed, etc., as the deceased person that he represented and thus the name and memory of the deceased person were perpetuated.

In relation to adjoining groups, the Neutrals carried out trade with the Hurons, who acted as middlemen between the French and the Neutrals (J.R. Vol. XV:155; Vol. XXI:205). In regards to both the Iroquois Confederacy and the Huron Nation, the Neutrals remained unallied, and kept their territory neutral so that either Iroquois or Huron could seek sanctuary in their land (J.R. Vol. XXXIII:83, 97; Vol. XI:45).

The Neutral Nation collapsed at the hands of the Five Nations Iroquois Confederacy just after the destruction of the Huron Nation between 1642 and 1649 A.D. The first attack was on the Neutral town of Teotondiaton in 1650 (J.R. Vol. XXXVI:141). Another recorded attack on another village, early in the spring of 1651 (J.R. Vol. XXXVI:121) saw its destruction and it is said that this was when the Neutral Nation collapsed as a cultural-political entity. Members of the Nation were driven from their lands.

(iii) The Shaver Hill Ossuary and the Carton Ossuary Sites

Before the descriptions of the protohistoric Neutral ossuary sites of Shaver Hill and Carton are presented, a brief discussion on burial practices of the Neutral Indians in general will be given.

It has already been mentioned that the Neutrals kept the bodies of their dead in their longhouses for as long as was possible, and that the corpse was not taken to a primary cemetry until decomposition had reached a critical state. At the primary cemetery, the bodies were placed exposed on scaffolding until the remaining tissues rotted away from the bone (J.R. Vol. XXI:199). When the time came for final secondary burial they were arranged for viewing. Then, they were again collected and deposited within a communal secondary burial pit (ossuary) as part of the renowned Feast of the Dead (J.R. Vol. XXII:199).

All the historic tribes of the Ontario Iroquois Tradition practiced an elaborate ossuary burial ceremony (Noble 1968:69-75). This is known from archaeology; but only the ceremonial ossuary burial of the Hurons, the Feast of the Dead or the "Kettle" (J.R. Vol. X:279) is historically documented. Thus, only comparative inferences can be drawn between the Huron and Neutral ossuary ceremonies.

The Huron Feast of the Dead took place every eight, ten or twenty years (Grant 1970:96) and involved many feasts

and activities over a period of about ten days with the main terminal ceremony being the communal burial (J.R. Vol. X:279). Champlain's description of the historic Hurons' ossuary ceremonies states:

> ". . . they summon a general assembly at which, among other things the delegates decide when and where the next festival of the dead will be held. Then they each return to their district and uncover the bones of those who have died since the last festival. These are carefully cleaned and preserved, though they smell like newly-buried bodies. At the appointed time, the relatives and friends of the dead bring the bones together with necklaces, skins, tomahawks, spits and other valuables and quantity of food, to the chosen place. There they lay down their burdens and give themselves up to dancing and feasting for the ten days of the festival. Tribes come from all over the country to take part in the ceremonies. The dancing, the feasting, the general councils all serve to renew and strengthen old friendships. As a symbol of goodwill they mingle the bones of their relatives and friends one with another, saying that just as the bones of the dead are gathered in one place, so also the living will be united in friendship, as one people, as long as they live. They make a number of speeches over the bones and then after making certain faces and signs, they dig a trench sixty feet square and bury all the bones in it together with the necklaces, beads, tomahawks, spits, knives and other trinkets they have brought with them. This they cover with earth and on top of that they build a wooden canopy supported on four posts. The burial of the dead is the most solemn of all their festivals." (Grant 1970:96).

Neutral ossuaries are known to differ somewhat from the Huron ossuaries in physical construction by having an upper and lower section of bone deposits separated by a level of clay fill (Ridley 1961:61; Noble 1968:79).

With this background information in mind, I will

now present descriptions of the two protohistoric Neutral ossuary sites.

The Carton Ossuary:

The Carton Ossuary has been identified as a late protohistoric Neutral site (circa 1590 - 1610 A.D.) on the basis of ceramics and trade goods found there (I.T. Kenyon, pers. comm.). It was located in 1959 by Dr. R.D. Axelson and was excavated by him during the summers of 1966 and 1967 with assistance from University of Toronto anthropology students in the summer of 1967. The skeletal and dental material is now in the possession of the University of Toronto's Department of Anthropology while the archaeological material is in the personal possession of Dr. Axelson. Cranial analyses have already been carried out by Halpren (1973).

The Carton Ossuary is located on the farm of Mr. Gerry Carton, Lot 7, Concession 1, Nassagaweya Township, Halton County, Ontario (see map #1). The farm is located just northwest of the town of Milton, fifty miles west of Toronto. The ossuary was located in a worked field behind the barn, and its associated village site was 300 to 400 yards away and 4 to 5 acres in size. The village site has never been excavated except for a number of test pits dug in the several midden areas (Axelson, pers. comm.).

The excavated ossuary consisted of a single ossuary pit with no second subfloor or associated burial pits. The area around the ossuary pit was cleared away by bulldozer to check for associated burials (Axelson, pers. comm.). The ossuary pit measured 134" by 142" in diameter and 39" in depth. It was lined with bark and fur pieces. No evidence of any structures, either in the pit or on the pit's periphery, were recognized (Axelson, pers. comm.)(1970) but these results cannot be considered conclusive. The remains of at least 250 individuals were contained in the pit. The skeletal material was disarticulated and thoroughly mixed in "en masse" form, though the crania do appear to have been placed in a number of small groupings. Mature and immature skeletal material were mixed together, and there was no evidence of any of the bone being burnt (Axelson, pers. comm.).

A limited number of grave goods were found in Carton. They included strings of discoidal and tubular shell beads (several hundred), a few tubular brass beads, strings of glass trade beads (over 700 beads), a few brass arm bands, a number of coiled wire and band brass rings (over 35), two snake effigy brass pendants and four pot sherds. No clay pipes or pots, worked bone or stone, brass kettles or iron goods were found in the pit (Axelson, pers. comm.).

The glass trade beads were examined by Dr. Walter Kenyon of the Royal Ontario Museum. Some of these beads are thought to be early Dutch trade items, and may be the

earliest trade beads known in Ontario. Based on Noble's (1968, 1971) analysis of protohistoric trade chronology, in which glass beads are said to be a later protohistoric introduction, the site is tentatively dated at circa 1590 to 1610 A.D.

The Shaver Hill Ossuary:

The Shaver Hill Ossuary has also been identified (Stothers 1972a) as a late protohistoric Neutral site (circa 1600 to 1620 A.D.) on the basis of trade goods from the site. The ossuary (AiHa-1) was excavated by Mr. C.E. Stortroen and students from the Department of Anthropology, McMaster University during the summer of 1968, and the nearby associated village, Christiansen, was excavated by Dr. Noble (1970). The skeletal and archaeological materials are at McMaster University.

The site's location is on top of a drumlin on the Shaver farm, Lot 36, Concession 6, Beverly Township, Wentworth County, Ontario (see map #1) (Stothers 1972a: 28). This farm is about 14 miles northwest of the city of Hamilton. The village site (Noble 1970) is about ½ mile away from the ossuary. Two ossuary pits and eight associated burial pits (both flexed and extended primary burials and bundle burials) make up the pattern at Shaver Hill. The largest ossuary measured 174" by 144" and was 36" in depth.

Stothers (1972a:28) claims evidence of a structure or structures on the east and south sides of the largest ossuary pit, but he doesn't describe the nature of this feature. Post moulds were not recorded, and a test for a secondary compartment was not undertaken. Stothers reported that the remains of at least 163 individuals were found in the large ossuary pit; the remains of at least 18 individuals were found in the small ossuary pit and the remains of 14 individuals were found in the eight associated burial pits (Stothers, pers. comm.). The skeletal material was disarticulated and there was evidence to suggest a methodical arrangement of the bones in the main ossuary pit. The immature post cranial material was located in the southwest corner and was charred. Mature and immature crania and mature long bones were located on the east side of the pit and the remaining mature post cranial material was located on the northwest of the pit, north of the immature post cranial material (Stothers, pers. comm.).

A number of grave goods were found in the ossuary pits and the associated burials. The grave goods included strings of discoidal and tubular shell beads (over 1200), cut and polished bone tubes, clay vessels and pot sherds, a clay pipe, strings of trade glass beads (over 400), iron knives, a brass ladle, an iron trade axe(French) and a religious medallion probably Recollet (Stothers 1972a).

Based on the analysis of the glass trade beads by

Mr. Ian Kenyon, the Shaver Hill Ossuary (and associated village site) has been dated at circa 1600 to 1620 A.D.

B: The Control Dental Sample: Sopher Ossuary

The control sample that I have chosen is the dental material from the Sopher Huron ossuary (Noble 1968, 1971:42). As mentioned previously in both the introductory chapter and the archaeological section of this chapter, the Neutral-Erie and the Huron-Petun branches both arose from a common Middleport substage of the Middle Ontario Iroquois Stage and subsequently diverged, so that by 1400 A.D. they could be differentiated on the basis of archaeological, ethnohistoric and linguistic data (Wright 1966). Thus the Sopher site Huron ossuary dental sample constitutes a suitable control sample exhibiting both a recognised common cultural ancestry with the two protohistoric Neutral dental samples and a known cultural divergence from the same two dental samples which is reflected by the available archaeological, ethnohistoric and linguistic evidence.

In addition to the close cultural relationship between the two Neutral sites and the Huron ossuary site, there exists a very close temporal relationship between the three samples. The protohistoric Sopher site Huron ossuary dates, on the basis of an early iron bar celt found in the ossuary, circa 1580-1610 A.D. (Noble 1971:42) which makes

it temporally comparable with both the protohistoric Shaver Hill ossuary (1600-1620 A.D.) and the protohistoric Carton ossuary (1590-1610 A.D.). The small temporal differences between the three samples eliminates the possibility of biological differences due to microevolutionary change. Thus by using the protohistoric Sopher site Huron dental sample as a control sample, it will be possible to observe if a biological "divergence" (in terms specifically of dental morphology) has occurred between the Huron-Petun and the Neutral-Erie branches by the protohistoric period of the Late Ontario Iroquois Stage.

The Sopher Ossuary

The Sopher Ossuary site has been identified as a protohistoric Huron-Petun site (circa 1580 to 1610 A.D.) on the basis of ceramic comparisons and an iron bar celt (Noble 1968:121; 1971:42). More specifically, Sopher has been identified as probably being representative of the Rock clan (Noble 1968:212; 1971:45). The ossuary was excavated by Dr. W.C. Noble, who removed part of the ossuary in 1962 and completed the ossuary excavation in 1965. The skeltal and dental material is now in the possession of the National Museums of Canada.

The Sopher ossuary was located on Lot 2, Concession 1, South Orillia Township, Simcoe County, about 60 miles north of Toronto and ½ mile north of Bass Lake, west of

Orillia (Noble 1968:84; 1971:42) (see map #1). It was located in a bush lot, about 250 yards from its associated village site of about 3.7 acres (Noble 1968:108; 1971:121).

The excavated ossuary consisted of a main burial pit, two other pits, and evidence of scaffolding (Noble 1968:115-121). The main burial pit, 16 feet in diameter and 6 feet deep, was bark lined around its west and south sides and along the floor (Noble 1968:111). Burials were concentrated at the bottom and were restricted to the central and eastern section of the burial pit, suggestive of a pattern in the burial placement (Noble 1968:117). No primary articulated burials were found. Most burials were thoroughly mixed together ("en masse"), or were bundle burials wrapped in bark (Noble 1968:117). The preservation of the skeletal material was very poor due to heavy water saturation in the soil (Noble 1968:113,114). In the western section of the pit, layered features of a ritual nature were found (Noble 1968:117).

Few grave goods were found in the Sopher ossuary (Noble 1968:120). Associated with some of the discrete bundles were some rocks containing gold bearing ore, part of a mortar, an anvil stone and other pieces of rock (Noble 1968:120). Other material, including a fossil crinoid stem bead, a piece of pipe, a plain body sherd and a plain gaming disc appeared to have been accidently mixed in the fill (Noble 1968:120). The most important grave good found at

Sopher was the iron bar celt which has been used to date the site. Trade items such as this have proven most useful in differentiating between the early and late protohistoric periods. This particular trade item indicates that Sopher dates at the beginning of the early protohistoric period (Noble 1971, pers. comm.) circa 1580.

Chapter V

DENTAL MORPHOLOGY OF THE PERMANENT TEETH OF SHAVER HILL, CARTON AND SOPHER

The size of the dental samples from each ossuary population which is quoted here refers only to those teeth which could be identified accurately with their appropriate tooth group and thus be included in analysis. The following table (Table 5.1) presents the number of analysable teeth of each ossuary population.

TABLE 5.1

SIZE OF THE ANALYSABLE DENTAL SAMPLES OF THE THREE OSSUARY POPULATIONS

Tooth Class	Shaver Hill	Carton	Sopher
Maxillary Incisors	54	37	50
Maxillary Canines	35	69	31
Maxillary Premolars	82	159	72
Maxillary Molars	132	203	107
Mandibular Incisors	43	43	31
Mandibular Canines	27	34	37
Mandibular Premolars	72	108	72
Mandibular Molars	123	217	100
Total	568	870	500

In the tables presented in this chapter, the subtotals within each tooth group vary with each category under consideration because some teeth are not analysable for some categories, due to attrition, caries, chipping, etc. Thus, for example

of the left maxillary central incisors in the Sopher sample (see Table 5.2), 12 teeth were analysable for lingual shovel shape (1.), while only 10 were analysable for buccal shovel shape (4.) and 13 were analysable for buccal ridges (5.). Throughout this study, the right and left dentitions of the dental samples will be considered independently. Thus for example, these observations and tabulations made on the Shaver Hill right dental sample will only be compared with those made on the Carton and Sopher right dental sample. This separation of left and right dentition takes into consideration the asymmetrical occurrence of antimeres - see Chapter II for a discussion of asymmetrical antimeres. It will hopefully eliminate misinterpretations which might arise in the dental analysis of disarticulated skeletal and dental samples (e.g. samples from ossuary burials) due to the asymmetrical occurrence of the dental morphological variants.

Since it is impossible to sex the dental sample of these ossuaries, it is assumed that the same approximate ratio of males to females would occur in each of the three samples.

The dental morphology of the permanent crown of third molars has been omitted from this study. The reasons for this omission are the high rate of third molar agenesis in Mongoloid populations (Anderson 1969a:92) and the highly variable nature of the morphology of the third molar.

TABLE 5.2

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary Central Incisors

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Lingual shovel shape						
1.1 absent	0	0	0	0	0	0
1.2 semi-shovel	5	3	2	4	5	7
1.3 marked	10	9	1	3	7	8
Lingual fossa						
2.1 smooth	11	6	2	4	10	12
2.2 slight ridges	3	4	1	2	2	4
2.3 pronounced ridges	0	1	0	0	1	1
Lingual cervical area						
3.1 tubercle(s)	3	0	1	1	0	2
3.2 ridge(s)	1	1	0	0	2	1
3.3 groove at midline	1	2	0	0	1	2
3.4 no separation at midline	1	0	0	2	0	0
3.5 none of the above	11	10	2	4	8	10
Buccal shovel shape						
4.1 absent	10	4	2	2	6	8
4.2 semi-shovel	6	7	1	1	3	6
4.3 marked	0	2	0	3	1	1
Buccal ridges						
5.1 present	3	3	0	3	2	3
5.2 absent	10	10	3	4	11	12
Anomalous conditions						
6.1 absent	16	14	3	7	14	17
6.2 peg-shaped	0	0	0	0	0	0
6.3 supernumerary	0	0	0	0	0	0
6.4 barrel	0	0	0	0	0	0
6.5 trefoil	0	0	0	0	0	0

The observations of the dental morphology of the permanent crowns of the three dental samples will not be compared in this chapter. Comparison of the dental samples will be presented in Chapter VI where the null hypotheses are tested.

TABLE 5.3

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary Lateral Incisors

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Lingual shovel shape						
1.1 absent	1	1	0	0	0	0
1.2 semi-shovel	6	3	5	7	6	6
1.3 marked	3	7	7	7	3	1
Lingual fossa						
2.1 smooth	6	5	7	12	7	6
2.2 slight ridges	3	2	3	2	2	2
2.3 pronounced ridges	0	1	0	0	0	0
Lingual cervical area						
3.1 tubercle(s)	3	2	1	2	2	1
3.2 ridge(s)	1	0	0	0	2	3
3.3 grooved at midline	0	4	4	5	3	0
3.4 no separation at midline	3	1	6	5	1	1
3.5 none of the above	4	4	1	1	2	3
Buccal shovel shape						
4.1 absent	6	3	9	9	6	8
4.2 semi-shovel	4	4	1	3	2	6
4.3 marked	0	1	0	0	0	1
Buccal ridges						
5.1 present	2	0	1	2	2	3
5.2 absent	7	7	10	10	6	5
Anomalous conditions						
6.1 absent	10	10	11	14	8	8
6.2 peg-shaped	0	0	0	0	0	0
6.3 supernumerary	0	0	0	0	0	0
6.4 barrel	0	0	1	0	1	1
6.5 trefoil	0	0	0	0	0	0

TABLE 5.4

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary Canines

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Mesial incisal style						
1.1 present	0	1	1	1	0	2
1.2 absent	2	7	5	8	4	10
Main incisal apex						
2.1 blunt	1	1	5	0	3	2
2.2 nippled	0	2	0	3	1	2
2.3 typical	2	5	1	4	0	1
Lingual tubercles pits						
3.1 one with pits	0	1	2	2	1	2
3.2 one without pits	0	3	8	4	1	3
3.3 two or more without pits	0	1	0	0	0	0
3.4 two or more with pits	0	0	0	0	0	0
3.5 just pits	7	2	6	7	2	4
3.6 no tubercles or pits	8	10	16	16	6	9

TABLE 5.5

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary First Premolars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Mesial buccal cusplet						
1.1 present	6	1	3	3	3	9
1.2 absent	15	6	23	22	11	11
Distal buccal cusplet						
2.1 present	2	0	1	0	1	2
2.2 absent	19	10	26	25	13	14
Buccal ridges						
3.1 present	19	9	14	13	8	12
3.2 absent	7	6	24	23	8	10
Distal transverse ridge						
4.1 present	3	1	0	3	3	5
4.2 absent	23	10	35	30	11	17
Inclination of buccal cusp ridges						
5.1 sharp	12	7	7	4	1	5
5.2 blunt	6	3	16	16	2	3
5.3 intermediate	3	1	4	6	9	7
Inclination of lingual cusp ridges						
6.1 sharp	8	4	4	6	1	4
6.2 blunt	4	4	17	7	2	8
6.3 intermediate	6	3	3	8	9	5
Cusp positions						
7.1 mesial to buccal	15	11	36	33	13	16
7.2 aligned with buccal	5	5	4	4	1	2
7.3 distal to buccal	5	1	0	0	3	4

TABLE 5.5 (cont'd)

Maxillary First Premolars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Cusp masses						
8.1 buccal > lingual	17	8	19	18	12	20
8.2 buccal = lingual	7	7	18	17	5	3
Relative premolar sizes						
9.1 1st > 2nd	2	0	8	6	3	3
9.2 1st = 2nd	5	4	25	20	7	3
9.3 1st < 2nd	0	3	1	2	1	0

TABLE 5.6

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary Second Premolars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Mesial buccal cusplet						
1.1 present	2	7	6	6	7	4
1.2 absent	6	17	16	17	13	7
Distal buccal cusplet						
2.1 present	0	1	5	5	9	5
2.2 absent	8	15	17	19	11	6
Buccal ridges						
3.1 present	5	12	11	11	14	6
3.2 absent	7	8	26	21	8	5
Distal transverse ridge						
4.1 present	4	5	16	11	10	5
4.2 absent	5	14	12	14	9	4
Inclination of buccal cusp ridges						
5.1 sharp	2	5	2	3	0	1
5.2 blunt	4	7	19	18	13	4
5.3 intermediate	2	3	3	4	4	1
Inclination of lingual cusp ridges						
6.1 sharp	2	5	5	5	0	1
6.2 blunt	2	7	7	8	9	2
6.3 intermediate	4	4	4	7	6	5
Cusp positions						
7.1 mesial to buccal	6	9	28	22	10	2
7.2 aligned with buccal	5	10	9	8	10	9
7.3 distal to buccal	1	3	3	6	2	0
Cusp masses						
8.1 buccal > lingual	4	11	22	21	6	2
8.2 buccal = lingual	10	11	12	14	16	9

TABLE 5.7

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary First Molars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Cusp number						
1.1 (3)	0	0	0	0	0	0
1.2 (3+)	0	0	0	0	0	0
1.3 (4-)	7	6	12	8	8	7
1.4 (4)	26	38	45	59	25	29
Carabelli's trait						
2.1 pronounced tubercle	0	0	2	0	0	0
2.2 slight tubercle	1	2	4	5	2	5
2.3 groove(s)	12	12	10	11	9	10
2.4 pit(s)	0	8	10	17	3	12
2.5 absent	19	20	28	31	18	9
Buccal enamel extension						
3.1 absent	15	23	30	40	4	10
3.2 under 1.5 mm	5	3	6	4	2	1
3.3 not between roots	4	4	5	5	2	2
3.4 between roots	5	4	6	9	16	9
Lingual enamel extension						
4.1 absent	30	39	51	62	25	23
4.2 under 1.5 mm	1	0	0	0	1	1
4.3 not between roots	0	0	0	0	0	0
4.4 between roots	0	0	0	0	0	0
Anterior transverse ridge						
5.1 prominent	2	3	6	9	2	5
5.2 moderate	5	11	6	10	4	7
5.3 slight	5	6	5	1	7	5
5.4 absent	2	0	2	3	8	8
Size of oblique ridge						
6.1 pronounced	3	6	5	11	11	14
6.2 small	19	24	29	32	16	19
6.3 absent	0	0	0	0	0	0

TABLE 5.7 (cont'd)

Maxillary First Molars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Oblique ridge continuity						
7.1 continuous	8	8	9	12	7	9
7.2 partially interrupted	11	17	25	24	15	17
7.3 bisected	2	6	3	6	4	7
7.4 absent	0	0	0	0	0	0
Mesial marginal ridge tubercles						
8.1 solid ridge	3	3	1	2	5	9
8.2 only 1	3	6	2	0	1	3
8.3 2	3	5	1	3	5	3
8.4 3-5	1	0	6	4	1	3
8.5 6 or more	0	0	0	0	0	0
Distal marginal ridge						
9.1 tubercles present	4	1	3	7	5	7
9.2 1 groove	13	12	12	13	7	13
9.3 2 or more grooves	1	1	0	0	0	1
9.4 solid ridge	5	10	2	4	2	3
9.5 absent	1	0	0	0	1	0
Buccal groove termination						
10.1 abrupt or pit	5	8	15	10	8	7
10.2 blends in	23	31	43	56	18	24
Lingual groove termination						
11.1 abrupt or pit	27	38	51	60	30	32
11.2 blends in	5	3	5	7	2	1
11.3 not applicable	0	0	0	0	0	0
11.4 absent	0	0	0	0	0	0

TABLE 5.8

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Maxillary Second Molars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Cusp number						
1.1 (3)	7	9	4	7	4	2
1.2 (3 +)	11	11	8	15	10	5
1.3 (4 -)	5	2	14	16	5	9
1.4 (4)	2	0	1	0	2	1
Carabelli's trait						
2.1 pronounced tubercle	0	0	0	0	0	0
2.2 slight tubercle	0	0	0	0	0	0
2.3 groove(s)	0	0	0	0	0	0
2.4 pit(s)	3	0	1	0	1	3
2.5 absent	21	21	31	39	19	14
Buccal enamel extension						
3.1 absent	2	1	6	5	1	0
3.2 under 1.5 mm	5	4	6	4	1	2
3.3 not between roots	5	3	8	11	5	4
3.4 between roots	8	12	14	13	8	5
Lingual enamel extension						
4.1 absent	21	22	36	38	18	9
4.2 under 1.5 mm	3	1	3	0	1	2
4.3 not between roots	0	0	0	0	0	0
4.4 between roots	1	0	0	0	0	0
Anterior transverse ridge						
5.1 prominent	1	1	1	2	0	0
5.2 moderate	1	2	1	2	0	0
5.3 slight	3	0	3	6	1	1
5.4 absent	6	6	7	12	15	13
Size of oblique ridge						
6.1 pronounced	1	1	1	0	0	3
6.2 small	8	10	18	26	17	12
6.3 absent	0	1	0	0	1	0

TABLE 5.8 (cont'd)

Maxillary Second Molars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Oblique ridge continuity						
7.1 continuous	2	0	1	4	2	1
7.2 partially interrupted	6	7	9	12	7	5
7.3 bisected	3	4	10	12	9	9
7.4 absent	0	1	0	0	1	0
Mesial marginal ridge tubercles						
8.1 solid ridge	5	4	1	3	4	6
8.2 only 1	2	3	1	4	4	3
8.3 2	1	1	3	4	4	3
8.4 3-5	1	1	2	0	0	1
8.5 6 or more	0	0	0	0	0	0
Distal marginal ridge						
9.1 tubercles present	2	1	1	5	2	2
9.2 1 groove	8	4	7	14	6	5
9.3 2 or more groove	3	1	0	1	0	0
9.4 solid ridge	0	3	3	3	4	4
9.5 absent	1	0	0	0	1	0
Buccal groove termination						
10.1 abrupt or pit	3	3	2	2	3	0
10.2 blends in	15	15	31	32	10	10
Lingual groove termination						
11.1 abrupt or pit	8	5	13	19	8	8
11.2 blends in	5	1	9	9	7	4
11.3 not applicable	6	10	4	7	3	1
11.4 absent	3	5	3	4	2	3

TABLE 5.9

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Mandibular Central Incisors

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Lingual shovel shape						
1.1 over 1.5 mm	1	0	2	0	0	0
1.2 under 1.5 mm	6	6	3	1	5	5
1.3 absent	2	3	4	2	1	2
Lingual dental tubercle						
2.1 present	0	0	0	0	0	1
2.2 absent	10	14	12	7	7	7
Medial lingual ridges						
3.1 present	1	2	0	0	0	1
3.2 absent	9	12	7	2	7	6
Buccal shovel shape						
4.1 present	2	0	0	0	0	0
4.2 absent	6	7	8	2	7	8
Mesial marginal ridge						
5.1 present	3	1	1	0	1	0
5.2 absent	5	6	4	2	5	6

TABLE 5.10

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBERSVATIONS)

Mandibular Lateral Incisors

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Lingual shovel shape						
1.1 over 1.5 mm	3	2	0	0	2	0
1.2 under 1.5 mm	5	6	7	4	4	7
1.3 absent	1	0	4	4	0	3
Lingual dental tubercle						
2.1 present	1	1	0	0	0	4
2.2 absent	10	11	13	11	6	6
Medial lingual ridges						
3.1 present	2	3	0	0	0	1
3.2 absent	7	9	8	4	6	8
Buccal shovel shape						
4.1 present	2	3	1	0	1	0
4.2 absent	5	5	8	6	5	10
Mesial marginal ridge						
5.1 present	3	7	1	0	1	2
5.2 absent	4	2	8	4	5	6

TABLE 5.11

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Mandibular Canines

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Buccal styles						
1.1 on mesiobuccal	0	0	2	1	2	4
1.2 on distobuccal	2	1	0	0	1	1
1.3 on both	1	1	0	1	0	2
1.4 absent	2	1	0	0	9	4
Mesial buccal ridge						
2.1 present	5	5	5	6	7	8
2.2 absent	4	1	7	6	10	10
Medial buccal ridge						
3.1 present	2	1	0	1	1	0
3.2 absent	7	4	7	10	16	17
Distal buccal ridge						
4.1 present	11	3	5	5	4	6
4.2 absent	2	2	7	6	12	12
Mesial lingual ridge						
5.1 prominent	0	2	1	1	2	1
5.2 slight	13	7	16	14	14	18
5.3 absent	0	0	0	0	1	0
Medial lingual ridge						
6.1 prominent	2	1	2	2	1	4
6.2 slight	4	3	10	8	8	7
6.3 absent	6	4	3	3	7	8
Distomedial lingual ridge						
7.1 present	0	0	0	0	8	4
7.2 absent	10	6	14	11	8	11
Distal lingual ridge						
8.1 present	16	10	18	15	16	18
8.2 absent	0	0	0	0	1	1
Lingual dental tubercle						
9.1 present	0	0	0	0	1	2
9.2 absent	15	11	19	16	14	15

TABLE 5.12

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Mandibular First Premolars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Buccal styles						
1.1 distal side	2	0	1	2	1	1
1.2 mesial side	1	4	4	2	1	7
1.3 both sides	1	0	0	0	2	1
1.4 absent	5	3	2	1	11	8
Mesial buccal ridge						
2.1 present	7	3	7	6	3	7
2.2 absent	6	6	13	12	12	12
Medial buccal ridge						
3.1 present	1	1	0	0	1	0
3.2 absent	13	8	6	17	14	18
Distal buccal ridge						
4.1 present	4	3	3	3	3	0
4.2 absent	10	7	18	14	12	19
Mesial occlusal margin						
5.1 interrupted	9	4	8	10	5	9
5.2 uninterrupted	10	8	16	13	14	12
Distal occlusal margin						
6.1 interrupted	7	1	1	1	3	3
6.2 uninterrupted	11	11	26	22	16	18
Lingual grooves						
7.1 1 groove	8	2	6	8	5	4
7.2 2 grooves	0	0	0	0	2	0
7.3 3 or more	1	0	0	0	0	0
7.4 absent	13	11	19	14	12	16
Lingual cusps						
8.1 1 cusp	14	10	17	13	13	15
8.2 2 cusps	5	2	4	7	6	4
8.3 3 or more	0	0	0	2	0	1
8.4 absent	0	0	1	0	0	0

TABLE 5.12 (cont'd)

Mandibular First Premolars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Occlusal ridges						
9.1 5 or more	0	0	0	0	0	0
9.2 4	3	1	2	1	1	0
9.3 3	5	7	7	7	4	7
9.4 2	6	3	11	10	8	7
9.5 1	6	1	5	4	6	6
9.6 absent	0	0	0	0	0	0
Main occlusal ridge						
10.1 single	18	12	23	22	17	18
10.2 bifurcated	2	0	2	1	2	1
10.3 absent	0	1	0	0	0	0
Size of main occlusal ridge						
11.1 prominent	18	10	20	17	16	14
11.2 slight	2	3	5	6	3	6
11.3 absent	0	0	0	0	0	0
Cusp positions						
12.1 mesial to buccal	11	8	23	23	9	15
12.2 distal to buccal	7	6	3	1	6	4
12.3 aligned	4	0	0	0	4	2
Independence of lingual cusp						
13.1 independent	3	4	4	1	2	2
13.2 fused	17	9	19	22	17	18
Sagittal sulcus						
14.1 uninterrupted	0	1	0	0	0	0
14.2 interrupted	19	12	26	24	19	21

TABLE 5.13

DENTAL MORPHOLOGY OF PERMANENT TEETH(OBSERVATIONS)

Mandibular Second Premolars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Buccal styles						
1.1 distal side	0	0	0	0	0	1
1.2 mesial side	3	3	7	2	3	2
1.3 both sides	0	1	1	1	1	2
1.4 absent	0	3	3	5	11	5
Mesial buccal ridge						
2.1 present	2	9	8	11	7	5
2.2 absent	3	4	15	11	9	7
Medial buccal ridge						
3.1 present	2	4	1	[illegible]	1	1
3.2 absent	3	9	22	23	14	10
Distal buccal ridge						
4.1 present	1	9	5	5	5	2
4.2 absent	3	4	18	17	10	10
Mesial occlusal margin						
5.1 interrupted	7	4	20	5	1	4
5.2 uninterrupted	6	15	7	22	17	10
Distal occlusal margin						
6.1 interrupted	1	3	2	2	2	2
6.2 uninterrupted	11	15	24	27	16	11
Lingual grooves						
7.1 1 groove	3	5	2	3	1	2
7.2 2 grooves	0	1	0	0	0	0
7.3 3 or more	0	0	0	0	0	0
7.4 absent	10	13	25	25	17	11
Lingual cusps						
8.1 1 cusp	12	12	19	23	17	10
8.2 2 cusps	1	7	6	3	1	4
8.3 3 or more	0	0	0	1	0	0
8.4 absent	0	0	0	0	0	0

TABLE 5.13 (cont'd)

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Occlusal ridges						
9.1 5 or more	0	0	2	1	0	1
9.2 4	1	3	5	4	4	1
9.3 3	2	7	10	14	3	5
9.4 2	5	9	6	4	4	5
9.5 1	6	1	3	4	6	2
9.6 absent	1	0	0	0	0	0
Main occlusal ridge						
10.1 single	13	17	25	27	16	14
10.2 bifurcated	1	3	1	1	2	0
10.3 absent	0	0	0	0	0	0
Size of main occlusal ridge						
11.1 prominent	8	13	13	15	11	8
11.2 slight	6	7	13	12	6	6
11.3 absent	0	0	0	0	1	0
Cusp positions						
12.1 mesial to buccal	4	3	16	22	6	8
12.2 distal to buccal	9	14	5	3	4	1
12.3 aligned	2	4	5	2	8	5
Independence of lingual cusp						
13.1 independent	10	11	22	23	15	13
13.2 fused	1	5	2	2	3	0
Sagittal sulcus						
14.1 uninterrupted	7	6	12	13	11	4
14.2 interrupted	8	14	15	15	7	10

TABLE 5.14

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Mandibular First Molars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Molar fissure pattern						
1.1 "Y"	25	25	40	46	27	14
1.2 "+"	1	3	5	4	1	1
1.3 "λ"	4	4	0	2	5	3
Variation of the distal cusp						
2.1 absent	0	0	0	0	0	0
2.2 < than ½ size	2	1	3	0	0	0
2.3 > than ½ size	16	16	17	22	9	7
2.4 = in size	11	13	17	21	26	10
Tuberculum sextum						
3.1 present	8	8	9	11	12	6
3.2 absent	14	18	11	11	21	10
Tuberculum intermedium						
4.1 present	6	8	8	15	7	4
4.2 absent	21	24	34	33	27	14
Bolk's paramolar						
5.1 cusp	0	0	0	0	0	0
5.2 bulge	0	0	0	0	1	0
5.3 groove	0	1	1	2	4	0
5.4 pit(s)	0	1	1	1	0	1
5.5 absent	26	31	49	54	29	17
Groove termination						
6.1 pit or abruptly	25	33	53	58	33	17
6.2 blends in	1	1	0	0	1	1
6.3 absent	1	0	0	0	0	0
Buccal enamel extension						
7.1 absent	13	14	31	39	6	3
7.2 not over 1.5 mm	3	4	6	7	4	0
7.3 not between roots	3	2	2	2	2	0
7.4 between roots	4	8	13	8	12	5

TABLE 5.14 (cont'd)

Mandibular First Molars

Category		Shaver Hill		Carton		Sopher	
		left	right	left	right	left	right
Lingual enamel extension							
8.1	absent	20	23	38	45	14	6
8.2	not over 1.5 mm	7	6	16	14	8	2
8.3	not between roots	1	1	0	0	1	0
8.4	between roots	0	0	0	0	0	0

TABLE 5.15

DENTAL MORPHOLOGY OF PERMANENT TEETH (OBSERVATIONS)

Mandibular Second Molars

Category	Shaver Hill		Carton		Sopher	
	left	right	left	right	left	right
Molar fissure pattern						
1.1 "Y"	1	0	4	0	9	12
1.2 "+"	3	6	25	14	8	9
1.3 "λ"	10	15	17	26	4	4
Variation of distal cusp						
2.1 absent	6	2	6	5	3	5
2.2 < than ½ size	9	10	11	13	13	10
2.3 > than ½ size	7	4	10	13	5	9
2.4 = in size	1	0	11	0	0	2
Tuberculum sextum						
3.1 present	3	4	7	7	4	7
3.2 absent	12	7	16	15	14	13
Tuberculum intermedium						
4.1 present	2	2	1	2	5	5
4.2 absent	22	20	41	33	16	20
Bolk's paramolar						
5.1 cusp	0	0	0	0	0	0
5.2 bulge	0	0	0	1	0	0
5.3 groove	1	0	1	3	0	0
5.4 pit(s)	1	1	1	0	1	0
5.5 absent	24	23	44	35	20	26
Groove termination						
6.1 pit or abruptly	18	20	37	32	17	21
6.2 blends in	4	3	9	7	3	3
6.3 absent	1	2	2	2	1	1
Buccal enamel extension						
7.1 absent	6	3	8	7	5	3
7.2 not over 1.5 mm	4	5	5	7	3	2
7.3 not between roots	5	4	11	4	0	0
7.4 between roots	12	13	24	23	5	5

TABLE 5.15 (cont'd)

Mandibular Second Molars

Category		Shaver Hill		Carton		Sopher	
		left	right	left	right	left	right
Lingual enamel extension							
8.1	absent	23	21	45	41	12	9
8.2	not over 1.5 mm	3	3	5	2	1	3
8.3	not between roots	0	1	0	0	0	0
8.4	between roots	0	0	0	0	0	0

Chapter VI

A COMPARISON OF THE CATEGORY OBSERVATIONS ON THE PERMANENT CROWN MORPHOLOGY OF THE SHAVER HILL, CARTON AND SOPHER DENTAL SAMPLES

The comparisons of the data on the permanent crown morphology of the dental samples is conducted in the same manner as the observations of these dental samples, that is, the division into right and left dentition is maintained as is the assumption that the sex ratio is the same in each of the dental samples.

In the following tables, the frequency of occurrence of category variations for the Shaver Hill, Carton and Sopher dental samples are presented with the results of both Chi-square (χ^2) test and the Fisher's Exact probability Test (P), both of which indicate the probability of achieving such results by chance when considering two samples from the same population.

In most cases, the category members have been summed together in order to use the 2 x 2 contingency table, and to raise the frequency expressed within each cell, This process of lumping was done wherever possible to show the category trait as either present or absent, prominent or diminutive in size, expression, etc. However, there are at least four categories in which the category members could be lumped in

more than one combination to make biological sense (Glanville, pers. comm.). These four categories are the maxillary premolar inclination of buccal cusp ridges (5.), inclination of lingual cusp ridges (6.), buccal/lingual cusp relationship (7.) and the mandibular molar fissure pattern (1.). In these four categories, both the Chi-square (χ^2) and the Fisher's test (P) will be applied to all the possible arrangements of the 2 x 2 contingency tables. If a statistically significant difference is indicated by at least one of the comparisons for each of these four categories, then the category will be considered to show a statistically significant difference.

All the calculations for the value of Chi-square were computed on an Olivetti Programma 101 using a single degree-of-freedom (df1). The Yate's correction for continuity (χ^2yc) has been applied under the conditions outlined in Quantitative Zoology by Simpson et al. (1960):

> "1. When N is greater than 40 and the smallest observed frequency is 10 or less, use the adjusted χ^2yc (Yates correction for continuity).
> 2. When the smallest observed frequency is greater than 10, use the unadjusted χ^2.
> 3. When N is less than or equal to 40, calculate both the adjusted and unadjusted values of χ^2. If both indicate a significant difference, reject the hypothesis, while if both indicate no significant difference, do not reject. If the adjusted χ^2yc is not significant, the hypothesis must be regarded with suspicion although there is no definite evidence for its rejection . . ." (Simpson et al. 1960:323)

In calculating the Fisher's test to determine the exact probability level, the tables in Practical Statistics

(Langley 1971:297 et. seq.) were employed in accordance with the following conditions:

> "The tables provided will handle all cases of N = 850. When N is less than 8, a 5% probability level cannot be reached, so a significant difference or association cannot be demonstrated.
> When N is more than 50 use Yates Test . . ."
> (Langley 1971:293-294)

For the purposes of this study, I am prepared to accept a probability level of 5% (.05) as indicating a statistical difference between any two of the dental samples in terms of their dental morphology. More specifically, in any comparison for which the probability level is larger than .05, the interpretation is that a <u>significant difference is not proven</u>. In any comparison in which the probability level is .05 or less, the interpretation is that the difference is <u>probably significant</u>. Finally, in any comparison in which the probability level is .01 or less, the interpretation is that the difference is <u>almost certainly significant.</u> It is emphasized that all conclusions must be regarded as provisional and that all the above interpretations apply only to that data which is being examined in regards to the null hypotheses as stated in Section (iv) of Chapter II.

In the following tables, both the unadjusted Chi-square (χ^2) and the adjusted Chi- square (χ^2yc) values have been calculated for all comparisons. The value or values of the Chi-square used in interpretation are underlined.

Where a statistically significant difference is indicated by the Chi-square value, the symbol Y is used to indicate a probability level of .05 or less, and the symbol YY is used to indicate a probability level of .01 or less. These appear to the right of the Chi-square values in the tables under the heading P^2. In those comparisons in which the Fisher's test (P) is applied (where N = 8 to 50), the symbol X is used to indicate a probability level of .05 or less and the symbol XX is used to indicate a probability level of .01 or less. These symbols appear to the right of the Chi-square symbols (Y and YY).

The comparison of the dental samples is now presented in tabular form with accompanying discussion. The results will be summarized at the end of the chapter.

(i) Maxillary Dentition

TABLE 6.1

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary Central Incisors

6.1.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.2 semi-shovel	5	2					
1.3 marked	10	1	18	1.17	0.19		
Lingual fossa							
2.1 ridges absent	11	2					
2.2,3 ridges present	3	1	17	0.20	0.10		
Lingual cervical area							
3.5 grooves etc. absent	11	2					
3.1,2,3,4 grooves etc. present	6	1	20	0.00	0.35		
Buccal shovel shape							
4.1 absent	10	2					
4.2,3 present	6	1	19	0.02	0.27		
Buccal ridges							
5.1 present	3	0					
5.2 absent	10	3	16	0.85	0.01		
Anomalous conditions							
6.1 absent	16	3					
6.2,3,4,5 present	0	0	19	0.00	0.00		

6.1.2 Shaver Hill(Sh)/Sopher(So) comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.2 semi-shovel	5	5					
1.3 marked	10	7	27	0.20	0.00		
Lingual fossa							
2.1 ridges absent	11	10					
2.2,3 ridges present	3	3	27	0.01	0.13		

6.1.2 (cont'd)

Category	Sh	So	N	x^2	x^2_{yc}	P_{x2}	P
Lingual cervical area							
3.5 grooves etc. absent	11	8					
3.1,2,3,4 present	6	3	28	0.02	0.00		
Buccal shovel							
4.1 absent	10	6					
4.2,3 present	6	4	26	0.02	0.08		
Buccal ridges							
5.1 present	3	2					
5.2 absent	10	11	26	0.25	0.00		
Anomalous conditions							
6.1 absent	16	14					
6.1,2,3,4,5 present	0	0	30	0.00	0.00		

6.1.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x2}	P
Lingual shovel shape							
1.2 semi-shovel	2	5					
1.3 marked	1	7	15	0.60	0.02		
Lingual fossa							
2.1 ridges absent	2	10					
2.2,3 ridges present	1	3	16	0.14	0.14		
Lingual cervical area							
3.5 grooves etc. absent	2	8					
3.1,2,3,4 present	1	3	14	0.04	0.27		
Buccal shovel shape							
4.1 absent	2	6					
4.2,3 present	1	4	13	0.04	0.22		
Buccal ridges							
5.1 present	0	2					
5.2 absent	3	11	16	0.53	0.06		
Anomalous conditions							
6.1 absent	3	14					
6.2,3,4,5 present	0	0	17	0.00	0.00		

Table 6.1 presents the data for the left maxillary

central incisors. A statistically significant difference is not proven for any of the six category comparisons between Shaver Hill and Carton (Table 6.1.1), Shaver Hill and Sopher (Table 6.1.2) or Carton and Sopher (Table 6.1.3).

TABLE 6.2

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary Central Incisors

6.2.1 Shaver Hill(Sh/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
1.2 semi-shovel	3	4					
1.3 marked	9	3	19	1.96	0.82		
Lingual fossa							
2.1 ridges present	6	4					
2.2,3 ridges absent	5	2	17	0.24	0.00		
Lingual cervical area							
3.5 grooves etc. absent	10	4					
3.1,2,3,4 grooves etc. present	3	3	20	0.85	0.17		
Buccal shovel shape							
4.1 absent	4	2					
4.2,3 present	9	4	19	0.01	0.18		
Buccal ridges							
5.1 present	3	3					
5.2 absent	10	4		0.85	0.17		
Anomalous conditions							
6.1 absent	14	7					
6.2,3,4,5 present	0	0	21	0.00	0.00		

6.2.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Lingual shovel shape							
1.2 semi-shovel	3	7					
1.3 marked	9	8	27	1.34	0.57		
Lingual fossa							
2.1 ridges present	6	12					
2.2,3 ridges absent	5	5	28	0.75	0.21		
Lingual cervical area							
3.5 grooves etc. absent	10	10					
3.1,2,3,4 grooves etc. present	3	5	28	0.36	0.03		
Buccal shovel shape							
4.1 absent	4	8					
4.2,3 present	9	7	28	1.47	0.67		
Buccal ridges							
5.1 present	3	3					
5.2 absent	10	12	28	0.04	0.07		
Anomalous conditions							
6.1 absent	14	17					
6.2,3,4,5 present	0	0	32	0.00	0.00		

6.2.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Lingual shovel shape							
1.2 semi-shovel	4	7					
1.3 marked	3	8	22	0.21	0.00		
Lingual fossa							
2.1 ridges present	4	12					
2.2,3 ridges absent	2	5	23	0.03	0.11		
Lingual cervical area							
3.5 grooves etc. absent	4	10					
3.1,2,3,4 grooves etc. present	3	5	22	0.19	0.00		
Buccal shovel shape							
4.1 absent	2	8					
4.2,3 present	4	7	21	0.69	0.12		

6.2.3 (cont'd)

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal ridges							
5.1 present	3	3					
5.2 absent	4	12	22	1.26	0.37		
Anomalous conditions							
6.1 absent	7	17					
6.2,3,4,5 present	0	0	24	0.00	0.00		

Table 6.2 presents the data for the right maxillary central incisors. A statistically significant difference is not proven for any of the six category comparisons between Shaver Hill and Carton (Table 6.2.1), Shaver Hill and Sopher (Table 6.2.2) or Carton and Sopher (Table 6.2.3).

TABLE 6.3

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary Lateral Incisors

6.3.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Lingual shovel shape							
1.2 semi-shovel	6	5					
1.3 marked	3	7	21	1.29	0.48		
Lingual fossa							
2.1 ridges present	6	7					
2.2,3 ridges absent	3	3	19	0.02	0.11		
Lingual cervical area							
3.5 grooves etc. absent	4	1					
3.1,2,3,4 grooves etc. present	7	11	23	2.65	1.26		
Buccal shovel shape							
4.1 absent	6	9					
4.2,3 present	4	1	20	2.40	1.07		

6.3.1 (cont'd)

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal ridges							
5.1 present	2	1					
5.2 absent	7	10	20	0.67	0.04		
Anomalous conditions							
6.1 absent	10	11					
6.2,3,4,5 present	0	1	22	0.87	0.01		

6.3.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	^{2}	$^2_{yc}$	$P_{^2}$	P
Lingual shovel shape							
1.2 semi-shovel	6	6					
1.3 marked	3	3	18	0.00	0.25		
Lingual fossa							
2.1 ridges present	6	7					
2.2,3 absent	3	2	18	0.28	0.00		
Lingual cervical area							
3.5 grooves etc. absent	4	2					
3.1,2,3,4 grooves etc. present	7	8	21	0.69	0.12		
Buccal shovel shape							
4.1 absent	6	6					
4.2,3 present	4	2	18	0.45	0.03		
Buccal ridges							
5.1 present	2	2					
5.2 absent	7	6	17	0.02	0.19		
Anomalous conditions							
6.1 absent	10	8					
6.2,3,4,5 present	0	1	19	1.17	0.00		

6.3.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.2 semi-shovel	5	6					
1.3 marked	7	3	21	1.29	0.48		
Lingual fossa							
2.1 ridges present	7	7					
2.2,3 ridges absent	3	2	19	0.15	0.02		
Lingual cervical area							
3.5 grooves etc. absent	1	2					
3.1,2,3,4 grooves etc.	11	8	22	0.63	0.03		
Buccal shovel shape							
4.1 absent	9	6					
4.2,3 present	1	2	18	0.72	0.05		
Buccal ridges							
5.1 present	1	2					
5.2 absent	10	6	19	0.88	0.09		
Anomalous conditions							
6.1 absent	11	8					
6.2,3,4,5 present	1	1	21	0.05	0.29		

Table 6.3 presents the data for the left maxillary lateral incisors. A statistically significant difference is not proven for any of the six category comparisons between Shaver Hill and Carton (Table 6.3.1), Shaver Hill and Sopher (Table 6.3.2) or Carton and Sopher (Table 6.3.3).

TABLE 6.4

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary Lateral Incisors

6.4.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Lingual shovel shape							
1.2 semi-shovel	3	7					
1.3 marked	7	7	24	0.96	0.31		
Lingual fossa							
2.1 ridges present	5	12					
2.2,3 ridges absent	3	2	22	1.56	0.52		
Lingual cervical area							
3.5 grooves etc. absent	4	1					
3.1,2,3,4 grooves etc. present	7	12	24	2.97	1.49		
Buccal shovel shape							
4.1 absent	3	9					
4.2,3 present	5	3	20	2.81	1.47		
Buccal ridges							
5.1 present	0	2					
5.2 absent	7	10	19	1.30	0.13		
Anomalous conditions							
6.1 absent	10	14					
6.2,3,4,5 present	0	0	24	0.00	0.00		

6.4.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Lingual shovel shape							
1.2 semi-shovel	3	6					
1.3 marked	7	1	17	5.13	3.14		X
Lingual fossa							
2.1 ridges present	5	6					
2.2,3 ridges absent	3	2	16	0.29	0.00		
Lingual cervical area							
3.5 grooves etc. absent	4	3					
3.1,2,3,4 grooves etc. present	7	5	19	0.00	0.19		

6.4.2 (cont'd)

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal shovel shape							
4.1 absent	3	8					
4.2,3 present	5	7	23	0.52	0.08		
Buccal ridges							
5.1 present	0	3					
5.2 absent	7	5	15	3.28	1.36		
Anomalous conditions							
6.1 absent	10	8					
6.2,3,4,5 present	0	1	19	1.17	0.00		

6.4.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Lingual shovel shape							
1.2 semi-shovel	7	6					
1.3 marked	7	1	21	2.52	1.24		
Lingual fossa							
2.1 ridges present	12	6					
2.2,3 ridges absent	2	2	22	0.39	0.00		
Lingual cervical area							
3.5 grooves etc. absent	1	3					
3.1,2,3,4, grooves etc. present	12	5	21	2.85	1.25		
Buccal shovel shape							
4.1 absent	9	8					
4.2,3 present	3	7	27	1.34	0.57		
Buccal ridges							
5.1 present	2	3					
5.2 absent	10	5	20	1.11	0.28		
Anomalous conditions							
6.1 absent	14	8					
6.2,3,4,5 present	0	1	23	1.63	0.05		

Table 6.4 presents the data for the right maxillary lateral incisors. A statistically significant difference is not proven for any of the six category comparisons between

Shaver Hill and Carton (Table 6.4.1), or Carton and Sopher (Table 6.4.3). In the Shaver Hill/Sopher comparisons (Table 6.4.2), one of the six category comparisons indicates a statistically significant difference. Specifically, the Shaver Hill dental sample has a significantly higher incidence of marked lingual shovel shape (1.3) than does the Sopher dental sample.

TABLE 6.5

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary Canines

6.5.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial incisal styles							
1.1 present	0	1					
1.2 absent	2	5	8	0.38	0.38		
Main incisal apex							
2.1,2 typical apex absent	1	5					
2.3 typical apex present	2	1	9	2.25	0.56		
Lingual tubercles & pits							
3.1,2,3,4,5 tubercles &/or pits present	7	16					
3.6 tubercles &/or pits absent	8	16	47	0.05	0.01		

6.5.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial incisal styles							
1.1 present	0	0					
1.2 absent	2	4	6	0.00	0.00		

6.5.2 (cont'd)

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Main incisal apex							
2.1,2 typical apex absent	1	4					
2.3 typical apex present	2	0	7	3.73	1.18		
Lingual tubercles & pits							
3.1,2,3,4,5 tubercles &/or pits present	7	4					
3.6 tubercles &/or pits absent	8	6	25	0.11	0.01		

6.5.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial incisal styles							
1.1 present	1	0					
1.2 absent	5	4	10	0.74	0.05		
Main incisal apex							
2.1,2 typical apex absent	5	4					
2.3 typical apex present	1	0	10	0.74	0.05		
Lingual tubercles & pits							
3.1,2,3,4,5 tubercles &/or pits present	16	4					
3.6 tubercles &/or pits absent	16	6	42	0.31	0.04		

Table 6.5 presents the data for the left maxillary canines. A statistically significant difference is not proven for any of three category comparisons between Shaver Hill and Carton (Table 6.5.1), Shaver Hill and Sopher (Table 6.5.2) or Carton and Sopher (Table 6.5.3).

TABLE 6.6

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary Canines

6.6.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial incisal styles							
1.1 present	1	1					
1.2 absent	7	8	17	0.01	0.44		
Main incisal apex							
2.1,2 typical apex absent	3	3					
2.3 typical apex present	5	4	15	0.05	0.10		
Lingual tubercles & pits							
3.1,2,3,4,5 tubercles &/or pits present	7	13					
3.6 tubercles &/or pits absent	10	16	46	0.06	0.00		

6.6.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial incisal styles							
1.1 present	1	2					
1.2 absent	7	10	20	0.07	0.15		
Main incisal apex							
2.1,2 typical apex absent	3	4					
2.3 typical apex present	5	1	13	2.24	0.85		
Lingual tubercles & pits							
3.1,2,3,4,5 tubercles &/or pits present	7	9					
3.6 tubercles &/or pits absent	10	9	35	0.27	0.03		

6.6.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial incisal styles							
1.1. present	1	2					
1.2 absent	8	10	21	0.13	0.07		
Main incisal apex							
2.1,2 typical apex absent	3	4					
2.3 typical apex present	4	1	12	1.66	0.48		
Lingual tubercles & pits							
3.1,2,3,4,5 tubercles &/or pits present	13	9					
3.6 tubercles &/or	16	9	47	0.12	0.00		

Table 6.6 presents the data for the right maxillary canines. A statistically significant difference is not proven for any of the three category comparisons between Shaver Hill and Carton (Table 6.6.1), Shaver Hill and Sopher (Table 6.6.2) or Carton and Sopher (Table 6.6.3).

TABLE 6.7

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary Premolars

6.7.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	6	3					
1.2 absent	15	23	47	2.18	1.22		
Distal buccal cusplet							
2.1 present	2	1					
2.2 absent	19	26	48	0.68	0.05		

6.7.1 (cont'd)

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal ridges							
3.1 present	19	14					
3.2 absent	7	24	64	8.12	6.73	YY	
Distal transverse ridge							
4.1 present	3	0					
4.2 absent	23	35	61	4.25	2.14		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	12	7					
5.2,3 absent	9	20	48	4.82	3.60		X
5b. blunt form							
5.2 present	6	16					
5.1,3 absent	15	11	48	4.48	3.31		X
5c. intermediate form							
5.3 present	3	4					
5.1,2 absent	18	23	48	0.00	0.13		
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	8	4					
6.2,3 absent	10	20	42	3.89	2.65		
6b. blunt form							
6.2 present	4	17					
6.1,3 absent	14	7	42	9.72	7.88	YY	XX
6c. intermediate form							
6.3 present	6	3					
6.1,2 absent	12	21	42	2.65	1.56		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	15	36					
7.2,3 absent	10	4	65	8.19	6.51	Y	
7b. lingual aligned to buccal							
7.2 present	5	4					
7.1,3 absent	20	36	65	1.29	0.59		
7c. lingual distal to buccal							
7.3 present	5	0					
7.1,2 absent	20	40	65	8.67	6.08	Y	

6.7.1 (cont'd)

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Cusp masses							
8.1 buccal > lingual	17	19					
8.2 buccal = lingual	7	18	61	2.25	1.55		
Relative premolar sizes							
9.1,3 1st not equal in size to 2nd	2	9					
9.2 1st equal in size to 2nd	5	25	41	0.01	0.13		

6.7.2 Shaver Hill(Sh)/Sopher(Sø) Comparison

Category	Sh	So	N	^{2}	$^2_{yc}$	$P_{^2}$	P
Mesial buccal cusplet							
1.1 present	6	3					
1.2 absent	15	11	35	0.22	0.01		
Distal buccal cusplet							
2.1 present	2	1					
2.2 absent	19	13	35	0.06	0.14		
Buccal ridges							
3.1 present	19	8					
3.2 absent	7	8	42	2.30	1.40		
Distal transverse ridge							
4.1 present	3	3					
4.2 absent	23	11	40	0.70	0.14		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	12	1					
5.2,3 absent	9	11	33	7.62	5.71	Y	XX
5b. blunt form							
5.2 present	6	2					
5.1,3 absent	15	10	33	0.59	0.12		
5c. intermediate form							
5.3 present	3	9					
5.1,2 absent	18	3	33	12.17	9.68	YY	XX

6.7.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	8	1					
6.2,3 absent	10	11	30	4.47	2.92		X
6b. blunt form							
6.2 present	4	2					
6.1,3 absent	14	10	30	0.14	0.01		
6c. intermediate form							
6.3 present	6	9					
6.1,2 absent	12	3	30	5.00	3.47		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	15	13					
7.2,3 absent	10	4	42	1.24	0.61		
7b. lingual aligned to buccal							
7.2 present	5	1					
7.1,3 absent	20	16	42	1.65	0.70		
7c. lingual distal to buccal							
7.3 present	5	3					
7.1,2 absent	20	14	42	0.06	0.04		
Cusp masses							
8.1 buccal > lingual	17	12					
8.2 buccal = lingual	7	5	41	0.00	0.11		
Relative premolar sizes							
9.1,3 1st not equal in size to 2nd	2	4					
9.2 1st equal in size to 2nd	5	8	19	0.05	0.09		

6.7.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial buccal cusplet							
1.1 present	3	3					
1.2 absent	23	11	40	0.70	0.14		
Distal buccal cusplet							
2.1 present	1	1					
2.2 absent	26	13	41	0.24	0.08		
Buccal ridges							
3.1 present	14	8					
3.2 absent	24	8	54	0.81	0.35		

6.7.3 (cont'd)

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Distal transverse ridge							
4.1 present	0	3					
4.2 absent	35	11	49	7.99	4.70	Y	X
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	7	1					
5.2,3 absent	20	11	39	1.58	0.68		
5b. blunt form							
5.2 present	16	2					
5.1,3 absent	11	10	39	6.06	4.47	Y	X
5c. intermediate form							
5.3 present	4	9					
5.1,2 absent	23	3	39	13.54	10.97	YY	XX
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	4	1					
6.2,3 absent	20	11	36	0.46	0.03		
6b. blunt form							
6.2 present	17	2					
6.1,3 absent	7	10	36	5.37	7.37	YY	XX
6c. intermediate form							
6.3 present	3	9					
6.1,2 absent	21	3	36	14.06	11.39	YY	XX
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	36	13					
7.2,3 absent	4	4	57	1.81	0.86		
7b. lingual aligned to buccal							
7.2 present	4	1					
7.1,3 absent	36	16	57	0.25	0.00		
7c. lingual distal to buccal							
7.3 present	0	3					
7.1,2 absent	40	14	57	7.45	4.33	Y	
Cusp masses							
8.1 buccal > lingual	19	12					
8.2 buccal = lingual	18	5	54	1.76	1.06		
Relative premolar sizes							
9.1,3 1st not equal in size to 2nd	9	4					
9.2 1st equal in size to 2nd	25	8	46	0.21	0.01		

Table 6.7 presents the data for the left maxillary first premolars. In the Shaver Hill/Carton comparison (Table 6.7.1) four of the nine category comparisons indicate a statistically significant difference. Specifically, the Shaver Hill dental sample has a significantly higher incidence of buccal ridges (3.1) than the Carton dental sample. For the inclination of the buccal cusp ridges category (5.), the Shaver Hill dental sample had a significantly higher incidence of the sharp conical form (5.1) while Carton had a significantly higher incidence of the blunt form (5.2). The Carton dental sample had a significantly higher incidence of the blunt form (6.2) of the inclination of the lingual cusp ridges (6.). In the case of the buccal and lingual cusp relationship (7.), the Shaver Hill dental sample had a significantly higher incidence of cases in which the lingual cusp was mesial to the buccal cusp (7.1) while the Carton dental sample had a significantly higher incidence of cases in which the lingual cusp was distal to the buccal cusp (7.3).

Two of the nine category comparisons between Shaver Hill and Sopher (Table 6.7.2) indicate a statistically significant difference. First, the Sopher sample has a significantly higher incidence of the intermediate form of inclination of the buccal cusp ridges (5.3) while the Shaver Hill dental sample had a significantly higher incidence of the sharp conical form (5.1). Secondly, the Shaver Hill sample has a significantly higher incidence of the sharp

conical form of the lingual cusp ridge inclination (6.) In the Carton/Sopher comparison, four of the nine category comparisons (Table 6.7.3) indicate a statistically significant difference. First of all, the Sopher sample has a significantly higher incidence of distal transverse ridges (4.1) than does Carton. Secondly, the Sopher sample has a significantly higher incidence of the intermediate form of inclination of the buccal cusp ridges (5.3), while the Carton sample has a significantly higher incidence of the blunt form (5.2). Thirdly, the Sopher sample has a significantly higher incidence of the intermediate form of inclination of the lingual cusp ridges (6.3), while the Carton sample has a significantly higher incidence of the blunt form (6.2). Finally, the Sopher sample has a significantly higher incidence of cases in which the lingual cusp is distal to the buccal cusp (7.3).

TABLE 6.8

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary First Premolars

6.8.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	1	3					
1.2 absent	6	32	32	0.03	0.24		
Distal buccal cusplet							
2.1 present	0	0					
2.2 absent	10	25	35	0.00	0.00		

6.8.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal ridges							
3.1 present	9	13					
3.2 absent	6	23	51	2.46	1.59		
Distal transverse ridge							
4.1 present	1	3					
4.2 absent	10	30	44	0.00	0.37		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	7	4					
5.2,3 absent	4	22	37	8.62	6.46	Y	XX
5b. blunt form							
5.2 present	3	16					
5.1,3 absent	8	10	37	3.63	2.39		
5c. intermediate form							
5.3 present	1	6					
5.1,2 absent	10	20	37	0.99	0.79		
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	4	6					
6.2,3 absent	7	15	32	0.20	0.00		
6b. blunt form							
6.2 present	4	7					
6.1,3 absent	7	14	32	0.03	0.05		
6c. intermediate form							
6.3 present	3	8					
6.1,2 absent	8	13	32	0.38	0.05		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	11	33					
7.2,3 absent	6	4		4.63	3.15		
7b. lingual aligned to buccal							
7.2 present	5	4					
7.1,3 absent	12	33	54	2.90	1.72		
7c. lingual distal to buccal							
7.3 present	1	0					
7.1,2 absent	16	37	54	2.20	0.16		
Cusp masses							
8.1 buccal > lingual	8	18					
8.2 buccal = lingual	7	17	50	0.15	0.03		

6.8.1 (cont'd)

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Relative premolar sizes							
9.1,3 1st not equal in size to 2nd	3	8					
9.2 1st equal in size to 2nd	4	20	35	0.53	0.08		

6.8.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	1	9					
1.2 absent	6	11	27	2.10	0.99		
Distal buccal cusplet							
2.1 present	0	2					
2.2 absent	10	14	26	1.35	0.17		
Buccal ridges							
3.1 present	9	12					
3.2 absent	6	10	37	0.11	0.00		
Distal transverse ridge							
4.1 present	1	5					
4.2 absent	10	17	33	0.92	0.23		
Inclination of buccal cusp ridges							
5a. 5.1 present	7	5					
5.2,3 absent	4	10	26	2.35	1.28		
5b. blunt form							
5.2 present	3	3					
5.1,3 absent	8	12	26	0.19	0.00		
5c. intermediate form							
5.3 present	1	10					
5.1,2 absent	10	5	26	8.62	6.42	Y	X
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	4	4					
6.2,3 absent	7	13	28	0.54	0.09		
6b. blunt form							
6.2 present	4	8					
6.1,3 absent	7	9	28	0.31	0.03		
6c. intermediate form							
6.3 present	3	5					
6.1,2 absent	8	12	28	0.02	0.09		

6.8.2 (cont'd)

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	11	16					
7.2,3 absent	6	6	39	0.29	0.04		
7b. lingual aligned to buccal							
7.2 present	5	2					
7.1,3 absent	12	20	39	2.69	1.49		
7c. lingual distal to buccal							
7.3 present	1	4					
7.1,2 absent	16	18	39	1.30	0.43		

6.8.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	3	9					
1.2 absent	22	11	45	6.19	4.62	Y	X
Distal buccal cusplet							
2.1 present	0	2					
2.2 absent	25	14	41	3.29	1.14		
Buccal ridges							
3.1 present	13	12					
3.2 absent	23	10	58	1.89	1.22		
Distal transverse ridge							
4.1 present	3	5					
4.2 absent	30	17	55	1.98	1.03		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	4	5					
5.2,3 absent	22	10	41	1.79	0.89		
5b. blunt form							
5.2 present	16	3					
5.1,3 absent	10	12	41	6.60	5.04	Y	X
5c. intermediate form							
5.3 present	6	10					
5.1,2 absent	20	5	41	7.60	5.87	Y	XX

6.8.3 (cont'd)

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	6	4					
6.2,3 absent	15	13	38	0.12	0.00		
6b. blunt form							
6.2 present	7	8					
6.1,3 absent	14	9	38	0.74	0.28		
6c. intermediate form							
6.3 present	8	5					
6.1,2 absent	13	12	38	0.32	0.05		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	33	16					
7.2,3 absent	4	6	59	2.66	1.62		
7b. lingual aligned to buccal							
7.2 present	4	2					
7.1,3 absent	33	22	59	0.05	0.06		
7c. lingual distal to buccal							
7.3 present	0	4					
7.1,2 absent	37	18	59	7.22	4.63		Y
Cusp masses							
8.1 buccal >lingual	18	20					
8.2 buccal = lingual	17	3	58	7.24	5.79		Y
Relative premolar sizes							
9.1,3 1st not equal in size to 2nd	8	3					
9.2 1st equal in size to 2nd	20	3	34	1.04	0.29		

Table 6.8 presents the data for the right maxillary first premolars. A statistically significant difference has been proven for one of the nine category comparisons between Shaver Hill and Carton (Table 6.8.1). In this case, the Shaver Hill sample has a significantly higher incidence of the sharp conical form of buccal cusp ridge inclination (5.1).

In the Shaver Hill/Sopher comparisons (Table 6.8.2), two category comparisons indicate statistically significant differences. Specifically, the Sopher sample has a significantly higher incidence of the intermediate form of inclination of the buccal cusp ridges (5.3), and secondly, the Shaver Hill sample has a significantly higher incidence of cases in which the mass of the buccal and lingual cusps are approximately equal in size (8.2). Four of the nine category comparisons between Carton and Sopher (Table 6.8.3) indicate a statistically significant difference. First of all, the Sopher sample has a significantly higher incidence of the mesial accessory buccal cusplet (1.1) than does the Carton sample. Secondly, Carton has a significantly higher incidence of cases in which the mass of the buccal and the lingual cusps are approximately equal in size (8.2). Thirdly, the Sopher sample has a significantly higher incidence of the intermediate form of inclination of the buccal cusp ridges (5.3) while the Carton sample has a significantly higher incidence of the blunt form (5.2). Finally, Sopher has a higher incidence of the lingual cusp being distal to the buccal cusp (7.3).

TABLE 6.9

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary Second Premolars

6.9.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x2}	P
Mesial buccal cusplet							
1.1 present	2	6					
1.2 absent	6	16	30	0.02	0.12		
Distal buccal cusplet							
2.1 present	0	5					
2.2 absent	8	17	30	2.18	0.85		
Buccal ridges							
3.1 present	5	11					
3.2 absent	7	26	49	0.59	0.17		
Distal transverse ridge							
4.1 present	4	16					
4.2 absent	5	12	37	0.44	0.08		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	2	2					
5.2,3 absent	6	22	32	1.52	0.38		
5b. blunt form							
5.2 present	4	19					
5.1,3 absent	4	5	32	2.53	1.29		
5c. intermediate form							
5.3 present	2	3					
5.1,2 absent	6	21	32	0.71	0.08		
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	2	5					
6.2,3 absent	6	11	24	0.10	0.03		
6b. blunt form							
6.2 present	2	7					
6.1,3 absent	6	9	24	0.71	0.11		
6c. intermediate form							
6.3 present	4	4					
6.1,2 absent	4	12	24	1.50	0.59		

6.9.1 (cont'd)

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	6	28					
7.2,3 absent	6	12	52	1.63	0.87		
7b. lingual aligned to buccal							
7.2 present	5	9					
7.1,3 absent	7	31	52	1.72	0.89		
7c. lingual distal to buccal							
7.3 present	1	3					
7.1,2 absent	11	37	52	0.01	0.27		
Cusp masses							
8.1 buccal >lingual	4	22					
8.2 buccal = lingual	10	12	48	5.22	3.86	Y	X

6.9.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	2	7					
1.2 absent	6	13	28	0.26	0.00		
Distal buccal cusplet							
2.1 present	0	9					
2.2 absent	8	11	28	4.79	2.98		X
Buccal ridges							
3.1 present	5	14					
3.2 absent	7	8	34	1.52	0.76		
Distal transverse ridge							
4.1 present	4	10					
4.2 absent	5	9	28	0.16	0.00		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	2	0					
5.2,3 absent	6	17	25	4.62	1.85		X
5b. blunt form							
5.2 present	4	13					
5.1,3 absent	4	4	25	1.75	0.75		
5c. intermediate form							
5.3 present	2	4					
5.1,2 absent	6	13	25	0.01	0.18		

6.9.2 (cont'd)

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	2	0					
6.2,3 absent	6	15	23	4.11	1.56		X
6b. blunt form							
6.2 present	2	9					
6.1,3 absent	6	6	23	2.56	1.35		
6c. intermediate form							
6.3 present	4	6					
6.1,2 absent	4	9	23	0.21	0.00		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	6	10					
7.2,3 absent	6	12	34	0.06	0.01		
7b. lingual aligned to buccal							
7.2 present	5	10					
7.1,3 absent	7	12	34	0.05	0.02		
7c. lingual distal to buccal							
7.3 present	1	2					
7.1,2 absent	11	20	34	0.01	0.31		
Cusp masses							
8.1 present	4	6					
8.2 absent	10	16	36	0.01	0.09		

6.9.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	6	7					
1.2 absent	16	13	42	0.29	0.04		
Distal buccal cusplet							
2.1 present	5	9					
2.2 absent	17	11	42	1.77	0.99		
Buccal ridges							
3.1 present	11	14					
3.2 absent	26	8	59	6.50	5.18	Y	X
Distal transverse ridge							
4.1 present	16	10					
4.2 absent	12	9	47	0.09	0.00		

6.9.3 (cont'd)

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	2	0					
5.2,3 absent	22	17	41	1.49	0.23		
5b. blunt form							
5.2 present	19	13					
5.1,3 absent	5	4	41	0.04	0.03		
5c. intermediate form							
5.3 present	3	4					
5.1,2 absent	21	13	41	0.86	0.25		
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	5	0					
6.2,3 absent	11	15	31	3.59	3.52		X
6b. blunt form							
6.2 present	7	9					
6.1,3 absent	9	6	31	0.82	0.30		
6c. intermediate form							
6.3 present	4	6					
6.1,2 absent	2	9	31	0.80	0.26		
Buccal lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	28	10					
7.2,3 absent	12	12	62	3.60	2.64		
7b. lingual aligned to buccal							
7.2 present	9	10					
7.1,3 absent	31	12	62	3.52	2.52		
7c. lingual distal to buccal							
7.3 present	3	2					
7.1,2 absent	37	20	62	0.05	0.07		
Cusp masses							
8.1 buccal >lingual	22	6					
8.2 buccal = lingual	12	16	56	7.49	6.06	Y	X

Table 6.9 presents the data for the left maxillary second premolars. In the Shaver Hill/Carton comparisons (Table 6.9.1), one of the eight category comparisons indicates

a statistically significant difference. Specifically, the Shaver Hill dental sample has a significantly higher incidence of cases in which the buccal and lingual cusp masses are approximately equal in size (8.2). Three of the eight category comparisons indicate a statistically significant difference in the Shaver Hill/Sopher comparison (Table 6.9.2). First of all, the Shaver Hill sample has a significantly higher incidence of the sharp conical buccal cusp ridge inclination (5.1). Secondly, the Sopher sample has a significantly higher incidence of the sharp conical form of buccal cusp ridge inclination (6.1). Finally, the Sopher sample has a significantly higher incidence of the distal accessory cusp (2.1). Three of the eight category comparisons indicate a statistically significant difference between Carton and Sopher (Table 6.9.3). First of all, the Sopher sample has a significantly higher incidence of buccal ridges (3.1) than does the Carton sample. Similarly, the Sopher sample has a significantly higher incidence of cases in which the buccal and lingual cusp masses are equal (8.2). Finally, the Carton sample has a significantly higher incidence of the sharp conical form of inclination of the lingual cusp ridge.(6.1).

TABLE 6.10

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary Second Premolars

6.10.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Mesial buccal cusplet							
1.1 present	7	6					
1.2 absent	17	17	47	0.06	0.01		
Distal buccal cusplet							
2.1 present	1	5					
2.2 absent	15	19	40	1.42	0.54		
Buccal ridges							
3.1 present	12	11					
3.2 absent	8	21	52	3.28	2.32		
Distal transverse ridge							
4.1 present	5	11					
4.2 absent	14	14	44	1.46	0.80		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	5	3					
5.2,3 absent	10	22	40	2.67	1.50		
5b. blunt form							
5.2 present	7	18					
5.1,3 absent	8	7	40	2.56	1.60		
5c. intermediate form							
5.3 present	3	4					
5.1,2 absent	12	21	40	0.10	0.02		
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	5	5					
6.2,3 absent	11	15	36	0.17	0.00		
6b. blunt form							
6.2 present	7	8					
6.1,3 absent	9	12	36	0.05	0.01		
6c. intermediate form							
6.3 present	4	7					
6.1,2 absent	12	13	36	0.42	0.08		

6.10.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	9	30					
7.2,3 absent	13	12	58	5.74	4.42	Y	
7b. lingual aligned to buccal							
7.2 present	10	8					
7.1,3 absent	12	28	58	3.44	2.44		
7c. lingual distal to buccal							
7.3 present	3	6					
7.1,2 absent	19	30	58	0.09	0.00		
Cusp masses							
8.1 buccal >lingual	11	21					
8.2 buccal = lingual	11	14	57	0.55	0.22		

6.10.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial buccal cusplet							
1.1 present	7	4					
1.2 absent	17	7	35	0.18	0.00		
Distal buccal cusplet							
2.1 present	1	5					
2.2 absent	15	6	27	5.38	3.42		
Buccal ridges							
3.1 present	12	6					
3.2 absent	8	5	31	0.10	0.00		
Distal transverse ridge							
4.1 present	5	5					
4.2 absent	14	4	28	2.27	1.18		
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	5	1					
5.2,3 absent	10	5	21	0.58	0.05		
5b. blunt form							
5.2 present	7	4					
5.1,3 absent	8	2	21	0.69	0.12		
5c. intermediate form							
5.3 present	3	1					
5.1,2 absent	12	5	21	0.03	0.19		

6.10.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	5	1					
6.2,3 absent	11	7	24	1.00	0.25		
6b. blunt form							
6.2 present	7	2					
6.1,3 absent	9	6	24	0.80	0.20		
6c. intermediate form							
6.3 present	4	5					
6.1,2 absent	12	3	24	3.20	1.80		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	9	2					
7.2,3 absent	13	9	33	1.70	0.83		
7b. lingual aligned to buccal							
7.2 present	10	9					
7.1,3 absent	12	2	33	3.97	2.62		
7c. lingual distal to buccal							
7.3 present	3	0					
7.1,2 absent	19	11	33	1.65	0.41		
Cusp masses							
8.1 present	11	2					
8.2 absent	11	9	33	3.11	1.92		

6.10.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Mesial buccal cusplet							
1.1 present	6	4					
1.2 absent	17	7	34	0.38	0.05		
Distal buccal cusplet							
2.1 present	5	5					
2.2 absent	19	6	35	2.24	1.20		
Buccal ridges							
3.1 present	11	6					
3.2 absent	21	5	43	1.39	0.68		
Distal transverse ridge							
4.1 present	11	5					
4.2 absent	14	4	34	0.36	0.04		

6.10.3 (cont'd)

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Inclination of buccal cusp ridges							
5a. sharp conical form							
5.1 present	3	1					
5.2,3 absent	22	5	31	0.09	0.13		
5b. blunt form							
5.2 present	18	4					
5.1,3 absent	7	2	31	0.07	0.06		
5c. intermediate form							
5.3 present	4	1					
5.1,2 absent	21	5	31	0.00	0.33		
Inclination of lingual cusp ridges							
6a. sharp conical form							
6.1 present	5	1					
6.2,3 absent	15	7	28	0.53	0.05		
6b. blunt form							
6.2 present	8	2					
6.1,3 absent	12	6	28	0.56	0.09		
6c. intermediate form							
6.3 present	7	5					
6.1,2 absent	13	3	28	1.77	0.82		
Buccal/lingual cusp relationship							
7a. lingual mesial to buccal							
7.1 present	30	2					
7.2,3 absent	12	9	47	9.93	8.24	YY	XX
7b. lingual aligned to buccal							
7.2 present	8	9					
7.1,3 absent	28	2	47	12.96	10.51	YY	XX
7c. lingual distal to buccal							
7.3 present	6	0					
7.1,2 absent	30	11	47	2.10	0.87		
Cusp masses							
8.1 present	21	2					
8.2 absent	14	9	46	5.86	4.30	Y	X

Table 6.10 presents the data for the right maxillary second premolars. A statistically significant difference is indicated for one of the eight categories in the Shaver Hill/ Carton comparisons (Table 6.10.1). In this case, the Carton

has a significantly higher incidence of cases in which the lingual cusp is mesial to the buccal cusp (7.1). One of the eight category comparisons indicated a statistically significant difference between Shaver Hill and Sopher (Table 6.10.2). Specifically, the Sopher sample has a significantly higher incidence of the distal accessory buccal cusplet (2.1). In the Carton/Sopher comparison (Table 6.10.3) two of the category comparisons indicate a statistically significant difference. First of all, the Sopher sample has a significantly higher incidence of aligned buccal and lingual cusps (7.2) while the Carton sample has a significantly higher incidence of the lingual cusp being mesial to the buccal cusp (7.1). Secondly, the Sopher sample has a significantly higher incidence of cases in which the buccal and lingual cusp masses are approximately equal in size (8.2).

TABLE 6.11

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary First Molars

6.11.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	7	12					
1.4 distolingual equal in size to others	26	45	90	0.00	0.06		
Carabelli's trait							
2.5 absent	19	28					
2.1,2,3,4 present	13	26	86	0.46	0.21		
Buccal enamel extension							
3.1 absent	15	30					
3.2,3,4 present	14	17	76	1.09	0.65		
Lingual enamel extension							
4.1 absent	30	51					
4.2,3,4 present	1	0	82	1.67	0.06		
Anterior transverse ridge							
5.4 absent	2	2					
5.1,2,3 present	12	17	33	0.11	0.05		
Size of oblique ridge							
6.1 pronounced	3	5					
6.2 small	19	29	56	0.01	0.08		
Oblique ridge continuity							
7.1 solid ridge present	8	9					
7.2,3 solid ridge absent	13	28	58	1.23	0.65		
Mesial marginal ridge tubercle							
8.1 tubercles absent	3	1					
8.2,3,4,5,6 tubercles present	7	9	20	1.25	0.31		
Distal marginal ridge							
9.1,2,3 solid ridge absent	18	15					
9.4 solid ridge present	5	2	40	0.67	0.16		

6.11.1 (cont'd)

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Buccal groove termination							
10.1 abrupt	5	15					
10.2 blends in	23	43	86	0.68	0.30		
Lingual groove termination							
11.1 abrupt	27	51					
11.2 blends in	5	5	88	0.91	0.36		

6.11.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	7	8					
1.4 distolingual equal in size to others	26	25	66	0.09	0.00		
Carabelli's trait							
2.5 absent	19	18					
2.1,2,3,4 present	13	14	64	0.06	0.00		
Buccal enamel extension							
3.1 absent	15	4					
3.2,3,4 present	14	20	53	7.02	5.58	Y	
Lingual enamel extension							
4.1 absent	30	25					
4.2,3,4 present	1	1	57	0.02	0.36		
Anterior transverse ridge							
5.4 absent	2	8					
5.1,2,3 present	12	13	35	2.33	1.31		
Size of oblique ridge							
6.1 pronounced	3	11					
6.2 small	19	16	49	4.36	3.14		
Oblique ridge continuity							
7.1 solid ridge present	8	7					
7.2,3 solid ridge absent	13	19	47	0.67	0.25		
Mesial marginal ridge tubercles							
8.1 tubercles absent	3	5					
8.2,3,4,5,6 tubercles present	7	7	22	0.32	0.02		

6.11.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distal marginal ridge							
9.1,2,3 solid ridge absent	18	12					
9.4 solid ridge present	5	2	37	0.32	0.02		
Buccal groove termination							
10.1 abrupt	5	8					
10.2 blends in	23	18	54	1.23	0.63		
Lingual groove termination							
11.1 abrupt	27	30					
11.2 blends in	5	2	64	1.44	0.64		

6.11.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	12	8					
1.4 distolingual cusp equal in size to others	45	25	90	0.12	0.01		
Carabelli's trait							
2.5 absent	28	18					
2.1,2,3,4 present	26	14	86	0.16	0.03		
Buccal enamel extension							
3.1 absent	30	4					
3.2,3,4 present	17	20	71	14.16	12.33	YY	XX
Lingual enamel extension							
4.1 absent	51	25					
4.2,3,4 present	0	1	77	1.99	0.12		
Anterior transverse ridge							
5.4 absent	2	8					
5.1,2,3 present	17	13	40	4.04	2.71		
Size of oblique ridge							
6.1 pronounced	5	11					
6.2 small	29	16	61	5.27	4.01	Y	
Oblique ridge continuity							
7.1 solid ridge present	9	7					
7.2,3 solid ridge absent	28	19	63	0.05	0.00		

6.11.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial marginal ridge tubercles							
8.1 tubercles absent	1	5					
8.2,3,4,5,6 tubercles present	9	7	22	2.76	1.39		
Distal marginal ridge							
9.1,2,3 solid ridge absent	15	12					
9.4 solid ridge present	2	2	31	0.04	0.11		
Buccal groove termination							
10.1 abrupt	15	8					
10.2 blends in	43	18	84	0.22	0.04		
Lingual groove termination							
11.1 abrupt	51	30					
11.2 blends in	5	2	88	0.20	0.00		

Table 6.11 presents the data for the left maxillary first molar. A statistically significant difference has not been proven for any of the eleven category comparisons between Shaver Hill and Carton (Table 6.11.1). One of the eleven category comparisons between Shaver Hill and Sopher (Table 6.11.2) indicates a statistically significant difference. Specifically, the Sopher sample has a significantly higher incidence of buccal enamel extensions (3.2,3,4). Two of the category comparisons between Carton and Sopher (Table 6.11.3) indicate a statistically significant difference. First of all, Sopher has a significantly higher incidence of buccal enamel extensions (3.2,3,4), and secondly, the Sopher sample has a significantly higher incidence of prominent oblique ridges (6.1).

TABLE 6.12

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary First Molar

6.12.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	x^2	x^2_{yc}	P_{x^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	6	8					
1.4 distolingual cusp equal in size to others	38	59	111	0.07	0.00		
Carabelli's trait							
2.5 absent	20	31					
2.1,2,3,4 present	22	33	106	0.01	0.01		
Buccal enamel extension							
3.1 absent	23	40					
3.2,3,4 present	11	18	92	0.02	0.01		
Lingual enamel extension							
4.1 absent	39	62					
4.2,3,4 present	0	0	101	0.00	0.00		
Anterior transverse ridge							
5.4 absent	0	3					
5.1,2,3 present	20	20	43	2.80	1.16		
Size of oblique ridge							
6.1 pronounced	6	11					
6.2 small	24	32	73	0.31	0.08		
Oblique ridge continuity							
7.1 solid ridge present	8	12					
7.2,3 solid ridge absent	23	30	73	0.07	0.00		
Mesial marginal ridge tubercles							
8.1 tubercles absent	3	2					
8.2,3,4,5 tubercles present	11	7	23	0.00	0.22		
Distal marginal ridge							
9.1,2,3 solid ridge absent	14	20					
9.4 solid ridge present	10	4	48	3.63	2.52		

6.12.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal groove termination							
10.1 abrupt	8	10					
10.2 blends in	31	56	105	0.50	0.19		
Lingual groove termination							
11.1 abrupt	38	60					
11.2 blends in	3	7	108	0.30	0.04		

6.12.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	^{2}	$^2_{yc}$	$P_{^2}$	P
Cusp number							
1.2,3 distolingual cusp smaller than others	6	7					
1.4 distolingual cusp equal in size to others	38	29	80	0.49	0.16		
Carabelli's trait							
2.5 absent	20	9					
2.1,2,3,4 present	22	27	78	4.25	3.33		
Buccal enamel extension							
3.1 absent	23	10					
3.2,3,4 present	11	12	56	2.72	1.88		
Lingual enamel extension							
4.1 absent	39	23					
4.2,3,4 present	0	1	63	1.65	0.06		
Anterior transverse ridge							
5.4 absent	0	8					
5.1,2,3 present	20	17	45	7.78	5.75	Y	XX
Size of oblique ridge							
6.1 pronounced	6	14					
6.2 small	24	19	63	3.65	2.69		
Oblique ridge continuity							
7.1 solid ridge present	8	9					
7.2,3 solid ridge absent	23	24	64	0.02	0.02		
Mesial marginal ridge tubercles							
8.1 tubercles absent	3	9					
8.2,3,4,5 tubercles present	11	9	32	2.74	1.66		

6.12.2 (cont'd)

Category	Sh	So	N	x^2	x^2_{yc}	P_{x^2}	P
Distal marginal ridge							
9.1,2,3 solid ridge absent	14	21					
9.4 solid ridge present	10	3	48	5.17	3.80		X
Buccal groove termination							
10.1 abrupt	8	7					
10.2 blends in	31	24	70	0.04	0.01		
Lingual groove termination							
11.1 abrupt	38	32					
11.2 blends in	3	1	74	0.66	0.09		

6.12.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	x^2	x^2_{yc}	P_{x^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	8	7					
1.4 distolingual cusp equal in size to others	59	29	103	1.06	0.54		
Carabelli's trait							
2.5 absent	31	9					
2.1,2,3,4 present	33	27	100	5.27	4.34	Y	
Buccal enamel extension							
3.1 absent	40	10					
3.2,3,4 present	18	12	80	3.76	2.83		
Lingual enamel extension							
4.1 absent	62	23					
4.2,3,4 present	0	1	86	2.61	0.25		
Anterior transverse ridge							
5.4 absent	3	8					
5.1,2,3 present	20	17	48	2.44	1.48		
Size of oblique ridge							
6.1 pronounced	11	14					
6.2 small	32	19	76	2.40	1.70		
Oblique ridge continuity							
7.1 solid ridge present	12	9					
7.2,3 solid ridge absent	30	24	75	0.02	0.02		

6.12.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial marginal ridge tubercles							
8.1 tubercles absent	2	9					
8.2,3,4,5 tubercles present	7	9	27	1.92	0.94		
Distal marginal ridge							
9.1,2,3 solid ridge absent	20	21					
9.4 solid ridge present	4	3	48	0.17	0.00		
Buccal groove termination							
10.1 abrupt	10	7					
10.2 blends in	56	24	97	0.81	0.37		
Lingual groove termination							
11.1 abrupt	60	32					
11.2 blends in	7	1	100	1.65	0.80		

Table 6.12 presents the data for the right maxillary first molars. A statistically significant difference is not proven for any of the eleven category comparisons between Shaver Hill and Carton (Table 6.12.1). Two of the eleven categories indicate statistically significant differences in the Shaver Hill/Sopher comparisons (Table 6.12.2). Specifically, the Shaver Hill sample has a significantly higher incidence of both the anterior transverse ridge (5.1,2,3) and the solid distal marginal ridge (9.4). In the Carton/Sopher comparison, one of the eleven categories indicate a statistically significant difference. In this case, the Sopher sample has a significantly higher incidence of Carabelli's trait (2.1,2,3,4).

TABLE 6.13

COMPARISON OF CATEGORY OBSERVATIONS

Left Maxillary Second Molars

6.13.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	16	22					
1.4 distolingual cusp equal in size to others	2	1	41	0.68	0.05		
Carabelli's trait							
2.5 absent	21	31					
2.1,2,3,4 present	3	1	56	1.82	0.68		
Buccal enamel extension							
3.1 absent	2	6					
3.2,3,4 present	18	28	54	0.58	0.14		
Lingual enamel extension							
4.1 absent	21	36					
4.2,3,4 present	4	3	64	1.08	0.40		
Anterior transverse ridge							
5.4 absent	6	7					
5.1,2,3 present	5	5	23	0.03	0.06		
Size of oblique ridge							
6.1 pronounced	1	1					
6.2 small	8	18	28	0.32	0.05		
Cblique ridge continuity							
7.1 solid ridge present	2	1					
7.2,3 solid ridge absent	9	19	31	1.41	0.31		
Mesial marginal ridge tubercles							
8.1 tubercles absent	5	1					
8.2,3,4,5 tubercles present	4	6	16	2.86	1.37		
Distal marginal ridge							
9.1,2,3 solid ridge absent	13	8					
9.4 solid ridge present	0	3	24	3.76	1.74		

6.13.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal groove termination							
10.1 abrupt	3	2					
10.2 blends in	15	31	51	1.48	0.53		
Lingual groove termination							
11.1 abrupt	8	13					
11.2 blends in	5	9	35	0.02	0.05		

6.13.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	16	15					
1.4 distolingual cusp equal in size to others	2	2	35	0.00	0.22		
Carabelli's trait							
2.5 absent	21	19					
2.1,2,3,4 present	3	1	44	0.74	0.11		
Buccal enamel extension							
3.1 absent	2	1					
3.2,3,4 present	18	14	35	0.12	0.07		
Lingual enamel extension							
4.1 absent	21	18					
4.2,3,4 present	4	1	44	1.24	0.40		
Anterior transverse ridge							
5.4 absent	6	15					
5.1,2,3 present	5	1	27	5.80	3.75		X
Size of oblique ridge							
6.1 pronounced	1	0					
6.2 small	8	17	26	1.96	0.11		
Oblique ridge continuity							
7.1 solid ridge present	2	2					
7.2,3 solid ridge absent	9	16	29	0.29	0.00		
Mesial marginal ridge tubercles							
8.1 tubercles absent	5	4					
8.2,3,4,5 tubercles present	4	8	21	1.04	0.33		

6.13.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distal marginal ridge							
9.1,2,3 solid ridge absent	13	8					
9.4 solid ridge present	0	4	25	4.80	2.70		X
Buccal groove termination							
10.1 abrupt	3	3					
10.2 blends in	15	10	31	0.20	0.00		
Lingual groove termination							
11.1 abrupt	8	8					
11.2 blends in	5	7	28	0.62	0.17		

6.13.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Cusp number							
1.2,3 distolingual cusp smaller than others	22	15					
1.4 distolingual cusp equal in size to others	1	2	40	0.78	0.08		
Carabelli's trait							
2.5 absent	31	19					
2.1,2,3,4 present	1	1	52	0.12	0.16		
Buccal enamel extension							
3.1 absent	6	1					
3.2,3,4 present	28	14	49	1.03	0.32		
Lingual enamel extension							
4.1 absent	36	18					
4.2,3,4 present	3	1	58	0.12	0.04		
Anterior transverse ridge							
5.4 absent	7	15					
5.1,2,3 present	5	1	28	5.11	3.22		
Size of oblique ridge							
6.1 pronounced	1	0					
6.2 small	18	17	36	0.92	0.00		
Oblique ridge continuity							
7.1 solid ridge present	1	2					
7.2,3 solid ridge absent	19	16	38	0.49	0.01		

6.13.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial marginal ridge tubercle							
8.1 tubercles absent	1	4					
8.2,3,4,5 tubercles present	6	8	19	0.83	0.14		
Distal marginal ridge							
9.1,2,3 solid ridge absent	8	8					
9.4 solid ridge present	3	4	23	0.10	0.02		
Buccal groove termination							
10.1 abrupt	2	3					
10.2 blends in	31	10	46	2.79	1.31		
Lingual groove termination							
11.1 abrupt	13	8					
11.2 blends in	9	7	37	0.12	0.00		

Table 6.13 presents the data for the left maxillary second molars. A statistically significant difference is not proven for any of the eleven category comparisons between Shaver Hill and Carton (Table 6.13.1) or Carton and Sopher (Table 6.13.3). Two of the eleven category comparisons indicate a statistically significant difference in the Shaver Hill/Sopher comparison (Table 6.13.2). Specifically, the Shaver Hill sample has a significantly higher incidence of the anterior transverse ridge (5.1,2,3) and of the distal marginal ridge (9.1,2,3).

TABLE 6.14

COMPARISON OF CATEGORY OBSERVATIONS

Right Maxillary Second Molars

6.14.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Cusp number							
1.2,3 distolingual cusp smaller than others	13	31					
1.4 distolingual cusp equal in size to others	0	0	44	0.00	0.00		
Carabelli's trait							
2.5 absent	21	39					
2.1,2,3,4 present	0	0	60	0.00	0.00		
Buccal enamel extension							
3.1 absent	1	5					
3.2,3,4 present	19	28	53	1.28	0.47		
Lingual enamel extension							
4.1 absent	22	38					
4.2,3,4 present	1	0	61	1.68	0.07		
Anterior transverse ridge							
5.4 absent	6	12					
5.1,2,3 present	3	10	31	0.39	0.05		
Size of oblique ridge							
6.1 pronounced	1	0					
6.2 small	10	26	37	2.43	0.20		
Oblique ridge continuity							
7.1 solid ridge present	0	4					
7.2,3 solid ridge absent	11	24	39	1.75	0.54		
Mesial marginal ridge tubercle							
8.1 tubercles absent	4	3					
8.2,3,4,5 tubercles present	5	8	20	0.64	0.11		
Distal marginal ridge							
9.1,2,3 solid ridge absent	6	20					
9.4 solid ridge present	3	3	32	1.75	0.67		

6.14.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Buccal groove termination							
10.1 abrupt	3	2					
10.2 blends in	15	32	52	1.58	0.58		
Lingual groove termination							
11.1 abrupt	5	19					
11.2 blends in	1	9	34	0.57	0.07		

6.14.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Cusp number							
1.2,3 distolingual cusp smaller than others	13	14					
1.4 distolingual cusp equal in size to others	0	1	28	0.90	0.01		
Carabelli's trait							
2.5 absent	21	14					
2.1,2,3,4 present	0	3	38	4.02	1.96		
Buccal enamel extension							
3.1 absent	1	0					
3.2,3,4 present	19	11	31	0.57	0.10		
Lingual enamel extension							
4.1 absent	22	9					
4.2,3,4 present	1	2	34	1.77	0.47		
Anterior transverse ridge							
5.4 absent	6	13					
5.1,2,3 present	3	1	23	2.62	1.11		
Size of oblique ridge							
6.1 pronounced	1	3					
6.2 small	10	12	26	0.58	0.05		
Oblique ridge continuity							
7.1 solid ridge present	0	1					
7.2,3 solid ridge absent	11	14	26	0.76	0.03		

6.14.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Mesial marginal ridge tubercle							
8.1 tubercles absent	4	6					
8.2,3,4,5 tubercles present	5	7	22	0.01	0.13		
Distal marginal ridge							
9.1,2,3 solid ridge absent	6	7					
9.4 solid ridge present	3	4	20	0.02	0.11		
Buccal groove termination							
10.1 abrupt	3	0					
10.2 blends in	15	10	28	1.87	0.53		
Lingual groove termination							
11.1 abrupt	5	8					
11.2 blends in	1	4	18	0.55	0.04		

6.14.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Cusp number							
1.2,3 distolingual cusp smaller than others	31	14					
1.4 distolingual cusp equal in size to others	0	1	46	2.11	0.14		
Carabelli's trait							
2.5 absent	39	14					
2.1,2,3,4 present	0	3	56	7.27	4.21	Y	X
Buccal enamel extension							
3.1 absent	5	0					
3.2,3,4 present	28	11	44	1.88	0.68		
Lingual enamel extension							
4.1 absent	38	9					
4.2,3,4 present	0	2	49	7.20	3.31		X
Anterior transverse ridge							
5.4 absent	12	13					
5.1,2,3 present	10	1	36	5.92	4.25	Y	X
Size of oblique ridge							
6.1 pronounced	0	3					
6.2 small	26	12	41	5.61	3.05		X

6.14.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Oblique ridge continuity							
7.1 solid ridge present	4	1					
7.2,3 solid ridge absent	24	14	43	0.55	0.06		
Mesial marginal ridge tubercle							
8.1 tubercles absent	3	6					
8.2,3,4,5 tubercles present	8	7	24	0.91	0.28		
Distal marginal ridge							
9.1,2,3 solid ridge absent	20	7					
9.4 solid ridge present	3	4	34	2.48	1.25		
Buccal groove termination							
10.1 abrupt	2	0					
10.2 blends in	32	10	44	0.62	0.01		
Lingual groove termination							
11.1 abrupt	19	8					
11.2 blends in	9	4	40	0.01	0.09		

Table 6.14 presents the data for the right maxillary second molars. A statistically significant difference is not proven for any of the eleven category comparisons between Shaver Hill and Carton (Table 6.14.1) or Shaver Hill and Sopher (Table 6.14.2). Four of the eleven category comparisons between Carton and Sopher (Table 6.14.3) indicate a statistically significant difference. First of all, the Sopher sample has a significantly higher incidence of Carabelli's trait (2.1,2,3,4) than does the Carton sample. Similarily, the Sopher sample has a significantly higher incidence of lingual enamel extensions (4.2,3,4). On the other hand the Carton sample has a significantly higher incidence of the anterior transverse ridge (5.1,2,3).

Finally, the Sopher sample has a significantly higher incidence of prominent oblique ridges (6.1)

Summary of Maxillary Comparisons

Five category comparisons out of 54 for the left maxillary dentition indicated a statistically significant difference between the Shaver Hill and Carton dental samples. Of these, three are at the 0.05 probability level, indicating a probable statistically significant difference. The other two are at the 0.01 probability level, and thus indicates an almost certain statistically significant difference.

A statistically significant difference was proven for two of the 54 category comparisons for the right maxillary dentitions of the Shaver Hill and Carton dental samples. Of these, one is at the 0.05 probability level, indicating a probable statistically significant difference. The other is at the 0.01 probability level, and thus indicates an almost certain statistically significant difference.

In the Shaver Hill/Sopher comparison, eight of the 54 comparisons indicated a statistically significant difference for the left maxillary dentition. Of these, seven category comparisons indicate a probable statistically significant difference (probability less than 0.05) and one indicates an almost certain statistically significant difference (probability less than 0.01).

A total of six of the 54 category comparisons for the right maxillary dentition indicates a statistically significant difference between the Shaver Hill and Sopher dental samples. Five of these category comparisons indicate a probable statistically significant difference (probability less than 0.05) and the sixth indicates an almost certain statistically significant difference (probability less than 0.01).

For the left maxillary dentition, nine of the 54 category comparisons for Carton and Sopher indicate a statistically significant difference. Six of these category comparisons indicate a probable statistically significant difference (probability level less than 0.05), while three indicate an almost certain statistically significant difference (probability less than 0.01).

Eleven of the 54 comparisons for the right maxillary dentition of the Carton and Sopher samples indicate a statistically significant difference. Nine of these indicate a probable statistically significant difference (probability less than 0.05) and two indicate an almost certain statistically significant difference (probability less than 0.01).

(ii) Mandibular Dentition

TABLE 6.15

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular Central Incisor

6.15.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Lingual shovel shape							
1.1,2 present	7	5					
1.3 absent	2	4	18	1.00	0.25		
Lingual dental tubercle							
2.1 present	0	0					
2.2 absent	10	12	22	0.00	0.00		
Medial lingual ridges							
3.1 present	1	0					
3.2 absent	9	7	17	0.74	0.03		
Buccal shovel shape							
4.1 present	2	0					
4.2 absent	6	8	16	2.29	0.57		
Mesial marginal ridge							
5.1 present	3	1					
5.2 absent	5	4	13	0.44	0.00		

6.15.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Lingual shovel shape							
1.1,2 present	7	5					
1.3 absent	2	1	15	0.07	0.16		
Lingual dental tubercle							
2.1 present	0	0					
2.2 absent	10	7	17	0.00	0.00		
Medial lingual ridges							
3.1 present	1	0					
3.2 absent	9	7	17	0.74	0.03		

6.15.2 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal shovel shape							
4.1 present	2	0					
4.2 absent	6	7	15	2.02	0.44		
Mesial marginal ridge							
5.1 present	3	1					
5.2 absent	5	5	14	0.73	0.07		

6.15.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	5	5					
1.3 absent	4	1	15	1.25	0.32		
Lingual dental tubercle							
2.1 present	0	0					
2.2 absent	12	7	19	0.00	0.00		
Medial lingual ridge							
3.1 present	0	0					
3.2 absent	7	7	14	0.00	0.00		
Buccal shovel shape							
4.1 present	0	0					
4.2 absent	8	7	15	0.00	0.00		
Mesial marginal ridge							
5.1 present	1	1					
5.2 absent	4	5	11	0.02	0.41		

Table 6.15 presents the data for the left mandibular central incisors. A statistically significant difference is not proven for any of the five category comparisons between Shaver Hill and Carton (Table 6.15.1), Shaver Hill and Sopher (Table 6.15.2) or Carton and Sopher (Table 6.15.3).

TABLE 6.16

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular Central Incisors

6.16.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	6	1					
1.3 absent	3	2	12	1.03	0.11		
Lingual dental tubercle							
2.1 present	0	0					
2.2 absent	14	7	21	0.00	0.00		
Medial lingual ridges							
3.1 present	2	0					
3.2 absent	12	2	16	0.33	0.33		
Buccal shovel shape							
4.1 present	0	0					
4.2 absent	7	2	9	0.00	0.00		
Mesial marginal ridge							
5.1 present	1	0					
5.2 absent	6	2	9	0.32	0.50		

6.16.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	6	5					
1.3 absent	3	2	16	0.04	0.12		
Lingual dental tubercle							
2.1 present	0	1					
2.2 absent	14	7	22	1.83	0.08		
Medial lingual ridges							
3.1 present	2	1					
3.2 absent	12	6	21	0.00	0.44		

6.16.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Buccal shovel shape							
4.1 present	0	0					
4.2 absent	7	8	15	0.93	0.01		
Mesial marginal ridge							
5.1 present	1	0					
5.2 absent	6	6	13	0.71	0.05		

6.16.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Lingual shovel shape							
1.1,2 present	1	5					
1.3 absent	2	2	10	1.27	0.18		
Lingual dental tubercle							
2.1 present	0	1					
2.2 absent	7	7	15	0.94	0.01		
Medial lingual ridges							
3.1 present	0	1					
3.2 absent	2	6	9	0.32	0.50		
Buccal shovel shape							
4.1 present	0	0					
4.2 absent	2	8	10	0.00	0.00		
Mesial marginal ridge							
5.1 present	0	0					
5.2 absent	2	6	8	0.00	0.00		

Table 6.16 presents the data for the right mandibular central incisors. A statistically significant difference is not proven for any of the five category comparisons between Shaver Hill and Carton (Table 6.16.1), Shaver Hill and Sopher (Table 6.16.2) or Carton and Sopher (Table 6.16.3).

TABLE 6.17

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular Lateral Incisors

6.17.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	8	7					
1.3 absent	1	4	20	1.68	0.61		
Lingual dental tubercle							
2.1 present	1	0					
2.2 absent	10	13	24	1.23	0.01		
Medial lingual ridges							
3.1 present	2	0					
3.2 absent	7	8	17	2.02	0.44		
Buccal shovel shape							
4.1 present	2	1					
4.2 absent	5	8	16	0.79	0.06		
Mesial marginal ridge							
5.1 present	3	1					
5.2 absent	4	8	16	2.12	0.76		

6.17.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	8	6					
1.3 absent	1	0	15	0.71	0.05		
Lingual dental tubercle							
2.1 present	1	0					
2.2 absent	10	6	17	0.58	0.10		
Medial lingual ridges							
3.1 present	2	0					
3.2 absent	7	6	15	1.54	0.22		

6.17.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal shovel shape							
4.1 present	2	1					
4.2 absent	5	5	13	0.26	0.02		
Mesial marginal ridge							
5.1 present	3	1					
5.2 absent	4	5	13	1.04	0.17		

6.17.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	7	6					
1.3 absent	4	0	17	2.85	1.19		
Lingual dental tubercle							
2.1 present	0	0					
2.2 absent	13	6	19	0.00	0.00		
Medial lingual ridges							
3.1 present	0	0					
3.2 absent	8	6	14	0.00	0.00		
Buccal shovel shape							
4.1 present	1	1					
4.2 absent	8	5	15	0.10	0.22		
Mesial marginal ridge							
5.1 present	1	1					
5.2 absent	8	5	15	0.10	0.22		

Table 6.17 presents the data for the left mandibular lateral incisors. A statistically significant difference is not proven for any of the five category comparisons between Shaver Hill and Carton (Table 6.17.1), Shaver Hill and Sopher (Table 6.17.2) or Carton and Sopher (Table 6.17.3)

TABLE 6.18

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular Lateral Incisors

6.18.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	8	4					
1.3 absent	0	4	16	5.33	3.00		
Lingual dental tubercle							
2.1 present	1	0					
2.2 absent	11	11	23	0.96	0.00		
Medial lingual ridges							
3.1 present	3	0					
3.2 absent	9	4	16	1.23	0.14		
Buccal shovel shape							
4.1 present	3	0					
4.2 absent	5	6	14	2.86	1.07		
Mesial marginal ridge							
5.1 present	7	0					
5.2 absent	2	4	13	6.74	3.97		X

6.18.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	8	7					
1.3 absent	0	3	18	2.88	1.13		
Lingual dental tubercle							
2.1 present	1	4					
2.2 absent	11	6	22	3.12	1.57		
Medial lingual ridges							
3.1 present	3	1					
3.2 absent	9	8	21	0.64	0.06		

6.18.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal shovel shape							
4.1 present	3	0					
4.2 absent	5	10	18	4.50	2.21		
Mesial marginal ridge							
5.1 present	7	2					
5.2 absent	2	6	17	4.74	2.85		

6.18.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual shovel shape							
1.1,2 present	4	7					
1.3 absent	4	3	18	0.75	0.14		
Lingual dental tubercle							
2.1 present	0	4					
2.2 absent	11	6	21	5.44	3.15		X
Medial lingual ridges							
3.1 present	0	1					
3.2 absent	4	8	13	0.48	0.19		
Buccal shovel shape							
4.1 present	0	0					
4.2 absent	6	10	16	0.00	0.00		
Mesial marginal ridge							
5.1 present	0	2					
5.2 absent	4	6	12	1.20	0.08		

Table 6.18 presents the data for the right mandibular lateral incisors. A statistically significant difference is not proven for the five category comparisons between Shaver Hill and Sopher (Table 6.18.2). One of the category comparisons between Shaver Hill and Carton (Table 6.18.1) indicates a statistically significant difference. Specifically, the Shaver Hill sample has a significantly higher incidence of

the mesial marginal ridge on the buccal surface (5.1). One of the category comparisons between Carton and Sopher (Table 6.18.3) indicates a statistically significant difference. In this case, the Sopher sample has a significantly higher incidence of the lingual dental tubercle (2.1), than does the Carton sample.

TABLE 6.19

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular Canines

6.19.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	3	2					
1.4 absent	2	0	7	1.12	0.02		
Mesial buccal ridge							
2.1 present	5	5					
2.2 absent	4	7	21	0.40	0.04		
Medial buccal ridge							
3.1 present	2	0					
3.2 absent	7	7	16	1.78	0.33		
Distal buccal ridge							
4.1 present	11	5					
4.2 absent	2	7	25	4.99	3.31		X
Mesial lingual ridge							
5.1 prominent	0	1					
5.2 slight	13	16	30	0.79	0.02		
Medial lingual ridge							
6.1,2 present	6	12					
6.3 absent	6	3	27	2.70	1.52		
Distomedial lingual ridge							
7.1 present	0	0					
7.2 absent	10	14	24	0.00	0.00		

6.19.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distal lingual ridge							
8.1 present	16	18					
8.2 absent	0	0	34	0.00	0.00		
Lingual dental tubercle							
9.1 present	0	0					
9.2 absent	15	19	34	0.00	0.00		

6.19.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	3	3					
1.4 absent	2	9	17	1.89	0.67		
Mesial buccal ridge							
2.1 present	5	7					
2.2 absent	4	10	26	0.49	0.08		
Medial buccal ridge							
3.1 present	2	1					
3.2 absent	7	16	26	1.54	0.36		
Distal buccal ridge							
4.1 present	11	4					
4.2 absent	2	12	29	10.21	7.96	YY	XX
Mesial lingual ridge							
5.1 prominent	0	2					
5.2 slight	13	14	29	1.75	0.34		
Medial lingual ridge							
6.1,2 present	6	9					
6.3 absent	6	7	28	0.11	0.00		
Distomedial lingual ridge							
7.1 present	0	8					
7.2 absent	10	8	26	7.22	5.07	Y	XX
Distal lingual ridge							
8.1 present	16	16					
8.2 absent	0	1	33	0.97	0.00		
Lingual dental tubercle							
9.1 present	0	1					
9.2 absent	15	14	30	1.03	0.00		

6.19.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	2	3					
1.4 absent	0	9	14	4.20	1.57		
Mesial buccal ridge							
2.1 present	5	7					
2.2 absent	7	10	29	0.00	0.13		
Medial buccal ridge							
3.1 present	0	1					
3.2 absent	7	16	24	0.43	0.22		
Distal buccal ridge							
4.1 present	5	4					
4.2 absent	7	12	28	0.87	0.28		
Mesial lingual ridge							
5.1 prominent	1	2					
5.2 slight	16	14	33	0.44	0.00		
Medial lingual ridge							
6.1,2 present	12	9					
6.3 absent	3	7	31	2.00	1.06		
Distomedial lingual ridge							
7.1 present	0	8					
7.2 absent	14	8	30	9.55	7.16	YY	XX
Distal lingual ridge							
8.1 present	18	16					
8.2 absent	0	1	33	1.09	0.00		
Lingual dental tubercle							
9.1 present	0	1					
9.2 absent	19	14	34	1.31	0.01		

Table 6.19 presents the data for the left mandibular canines. One of the nine category comparisons between Shaver Hill and Carton (Table 6.19.1) indicates a statistically significant difference. In this case, the Shaver Hill sample has a significantly higher incidence of the distal buccal

ridge (4.1). Two of the category comparisons between Shaver Hill and Sopher (Table 6.19.2) indicate a statistically significant difference. First of all, Shaver Hill has a significantly higher incidence of the distal buccal ridge (4.1). Secondly, the Sopher sample has a significantly higher incidence of the distomedial lingual ridge (7.1). One of the nine category comparisons between Carton and Sopher indicates a statistically significant difference. Specifically, the Sopher sample has a significantly higher incidence of the distomedial lingual ridge (7.1) than does Carton.

TABLE 6.20

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular Canines

6.20.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	2	2					
1.4 absent	1	0	5	0.83	0.05		
Mesial buccal ridge							
2.1 present	5	6					
2.2 absent	1	6	18	1.87	0.73		
Medial buccal ridge							
3.1 present	1	1					
3.2 absent	4	10	16	0.37	0.04		
Distal buccal ridge							
4.1 present	3	5					
4.2 absent	2	6	16	0.29	0.00		
Mesial lingual ridge							
5.1 prominent	2	1					
5.2 slight	7	14	24	1.24	0.23		

6.20.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Medial lingual ridge							
6.1,2 present	4	10					
6.3 absent	4	3	21	1.62	0.63		
Distomedial lingual ridge							
7.1 present	0	0					
7.2 absent	6	11	17	0.00	0.00		
Distal lingual ridge							
8.1 present	10	15					
8.2 absent	0	0	25	0.00	0.00		
Lingual dental tubercle							
9.1 present	0	0					
9.2 absent	11	16	27	0.00	0.00		

6.20.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	0	7					
1.4 absent	3	4	14	3.82	1.70		
Mesial buccal ridge							
2.1 present	5	8					
2.2 absent	1	10	24	2.74	1.40		
Medial buccal ridge							
3.1 present	1	0					
3.2 absent	4	17	22	3.56	0.44		
Distal buccal ridge							
4.1 present	3	6					
4.2 absent	2	12	23	1.17	0.32		
Mesial lingual ridge							
5.1 prominent	2	1					
5.2 slight	7	18	28	1.84	0.49		
Medial lingual ridge							
6.1,2 present	4	11					
6.3 absent	4	8	27	0.14	0.00		

6.20.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distomedial lingual ridge							
7.1 present	0	4					
7.2 absent	6	11	21	1.98	0.63		
Distal lingual ridges							
8.1 present	10	18					
8.2 absent	0	1	29	0.55	0.11		
Lingual dental tubercle							
9.1 present	0	2					
9.2 absent	11	15	28	1.39	0.18		

6.20.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	2	7					
1.4 absent	0	4	13	1.05	0.04		
Mesial buccal ridge							
2.1 present	6	8					
2.2 absent	6	10	30	0.09	0.01		
Medial buccal ridge							
3.1 present	1	0					
3.2 absent	10	17	28	1.60	0.05		
Distal buccal ridge							
4.1 present	5	6					
4.2 absent	6	12	29	0.43	0.07		
Mesial lingual ridge							
5.1 prominent	1	1					
5.2 slight	14	18	34	0.03	0.32		
Medial lingual ridge							
6.1,2 present	10	11					
6.3 absent	3	8	32	1.24	0.54		
Distomedial lingual ridge							
7.1 present	0	4					
7.2 absent	11	11	26	3.47	1.72		
Distal lingual ridges							
8.1 present	15	18					
8.2 absent	0	1	34	0.81	0.01		

6.20.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual dental tubercle							
9.1 present	0	2					
9.2 absent	16	15	33	2.00	0.47		

Table 6.20 presents the data for the right mandibular canines. A statistically significant difference is not proven for any of the nine comparisons between Shaver Hill and Carton (Table 6.20.1), Shaver Hill and Sopher (Table 6.20.2) or Carton and Sopher (Table 6.20.3).

TABLE 6.21

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular First Premolars

6.21.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	4	5					
1.4 absent	5	2	16	1.17	0.33		
Mesial buccal ridge							
2.1 present	7	7					
2.2 absent	6	13	33	1.15	0.50		
Medial buccal ridge							
3.1 present	1	0					
3.2 absent	13	6	20	0.45	0.20		
Distal buccal ridge							
4.1 present	4	3					
4.2 absent	10	18	35	1.07	0.37		
Mesial occlusal margin							
5.1 interrupted	9	8					
5.2 uninterrupted	10	16	43	0.87	0.39		

6.21.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distal occlusal margin							
6.1 interrupted	7	1					
6.2 uninterrupted	11	26	45	9.15	6.90	YY	XX
Lingual grooves							
7.1,2,3 present	9	6					
7.4 absent	13	19	47	1.54	0.86		
Lingual cusps							
8.1 one cusp present	14	17					
8.2,3 two or more present	5	4	40	0.30	0.03		
Occlusal ridges							
9.1,2,3,4,5 present	20	25					
9.6 absent	0	0	45	0.00	0.00		
Main occlusal ridge							
10.1 single	18	23					
10.2 bifurcated	2	2	45	0.06	0.09		
Size of main occlusal ridge							
11.1 prominent	18	20					
11.2 slight	2	5	45	0.85	0.26		
Cusp positions							
12.1,2 cusps not aligned	18	26					
12.3 cusps aligned	4	0	48	5.16	3.05		X
Independence of lingual cusp							
13.1 independent	3	4					
13.2 fused	17	19	43	0.05	0.04		
Sagittal sulcus							
14.1 uninterrupted	0	0					
14.2 interrupted	19	26	45	0.00	0.00		

6.21.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Buccal styles							
1.1,2,3 present	4	4					
1.4 absent	5	11	24	0.80	0.20		

6.21.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial buccal ridge							
2.1 present	7	3					
2.2 absent	6	12	28	3.48	2.16		
Medial buccal ridge							
3.1 present	1	1					
3.2 absent	13	14	29	0.02	0.47		
Distal buccal ridge							
4.1 present	4	3					
4.2 absent	10	12	29	0.29	0.01		
Mesial occlusal margin							
5.1 interrupted	9	5					
5.2 uninterrupted	10	14	38	1.81	1.02		
Distal occlusal margin							
6.1 interrupted	7	3					
6.2 uninterrupted	11	16	37	2.50	1.47		
Lingual grooves							
7.1,2,3 present	9	7					
7.4 absent	13	12	41	0.07	0.00		
Lingual cusps							
8.1 one cusp present	14	13					
8.2,3 two or more present	5	6	38	0.13	0.00		
Occlusal ridges							
9.1,2,3,4, present 5	20	19					
9.6 absent	0	0	39	0.00	0.00		
Main occlusal ridge							
10.1 single	18	17					
10.2 bifurcated	2	2	39	0.00	0.22		
Size of main occlusal ridge							
11.1 prominent	18	16					
11.2 slight	2	3	39	0.29	0.00		
Cusp positions							
12.1,2 cusps not aligned	18	15					
12.3 cusps aligned	4	4	41	0.05	0.03		

6.21.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Independence of lingual cusp							
13.1 independent	3	2					
13.2 fused	17	17	39	0.17	0.00		
Sagittal sulcus							
14.1 uninterrupted	0	0					
14.2 interrupted	19	19	38	0.00	0.00		

6.21.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	5	4					
1.4 absent	2	11	22	3.96	2.32		
Mesial buccal ridge							
2.1 present	7	3					
2.2 absent	13	12	35	0.95	0.35		
Medial buccal ridge							
3.1 present	0	1					
3.2 absent	6	14	21	0.42	0.24		
Distal buccal ridge							
4.1 present	3	3					
4.2 absent	18	12	36	0.21	0.00		
Mesial occlusal margin							
5.1 interrupted	8	5					
5.2 uninterrupted	16	14	43	0.25	0.03		
Distal occlusal margin							
6.1 interrupted	1	3					
6.2 uninterrupted	26	16	46	2.05	0.81		
Lingual grooves							
7.1,2,3 present	6	7					
7.4 absent	19	12	44	0.86	0.35		
Lingual cusps							
8.1 one cusp present	17	13					
8.2,3 two or more present	4	6	40	0.84	0.30		
Occlusal ridges							
9.1,2,3,4,5 present	25	19					
9.6 absent	0	0	44	0.00	0.00		

6.21.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Main occlusal ridge							
10.1 single	23	17					
10.2 bifurcated	2	2	44	0.08	0.06		
Size of main occlusal cusp							
11.1 prominent	20	16					
11.2 slight	5	3	44	0.13	0.00		
Cusp positions							
12.1,2 cusps not aligned	26	15					
12.3 cusps aligned	0	4	45	6.01	3.69		X
Independence of lingual cusp							
13.1 independent	4	2					
13.2 fused	19	17	42	0.40	0.04		
Sagittal sulcus							
14.1 uninterrupted	0	0					
14.2 interrupted	26	19	45	0.00	0.00		

Table 6.21 presents the data for the left mandibular first premolars. A statistically significant difference is not proven for any of the 14 comparisons between Shaver Hill and Sopher (Table 6.21.2). One of the 14 category comparisons between Shaver Hill and Carton (Table 6.21.1) indicate a statistically significant difference. In this case, the Shaver Hill sample has a significantly higher incidence of the interrupted distal occlusal margin (6.1), and secondly, the Shaver Hill sample has a significantly higher incidence of aligned buccal and lingual cusps (12.3). In the Carton/Sopher comparison (Table 6.21.3), one of the fourteen categories indicates a statistically significant difference. Specifically, the Sopher sample has a significantly higher

incidence of aligned buccal and lingual cusps (12.3) than does the Carton sample.

TABLE 6.22

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular First Premolars

6.22.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	4	4					
1.4 absent	3	1	12	0.69	0.04		
Mesial buccal ridge							
2.1 present	3	6					
2.2 absent	6	12	27	0.00	0.19		
Medial buccal ridge							
3.1 present	1	0					
3.2 absent	8	17	26	1.96	0.11		
Distal buccal ridge							
4.1 present	3	3					
4.2 absent	7	14	27	0.55	0.07		
Mesial occlusal margin							
5.1 interrupted	4	10					
5.2 uninterrupted	8	13	35	0.34	0.05		
Distal occlusal margin							
6.1 interrupted	1	1					
6.2 uninterrupted	11	22	35	0.23	0.08		
Lingual grooves							
7.1,2,3 present	2	8					
7.4 absent	11	14	35	1.76	0.88		
Lingual cusps							
8.1 one cusp present	10	13					
8.2,3 two or more present	2	9	34	2.09	1.12		
Occlusal ridges							
9.1,2,3,4,5 present	12	22					
9.6 absent	0	0	34	0.00	0.00		

6.22.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Main occlusal ridge							
10.1 single	12	22					
10.2 bifurcated	1	1	36	0.18	0.11		
Size of main occlusal cusp							
11.1 prominent	10	17					
11.2 slight	3	6	36	0.04	0.04		
Cusp positions							
12.1,2 cusps not aligned	14	24					
12.3 cusps aligned	0	0	38	0.00	0.00		
Independence of lingual cusp							
13.1 independent	4	1					
13.2 fused	9	22	36	4.85	2.89		X
Sagittal sulcus							
14.1 uninterrupted	1	0					
14.2 interrupted	12	24	37	1.90	0.10		

6.22.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	4	9					
1.4 absent	3	8	24	0.04	0.07		
Mesial buccal ridge							
2.1 present	3	7					
2.2 absent	6	12	28	0.03	0.06		
Medial buccal ridge							
3.1 present	1	0					
3.2 absent	8	18	27	2.08	0.13		
Distal buccal ridge							
4.1 present	3	0					
4.2 absent	7	19	29	6.36	3.53		X
Mesial occlusal margin							
5.1 interrupted	4	9					
5.2 uninterrupted	8	12	33	0.29	0.03		
Distal occlusal margin							
6.1 interrupted	1	3					
6.2 uninterrupted	11	18	33	0.25	0.00		

6.22.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual grooves							
7.1,2,3 present	2	4					
7.4 absent	11	16	33	0.11	0.02		
Lingual cusps							
8.1 one cusp present	10	15					
8.2,3 two or more present	2	5	32	0.31	0.01		
Occlusal ridges							
9.1,2,3,4,5 present	12	20					
9.6 absent	0	0	32	0.00	0.00		
Main occlusal ridge							
10.1 single	12	18					
10.2 bifurcated	1	1	32	0.08	0.22		
Size of main occlusal cusp							
11.1 prominent	10	14					
11.2 slight	3	6	33	0.19	0.00		
Cusp positions							
12.1,2 cusps not aligned	14	19					
12.3 cusps aligned	0	2	35	1.41	0.20		
Independence of lingual cusp							
13.1 independent	4	2					
13.2 fused	9	18	33	2.29	1.10		
Sagittal sulcus							
14.1 uninterrupted	1	0					
14.2 interrupted	12	21	34	1.66	0.06		

6.22.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	4	9					
1.4 absent	1	8	22	1.17	0.32		
Mesial buccal ridge							
2.1 present	6	7					
2.2 absent	12	12	37	0.05	0.02		
Medial buccal ridge							
3.1 present	0	0					
3.2 absent	17	18	35	0.00	0.00		

6.22.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distal buccal ridge							
4.1 present	3	0					
4.2 absent	14	19	36	3.66	1.71		
Mesial occlusal margin							
5.1 interrupted	10	9					
5.2 uninterrupted	13	12	44	0.00	0.07		
Distal occlusal margin							
6.1 interrupted	1	3					
6.2 uninterrupted	22	18	44	1.31	0.39		
Lingual grooves							
7.1,2,3 present	8	4					
7.4 absent	14	16	42	1.38	0.69		
Lingual cusps							
8.1 one cusp present	13	15					
8.2,3 two or more present	9	5	42	1.19	0.59		
Occlusal ridges							
9.1,2,3,4,5 present	22	20					
9.6 absent	0	0	42	0.00	0.00		
Main occlusal ridge							
10.1 single	22	18					
10.2 bifurcated	1	1	42	0.02	0.35		
Size of main occlusal cusp							
11.1 prominent	17	14					
11.2 slight	6	6	43	0.08	0.00		
Cusp positions							
12.1,2 cusps not aligned	24	19					
12.3 cusps aligned	0	2	45	2.39	0.68		
Independence of lingual cusp							
13.1 independent	1	2					
13.2 fused	22	18	43	0.53	0.02		
Sagittal sulcus							
14.1 uninterrupted	0	0					
14.2 interrupted	24	21	45	0.00	0.00		

Table 6.22 presents the data for the right mandibular

first premolars. A statistically significant difference is not proven for any of the fourteen category comparisons between Carton and Sopher (Table 6.22.3). One of the category comparisons indicates a significant difference between Shaver Hill and Carton (Table 6.22.1). Specifically, the Shaver Hill sample has a significantly higher incidence of independent lingual cusps (13.1). One of the category comparisons indicates a significant difference between Shaver Hill and Sopher (Table 6.22.2). In this case, the Shaver Hill sample has a statistically higher incidence of the distal buccal ridge (4.1).

TABLE 6.23

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular Second Premolars

6.23.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Buccal styles							
1.1,2,3 present	3	8					
1.4 absent	0	3	14	1.04	0.05		
Mesial buccal ridge							
2.1 present	2	8					
2.2 absent	3	15	28	0.05	0.09		
Medial buccal ridge							
3.1 present	2	1					
3.2 absent	3	22	28	5.46	2.37		
Distal buccal ridge							
4.1 present	1	5					
4.2 absent	3	18	27	0.02	0.26		

6.23.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Mesial occlusal margin							
5.1 interrupted	7	20					
5.2 uninterrupted	6	7	40	1.64	0.84		
Distal occlusal margin							
6.1 interrupted	1	2					
6.2 uninterrupted	11	24	38	0.01	0.34		
Lingual grooves							
7.1,2,3 present	3	2					
7.4 absent	10	25	40	1.97	0.80		
Lingual cusps							
8.1 one cusp present	12	19					
8.2,3 two or more present	1	6	38	1.51	0.62		
Occlusal ridges							
9.1,2,3,4,5 present	14	26					
9.6 absent	1	0	41	1.78	0.08		
Main occlusal ridge							
10.1 single	13	25					
10.2 bifurcated	1	1	40	0.21	0.09		
Size of main occlusal ridge							
11.1 prominent	8	13					
11.2 slight	6	13	40	0.19	0.01		
Cusp positions							
12.1,2 cusps not aligned	13	21					
12.3 cusps aligned	2	5	41	0.23	0.00		
Independence of lingual cusp							
13.1 independent	10	22					
13.2 fused	1	2	35	0.01	0.33		
Sagittal sulcus							
14.1 uninterrupted	7	12					
14.2 interrupted	8	15	42	0.02	0.03		

6.23.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	3	4					
1.4 absent	0	11	18	5.20	2.67		X
Mesial buccal ridge							
2.1 present	2	7					
2.2 absent	3	9	21	0.02	0.14		
Medial buccal ridge							
3.1 present	2	1					
3.2 absent	3	14	20	3.27	1.18		
Distal buccal ridge							
4.1 present	1	5					
4.2 absent	3	10	19	0.10	0.08		
Mesial occlusal margin							
5.1 interrupted	7	1					
5.2 uninterrupted	6	17	31	9.19	6.84	YY	XX
Distal occlusal margin							
6.1 interrupted	1	2					
6.2 uninterrupted	11	16	30	0.06	0.14		
Lingual grooves							
7.1,2,3 present	3	1					
7.4 absent	10	17	31	2.06	0.80		
Lingual cusps							
8.1 one cusp present	12	17					
8.2,3 two or more present	1	1	31	0.06	0.25		
Occlusal ridges							
9.1,2,3,4,5 present	14	17					
9.6 absent	1	0	32	1.17	0.00		
Main occlusal ridge							
10.1 single	13	16					
10.2 bifurcated	1	2	32	0.15	0.05		
Size of main occlusal ridge							
11.1 prominent	8	11					
11.2 slight	6	6	31	0.19	0.00		

6.23.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Cusp positions							
12.1,2 cusps not aligned	13	10					
12.3 cusps aligned	2	8	33	3.75	2.42		
Independence of lingual cusp							
13.1 independent	10	15					
13.2 fused	1	3	29	0.33	0.00		
Sagittal sulcus							
14.1 uninterrupted	7	11					
14.2 interrupted	8	7	33	0.69	0.23		

6.23.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	8	4					
1.4 absent	3	11	26	4.81	3.21		X
Mesial buccal ridge							
2.1 present	8	7					
2.2 absent	15	9	39	0.32	0.05		
Medial buccal ridge							
3.1 present	1	1					
3.2 absent	22	14	38	0.10	0.19		
Distal buccal ridge							
4.1 present	5	5					
4.2 absent	18	10	38	0.63	0.17		
Mesial occlusal margin							
5.1 interrupted	20	1					
5.2 uninterrupted	7	17	45	20.37	17.71	YY	XX
Distal occlusal margin							
6.1 interrupted	2	2					
6.2 uninterrupted	24	16	44	0.15	0.02		
Lingual grooves							
7.1,2,3 present	2	1					
7.4 absent	25	17	45	0.06	0.13		

6.23.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual cusps							
8.1 one cusp present	19	17					
8.2,3 two or more present	6	1	43	2.61	1.43		
Occlusal ridges							
9.1,2,3,4,5 present	26	17					
9.6 absent	0	0	43	0.00	0.00		
Main occlusal ridge							
10.1 single	25	16					
10.2 bifurcated	1	2	44	0.88	0.11		
Size of main occlusal ridge							
11.1 prominent	13	11					
11.2 slight	13	6	43	0.90	0.40		
Cusp positions							
12.1,2 cusps not aligned	21	10					
12.3 cusps aligned	5	8	44	3.25	2.15		
Independence of lingual cusp							
13.1 independent	22	15					
13.2 fused	2	3	42	0.68	0.12		
Sagittal sulcus							
14.1 uninterrupted	12	11					
14.2 interrupted	15	7	45	1.20	0.63		

Table 6.23 presents the data for the left mandibular second premolars. A statistically significant difference is not proven for any of the fourteen category comparisons between Shaver Hill and Carton (Table 6.23.1). Two of the categories indicate a statistically significant difference in the Shaver Hill/Sopher comparison (Table 6.23.2). Specifically, Shaver Hill has a significantly higher incidence of buccal styles (1.1,2,3), and similarly has a significantly higher incidence of the interrupted mesial occlusal margin

(5.1). In the Carton/Sopher comparison (Table 6.23.3), two of the fourteen categories indicate a statistically significant difference. In this case, the Carton sample has a significantly higher incidence of buccal styles (1.1,2,3) and the interrupted mesial occlusal margin (5.1).

TABLE 6.24

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular Second Premolars

6.24.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	4	3					
1.4 absent	3	5	15	0.58	0.06		
Mesial buccal ridge							
2.1 present	9	11					
2.2 absent	4	11	35	1.23	0.57		
Medial buccal ridge							
3.1 present	4	0					
3.2 absent	9	23	36	7.96	5.15	Y	X
Distal buccal ridge							
4.1 present	9	5					
4.2 absent	4	17	35	7.36	5.55	Y	X
Mesial occlusal margin							
5.1 interrupted	4	5					
5.2 uninterrupted	15	22	46	0.05	0.03		
Distal occlusal margin							
6.1 interrupted	3	2					
6.2 uninterrupted	15	27	48	1.12	0.32		
Lingual grooves							
7.1,2,3 present	6	3					
7.4 absent	13	25	47	3.18	1.98		

6.24.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Lingual cusps							
8.1 one cusp present	12	23					
8.2,3 two or more present	7	4	46	2.97	1.89		
Occlusal ridges							
9.1,2,3,4,5 present	20	27					
9.6 absent	0	0	47	0.00	0.00		
Main occlusal ridge							
10.1 single	17	27					
10.2 bifurcated	3	1	48	2.00	0.78		
Size of main occlusal ridge							
11.1 prominent	13	15					
11.2 slight	7	12	47	0.43	0.12		
Cusp positions							
12.1,2 cusps not aligned	17	25					
12.3 cusps aligned	4	2	48	1.46	0.59		
Independence of lingual cusp							
13.1 independent	11	23					
13.2 fused	5	2	41	3.77	2.26		
Sagittal sulcus							
14.1 uninterrupted	6	13					
14.2 interrupted	14	15	43	1.32	0.72		

6.24.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Buccal styles							
1.1,2,3 present	4	5					
1.4 absent	3	5	17	0.08	0.04		
Mesial buccal ridge							
2.1 present	9	5					
2.2 absent	4	7	25	1.92	0.97		
Medial buccal ridge							
3.1 present	4	1					
3.2 absent	9	10	24	1.70	0.64		

6.24.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Distal buccal ridge							
4.1 present	9	2					
4.2 absent	4	10	25	7.00	5.03	Y	X
Mesial occlusal margin							
5.1 interrupted	4	4					
5.2 uninterrupted	15	10	33	0.25	0.01		
Distal occlusal margin							
6.1 interrupted	3	2					
6.2 uninterrupted	15	11	31	0.01	0.16		
Lingual grooves							
7.1,2,3 present	6	2					
7.4 absent	13	11	32	1.08	0.39		
Lingual cusps							
8.1 one cusp present	12	10					
8.2,3 two or more present	7	4	33	0.25	0.02		
Occlusal ridges							
9.1,2,3,4,5 present	20	14					
9.6 absent	0	0	34	0.00	0.00		
Main occlusal ridge							
10.1 single	17	14					
10.2 bifurcated	3	0	34	2.30	0.82		
Size of main occlusal ridge							
11.1 prominent	13	8					
11.2 slight	7	6	34	0.22	0.01		
Cusp positions							
12.1,2 cusps not aligned	17	9					
12.3 cusps aligned	4	5	35	1.22	0.51		
Independence of lingual cusp							
13.1 independent	11	13					
13.2 fused	5	0	29	4.91	2.96		X
Sagittal sulcus							
14.1 uninterrupted	6	4					
14.2 interrupted	14	10	34	0.01	0.09		

6.24.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal styles							
1.1,2,3 present	3	5					
1.4 absent	5	5	18	0.28	0.00		
Mesial buccal ridge							
2.1 present	11	5					
2.2 absent	11	7	34	0.22	0.01		
Medial buccal ridge							
3.1 present	0	1					
3.2 absent	23	10	34	2.15	0.15		
Distal buccal ridge							
4.1 present	5	2					
4.2 absent	17	10	34	0.17	0.00		
Mesial occlusal margin							
5.1 interrupted	5	4					
5.2 uninterrupted	22	10	41	0.54	0.12		
Distal occlusal margin							
6.1 interrupted	2	2					
6.2 uninterrupted	27	11	42	0.75	0.09		
Lingual grooves							
7.1,2,3,4,5 present	3	2					
7.6 absent	25	11	41	0.18	0.01		
Lingual cusps							
8.1 one cusp present	23	10					
8.2,3 two or more present	4	4	41	1.11	0.41		
Occlusal ridges							
9.1,2,3,4,5 present	27	14					
9.6 absent	0	0	41	0.00	0.00		
Main occlusal ridge							
10.1 single	27	14					
10.2 bifurcated	1	0	42	0.51	0.13		
Size of main occlusal ridge							
11.1 prominent	15	8					
11.2 slight	12	6	41	0.01	0.06		

6.24.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Cusp positions							
12.1,2 cusps not aligned	25	9					
12.3 cusps aligned	2	5	41	5.22	3.41		X
Independence of lingual cusp							
13.1 independent	23	13					
13.2 fused	2	0	38	1.10	0.08		
Sagittal sulcus							
14.1 uninterrupted	13	4					
14.2 interrupted	15	10	42	1.24	0.61		

Table 6.24 presents the data for the right mandibular second premolars. Two of the fourteen category comparisons between Shaver Hill and Carton (Table 6.24.1) indicate a statistically significant difference. Specifically, Shaver Hill has a significantly higher incidence of both the medial buccal ridge (3.1) and the distal buccal ridge (4.1). In the Shaver Hill/Sopher comparison (Table 6.24.2), two of the categories indicate a statistically significant difference. In this case, Shaver Hill has a significantly higher incidence of the distal buccal ridge (4.1) and the Sopher sample has a significantly higher incidence of the independent lingual cusp (13.1). Finally, one of the fourteen category comparisons indicate a statistically significant difference in the Carton/Sopher comparison (Table 6.24.3). Here, the Sopher sample has a significantly higher incidence of aligned buccal and lingual cusps (12.1,2).

TABLE 6.25

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular First Molar

6.25.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	25	40					
1.2,3 "Y" pattern absent	5	5	75	0.48	0.12		
B.							
1.2 "+" pattern present	1	5					
1.1,3 "+" pattern absent	29	40	75	1.48	0.61		
C.							
1.3 "λ" pattern present	4	0					
1.1,2 "λ" pattern absent	26	45	75	6.34	3.97	Y	
Variation of distal cusp							
2.2,3 distal cusp < than others	18	20					
2.4 distal cusp = in size to others	11	17	66	0.43	0.16		
Tuberculum sextum							
3.1 present	8	9					
3.2 absent	14	11	42	0.32	0.07		
Tuberculum intermedium							
4.1 present	6	8					
4.2 absent	21	34	69	0.10	0.00		
Bolk's paramolar							
5.1,2,3,4 present	0	2					
5.5 absent	26	49	77	1.05	0.07		
Groove termination							
6.1 abrupt	25	53					
6.2 blends in	1	0	79	2.07	0.13		
Buccal enamel extension							
7.1 absent	13	31					
7.2,3,4 present	10	21	75	0.06	0.00		

6.25.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Lingual enamel extension							
8.1 absent	20	38					
8.2,3,4 present	8	16	82	0.01	0.02		

6.25.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	25	27					
1.2,3 "Y" pattern absent	5	6	63	0.03	0.03		
B.							
1.2 "+" pattern present	1	1					
1.1,3 "+" pattern absent	29	32	63	0.00	0.42		
C.							
1.3 "λ" pattern present	4	5					
1.1,2 "λ" pattern	26	28	63	0.04	0.02		
Variation of distal cusp							
2.2,3 distal cusp < than others	18	9					
2.4 distal cusp = in size to others	11	26	64	8.59	7.17	YY	
Tuberculum sextum							
3.1 present	8	12					
3.2 absent	14	21	55	0.00	0.08		
Tuberculum intermedium							
4.1 present	6	7					
4.2 absent	21	27	61	0.02	0.03		
Bolk's paramolar							
5.1,2,3,4 present	0	5					
5.5 absent	26	29	60	4.17	2.47		
Groove termination							
6.1 abrupt	25	33					
6.2 blends in	1	1	60	0.04	0.28		
Buccal enamel extension							
7.1 absent	13	6					
7.2,3,4 present	10	18	47	4.39	3.23		X

6.25.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Lingual enamel extension							
8.1 absent	20	14					
8.2,3,4 present	8	9	51	0.63	0.25		

6.25.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	40	27					
1.2,3 "Y" pattern absent	5	6	78	0.79	0.31		
B.							
1.2 "+" pattern present	5	1					
1.1,3 "+" pattern absent	40	32	78	1.75	0.80		
C.							
1.3 "λ" pattern present	0	5					
1.1,2 "λ" pattern	45	28	78	7.28	4.98		Y
Variation of distal cusp							
2.2,3 distal cusp < than others	20	9					
2.4 distal cusp = in size to others	17	26	72	6.01	4.89		Y
Tuberculum sextum							
3.1 present	9	12					
3.2 absent	11	21	53	0.39	0.11		
Tuberculum intermediate							
4.1 present	8	7					
4.2 absent	34	27	76	0.03	0.02		
Bolk's paramolar							
5.1,2,3,4 present	2	5					
5.5 absent	49	29	85	3.14	1.88		
Groove termination							
6.1 abrupt	53	33					
6.2 blends in	0	1	87	1.58	0.05		
Buccal enamel extension							
7.1 absent	31	6					
7.2,3,4 present	21	18	76	7.17	5.89		Y

6.25.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Lingual enamel extension							
8.1 absent	38	14					
8.2,3,4 present	16	9	77	0.66	0.30		

Table 6.25 presents the data for the left mandibular first molar. A statistically significant difference is indicated for one of the eight category comparisons between Shaver Hill and Carton (Table 6.25.1). Specifically, the Shaver Hill sample has a significantly higher incidence of the "λ" fissure pattern (1.3). In the Shaver Hill/Sopher comparison (Table 6.25.2) two of the categories indicate a statistically significant difference. Specifically, the Shaver Hill sample has a significantly higher incidence of cases in which the distal cusp is smaller than any of the other cusps (2.2,3) and the Sopher sample has a significantly higher incidence of buccal enamel extensions (6.2,3,4). In the Carton/Sopher comparison, three of the categories indicate a statistically significant difference. Specifically, the Carton sample has a significantly higher incidence of cases in which the distal cusp is smaller than any of the other cusps (2.2,3), while the Sopher sample has a significally higher incidence of buccal enamel extensions (6.2,3,4). Finally, the Sopher sample has a significantly higher incidence of the "λ" molar fissure pattern (1.3).

TABLE 6.26

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular First Molars

6.26.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	25	46					
1.2,3 "Y" pattern absent	7	6	84	1.62	0.92		
B.							
1.2 "+" pattern present	3	4					
1.1,3 "+" pattern absent	29	48	84	0.07	0.02		
C.							
1.3 "λ" pattern present	4	2					
1.1,2 "λ" pattern absent	28	50	84	2.24	1.12		
Variation of distal cusp							
2.2,3 distal cusp < than others	17	22					
2.4 distal cusp = in size to others	13	21	73	0.22	0.05		
Tuberculum sextum							
3.1 present	8	11					
3.2 absent	18	11	48	1.84	1.13		
Tuberculum intermedium							
4.1 present	8	15					
4.2 absent	24	33	80	0.37	0.13		
Bolk's paramolar							
5.1,2,3,4 present	2	3					
5.5 absent	31	54	90	0.03	0.10		
Groove termination							
6.1 abrupt	33	58					
6.2 blends in	1	0	92	1.73	0.07		

6.26.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Buccal enamel extension							
7.1 absent	14	39					
7.2,3,4 present	14	17	84	3.09	2.31		
Lingual enamel extension							
8.1 absent	23	45					
8.2,3,4 present	7	14	89	0.00	0.05		

6.26.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	25	14					
1.2,3 "Y" pattern absent	7	4	50	0.00	0.11		
B.							
1.2 "+" pattern present	3	1					
1.1,3 "+" pattern absent	29	17	50	0.23	0.00		
C.							
1.3 "λ" pattern present	4	3					
1.1,2 "λ" pattern absent	28	15	50	0.16	0.00		
Variation of distal cusp							
2.2,3 distal cusp < than others	17	7					
2.4 distal cusp = in size to others	13	10	47	1.04	0.51		
Tuberculum sextum							
3.1 present	8	6					
3.2 absent	18	10	42	0.20	0.01		
Tuberculum intermedium							
4.1 present	8	4					
4.2 absent	24	14	50	0.05	0.02		
Bolk's paramolar							
5.1,2,3,4 present	2	1					
5.5 absent	31	17	51	0.24	0.10		

6.26.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Groove termination							
6.1 abrupt	33	17					
6.2 blends in	1	1	52	0.22	0.09		
Buccal enamel extension							
7.1 absent	14	3					
7.2,3,4 present	14	5	36	0.39	0.05		
Lingual enamel extension							
8.1 absent	23	6					
8.2,3,4 present	7	2	38	0.01	0.14		

6.26.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	46	14					
1.2,3 "Y" pattern absent	6	4	70	1.25	0.53		
B.							
1.2 "+" pattern present	4	1					
1.1,3 "+" pattern absent	48	17	70	0.09	0.05		
C.							
1.3 "λ" pattern present	2	3					
1.1,2 "λ" pattern absent	50	15	70	3.31	1.66		
Variation of distal cusp							
2.2,3 distal cusp < than others	22	7					
2.4 distal cusp = in size to others	21	10	60	0.49	0.17		
Tuberculum sextum							
3.1 present	11	6					
3.2 absent	11	10	38	0.59	0.19		
Tuberculum intermedium							
4.1 present	15	4					
4.2 absent	33	14	66	0.52	0.17		

6.26.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Bolk's paramolar							
5.1,2,3,4 present	3	1					
5.5 absent	54	17	75	0.37	0.19		
Groove termination							
6.1 abrupt	58	17					
6.2 blends in	0	1	76	3.27	0.39		
Buccal enamel extension							
7.1 absent	39	3					
7.2,3,4 present	17	5	64	3.21	1.94		
Lingual enamel extension							
8.1 absent	45	6					
8.2,3,4 present	14	2	67	0.01	0.13		

Table 6.26 presents the data for the right mandibular first molars. A statistically significant difference is not proven for any of the eight category comparisons between Shaver Hill and Carton (Table 6.26.1), Shaver Hill and Sopher (Table 6.26.2) or Carton and Sopher (Table 6.26.3).

TABLE 6.27

COMPARISON OF CATEGORY OBSERVATIONS

Left Mandibular Second Molars

6.27.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	1	4					
1.2,3 "Y" pattern absent	13	42	60	0.03	0.14		

6.27.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
B.							
1.2 "+" pattern present	3	25					
1.1,3 "+" pattern absent	11	21	60	4.67	3.44		
C.							
1.3 "λ" pattern present	10	17					
1.1,2 "λ" pattern	4	29	60	5.15	3.85	Y	
Variation of distal cusp							
2.1 absent	6	6					
2.2,3,4 present	17	32	61	0.96	0.42		
Tuberculum sextum							
3.1 present	3	7					
3.2 absent	12	16	38	0.51	0.11		
Tuberculum intermedium							
4.1 present	2	1					
4.2 absent	22	41	66	1.25	0.25		
Bolk's paramolar							
5.1,2,3,4 present	4	2					
5.5 absent	24	44	74	2.31	1.17		
Groove terminations							
6.1 abrupt	18	37					
6.2 blends in	4	9	68	0.02	0.04		
Buccal enamel extension							
7.1 absent	6	8					
7.2,3,4 present	21	40	75	0.35	0.08		
Lingual enamel extension							
8.1 absent	23	45					
8.2,3,4 present	3	5	76	0.04	0.04		

6.27.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	1	9					
1.2,3 "Y" pattern absent	13	12	35	5.25	3.65		X
B.							
1.2 "+" pattern present	3	8					
1.1,3 "+" pattern absent	11	13	35	1.08	0.45		
C.							
1.3 "λ" pattern present	10	4					
1.1,2 "λ" pattern absent	4	17	35	9.60	7.54	YY	XX
Variation of distal cusp							
2.1 absent	6	3					
2.2,3,4 present	17	18	44	0.94	0.35		
Tuberculum sextum							
3.1 present	3	4					
3.2 absent	12	14	33	0.02	0.07		
Tuberculum intermedium							
4.1 present	2	5					
4.2 absent	22	16	45	2.04	1.03		
Bolk's paramolar							
5.1,2,3,4 present	4	1					
5.5 absent	24	20	49	1.19	0.38		
Groove termination							
6.1 abrupt	18	17					
6.2 blends in	4	3	42	0.08	0.02		
Buccal enamel extension							
7.1 absent	6	5					
7.2,3,4 present	21	8	40	1.16	0.49		
Lingual enamel extension							
8.1 absent	23	12					
8.2,3,4 present	3	1	39	0.14	0.04		

6.27.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	4	9					
1.2,3 "Y" pattern absent	42	12	67	10.76	8.69	YY	
B.							
1.2 "+" pattern present	25	8					
1.1,3 "+" pattern absent	21	13	67	1.52	0.94		
C.							
1.3 "λ" pattern present	17	4					
1.1,2 "λ" pattern absent	29	17	67	2.15	1.39		
Variation of distal cusp							
2.1 absent	6	3					
2.2,3,4 present	32	18	59	0.02	0.05		
Tuberculum sextum							
3.1 present	7	4					
3.2 absent	16	14	41	0.35	0.06		
Tuberculum intermedium							
4.1 present	1	5					
4.2 absent	41	16	63	7.46	5.18	Y	
Bolk's paramolar							
5.1,2,3,4 present	2	1					
5.5 absent	44	20	67	0.01	0.31		
Groove termination							
6.1 abrupt	37	17					
6.2 blends in	9	3	66	0.20	0.01		
Buccal enamel extension							
7.1 absent	8	5					
7.2,3,4 present	40	8	61	2.90	1.74		
Lingual enamel extension							
8.1 absent	45	12					
8.2,3,4 present	5	1	63	0.06	0.08		

Table 6.27 presents the data for the left mandibular second molars. A statistically significant difference is indicated for one of the eight category comparisons between

Shaver Hill and Carton (Table 6.27.1). Specifically, the Shaver Hill sample has a significantly higher incidence of the "λ" molar fissure pattern (1.3). One of the categories indicates a statistically significant difference in the Shaver Hill/Sopher comparison (Table 6.27.2). Specifically, the Sopher sample has a significantly higher incidence of the "Y" molar fissure pattern (1.1) while the Shaver Hill sample had a significantly higher incidence of the "λ" fissure pattern (1.3). In the Carton/Sopher comparison (Table 6.27.3), two of the eight category comparisons indicate a statistically significant difference. The Sopher sample has a significantly higher incidence of the molar "Y" fissure pattern (1.1) and it also has a significantly higher incidence of the tuberculum intermedium (4.1).

TABLE 6.28

COMPARISON OF CATEGORY OBSERVATIONS

Right Mandibular Second Molars

6.28.1 Shaver Hill(Sh)/Carton(Ca) Comparison

Category	Sh	Ca	N	χ^2	χ^2_{yc}	$P_{\chi 2}$	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	0	0					
1.2,3 "Y" pattern absent	21	40	61	0.00	0.00		
B.							
1.2 "+" pattern present	6	14					
1.1,3 "+" pattern absent	15	26	61	0.26	0.05		

6.28.1 (cont'd)

Category	Sh	Ca	N	χ^2	χ^2_{yc}	P_{χ^2}	P
C.							
1.3 "λ" pattern present	15	26					
1.1,2 "λ" pattern absent	6	14	61	0.26	0.05		
Variation of distal cusp							
2.1 absent	2	5					
2.2,3,4 present	14	26	47	0.11	0.01		
Tuberculum sextum							
3.1 present	4	7					
3.2 absent	7	15	33	0.07	0.02		
Tuberculum intermedium							
4.1 present	2	2					
4.2 absent	20	33	57	0.24	0.00		
Bolk's paramolar							
5.1,2,3,4 present	1	4					
5.5 absent	23	35	63	0.75	0.15		
Groove termination							
6.1 abrupt	20	32					
6.2 blends in	3	7	62	0.26	0.02		
Buccal enamel extension							
7.1 absent	3	7					
7.2,3,4 present	22	34	66	0.31	0.04		
Lingual enamel extension							
8.1 absent	21	41					
8.2,3,4 present	4	2	68	2.53	1.32		

6.28.2 Shaver Hill(Sh)/Sopher(So) Comparison

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	0	12					
1.2,3 "Y" pattern absent	21	13	46	13.64	11.26	YY	XX
B.							
1.2 "+" pattern present	6	9					
1.1,3 "+" pattern absent	15	16	46	0.28	0.05		

6.28.2 (cont'd)

Category	Sh	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
C.							
1.3 "λ" pattern present	15	4					
1.1,2 "λ" pattern	6	21	46	14.464	12.267	YY	XX
Variation of distal cusp							
2.1 absent	2	5					
2.2,3,4 present	14	21	42	0.32	0.02		
Tuberculum sextum							
3.1 present	4	7					
3.2 absent	7	13	31	0.01	0.10		
Tuberculum intermedium							
4.1 present	2	5					
4.2 absent	20	20	47	1.10	0.41		
Bolk's paramolar							
5.1,2,3,4 present	1	0					
5.5 absent	23	26	50	1.11	0.00		
Grooves termination							
6.1 abrupt	20	21					
6.2 blends in	3	3	47	0.00	0.15		
Buccal enamel extension							
7.1 absent	3	3					
7.2,3,4 present	22	7	35	1.63	0.61		
Lingual enamel extension							
8.1 absent	21	9					
8.2,3,4 present	4	3	37	0.43	0.42		

6.28.3 Carton(Ca)/Sopher(So) Comparison

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
Molar fissure pattern							
A.							
1.1 "Y" pattern present	0	12					
1.2,3 "Y" pattern absent	40	13	65	23.55	20.47	YY	
B.							
1.2 "+" pattern present	14	9					
1.1,3 "+" pattern absent	26	16	65	0.00	0.03		

6.28.3 (cont'd)

Category	Ca	So	N	χ^2	χ^2_{yc}	P_{χ^2}	P
C.							
1.3 "λ" pattern present	26	4					
1.1,2 "λ" pattern absent	14	21	56	14.86	12.96	YY	
Variation of distal cusp							
2.1 absent	5	5					
2.2,3,4 present	26	21	57	0.09	0.00		
Tuberculum sextum							
3.1 present	7	7					
3.2 absent	15	13	42	0.05	0.01		
Tuberculum intermedium							
4.1 present	2	5					
4.2 absent	33	20	60	2.89	1.67		
Bolk's paramolar							
5.1,2,3,4 present	4	0					
5.5 absent	35	26	65	2.84	1.34		
Grooves termination							
6.1 abrupt	32	21					
6.2 blends in	7	3	63	0.33	0.05		
Buccal enamel extension							
7.1 absent	7	3					
7.2,3,4 present	34	7	51	0.85	0.23		
Lingual enamel extension							
8.1 absent	41	9					
8.2,3,4 present	2	3	55	4.70	2.56		

Table 6.28 presents the data for the right mandibular second molar. A statistically significant difference is not proven for any of the eight category comparisons between Shaver Hill and Carton (Table 6.28.1). One of the eight categories indicates a statistically significant difference in the Shaver Hill/Sopher comparison (Table 6.28.2). Specifically, the Sopher sample has a significantly higher incidence of the molar "Y" fissure pattern, while the Shaver Hill

sample has a significantly higher incidence of the "λ" molar fissure pattern (1.3). In the Carton/Sopher comparison, one of the categories indicates a statistically significant difference (Table 6.28.3). In this case, the Sopher sample has a significantly higher incidence of the molar "Y" fissure pattern (1.1) while the Shaver sample has a significantly higher incidence of the molar "λ" fissure pattern (1.3).

Summary of Mandibular Comparisons

Five of the 63 category comparisons for the left mandibular dentition indicate a statistically significant difference between the Shaver Hill and Carton dental samples. Four of these indicate a probably statistically significant difference (probability less than 0.05), while one indicates an almost certain statistically significant difference (probability less than 0.01).

Four of the 63 category comparisons for the right maxillary dentition indicate a statistically significant difference. All four of these category comparisons indicate a probable statistically significant difference (probability less than 0.05).

Seven of the 63 category comparisons for the left mandibular dentition indicate a statistically significant difference between the Shaver Hill and Sopher samples. Two of these comparisons indicate a probable statistically significant difference (probability less than 0.05), while

the remaining five indicate an almost certain statistically significant difference (probability less than 0.01).

Three of the 63 category comparisons for the right mandibular dentition indicate a statistically significant difference between Shaver Hill and Sopher. Two of these indicate a probable statistically significant difference (probability less than 0.05), while one indicates an almost certain statistically significant difference (probability less than 0.01).

Nine of the 63 category comparisons for the left mandibular dentition indicate a statistically significant difference between the Carton and Sopher dental samples. Six of these category comparisons indicate a probable statistically significant difference, while three indicate an almost certain statistically significant difference.

Three of the category comparisons for the right mandibular dentition indicate a statistically significant difference between the Carton and Sopher dental samples. Two of these indicate a probable statistically significant difference and the other indicates an almost certain statistically significant difference.

(iii) Interpretation

Grouping both the left mandibular and left maxillary dentitions of the Shaver Hill and Carton dental samples, 117 category comparisons were made with a total of ten (or 8.5%)

indicating a statistically significant difference between the two samples. Thus, in regards to the left permanent dentition of the Shaver Hill and Carton dental samples, the first null hypothesis (stating that there is no statistically significant difference between the permanent crown morphologies of the dental samples representing what have been archaeologically defined as protohistoric Neutral ossuary populations of the Ontario Iroquois Tradition) may be rejected.

Grouping both the right maxillary and right mandibular dentitions of the Shaver Hill and Carton dental samples, six (or 5.1%) of the 117 category comparisons indicated a statistically significant difference. Thus, in regards to the right permanent dentition of the Shaver Hill and Carton samples, the first null hypothesis (restated above) again may be rejected.

Grouping both the left mandibular and left maxillary dentitions of the Shaver Hill and Sopher dental samples, a total of sixteen (or 13.6%) of the 117 category comparisons indicated a statistically significant difference between the two dental samples. Thus, in regards to the left permanent dentition of the Shaver Hill and Sopher dental samples, the second null hypothesis (stating that there is no statistically significant differences in the permanent dental crown morphologies of dental samples which have been archaeologically defined as protohistoric Neutral ossuary populations and a dental sample representing what has been archaeo-

logically defined as a protohistoric Huron ossuary population, all of which belong to the Cntario Iroquois Tradition) may be rejected for the Shaver Hill/Sopher comparison.

Grouping both the right mandibular and left mandibular dentitions of the Shaver Hill and Sopher dental samples, a total of ten (or 8.5%) of the 117 comparisons indicated a statistically significant difference between the two samples. Thus, in regards to the right permanent dentition of the Shaver Hill and Sopher samples, the second null hypothesis (restated above) may be rejected.

Grouping both the left maxillary and left mandibular dentitions of the Carton and Sopher dental samples, a total of eighteen (or 15.4%) of the comparisons indicated a statistically significant difference between the two dental samples. Thus, in regards to the left permanent dentition of the Carton and Sopher samples, the second null hypothesis may be rejected.

Finally, grouping both the right maxillary and right maxillary and right mandibular dentitions of the Carton and Sopher dental samples, a total of fourteen (or 11.9%) of the 117 category comparisons indicated a statistically significant difference between the two samples. Thus, in regards to the right permanent dentition of the Carton and Sopher samples, the second null hypothesis may be rejected.

While both null hypotheses may be rejected, a comparison of the number of categories which indicated a

statistically significant difference between each of the dental comparisons, indicates that the Huron/Neutral dental sample comparisons in both left and right dentition exhibited a greater number of statistically significant differences than did the Neutral/Neutral comparison (see Tables 6.29 and 6.30). As stated in Chapter II, it is assumed that populations which share a large number of inherited traits are biologically more closely related than populations with fewer shared features. In view of the statistical evidence, it can be said then that the Neutral Shaver Hill and Carton ossuary populations share a closer biological affinity (in terms of their dental morphology) than either does with the Huron Sopher ossuary population. However, with the rejection of the first null hypothesis, the two Neutral ossuary populations cannot be considered biologically homogeneous.

TABLE 6.29

DENTAL CATEGORIES INDICATING A STATISTICALLY SIGNIFICANT DIFFERENCE FOR THE LEFT DENTITION

Dental Sample Comparison	Maxillary		Mandibular		Total	
	P. .05	P. .01	P. .05	P. .01	P. .05	P. .01
Shaver Hill/ Carton	5	2	5	1	10	3
Shaver Hill/ Sopher	8	1	8	5	16	6
Carton/Sopher	9	3	9	3	18	6

Thus, it can be demonstrated that during the proto-historic period of the Late Ontario Stage, the Neutral ossuary populations appear to show a closer biological affinity to each other than to Huron ossuary populations. Furthermore, while the Neutral ossuary populations show a closer biological affinity, they do not however represent a homogeneous biological population. This dental morphological evidence parallels the archaeological evidence which suggests that the Hurons and Neutrals were two distinct divisions within the Ontario Iroquois Tradition (Wright 1966) and that within the Neutral Nation, there existed a number of distinct groups or units (I.T. Kenyon, pers. comm.; Noble, pers. comm.).

TABLE 6.30

DENTAL CATEGORIES INDICATING A STATISTICALLY SIGNIFICANT DIFFERENCE FOR THE RIGHT DENTITION

Dental Sample Comparison	Maxillary		Mandibular		Total	
	P. .05	P. .01	P. .05	P. .01	P. .05	P. .01
Shaver Hill/ Carton	2	1	4	0	6	1
Shaver Hill/ Sopher	6	1	4	1	10	2
Carton/Sopher	11	2	3	1	14	3

(iv) Interpretation of the Cumulative x^2 Values

In each of the sample comparisons (Shaver Hill/Carton, Shaver Hill/Sopher, Carton/Sopher) the accumulated value of x^2 (df = 117) was calculated for both the left and right dentition category comparisons. The unadjusted x^2 value was used in those category comparisons where $n > 40$, and the adjusted value was used in those category comparisons where $n \leqslant 40$.

TABLE 6.31

CUMULATIVE VALUES OF x^2

Dental Sample Comparison	Cumulative x^2 value for left dentition (df = 117)	Cumulative x^2 value for right dentition (df = 117)
Shaver Hill/ Carton	64.52	66.02
Shaver Hill/ Sopher	99.14	99.92
Carton/Sopher	149.01	122.18

None of the cumulative values of x^2 indicate a statistically significant difference in any of the dental sample comparisons. However, the cumulative x^2 value does indicate that the Huron/Neutral (Shaver Hill/Sopher and Carton/Sopher) comparisons show a greater difference than the Neutral/Neutral comparison. Interestingly enough, these values are expressed roughly in a 2:3:4 ratio.

These values show a very close relationship between the left and right dentitions in each of the dental sample comparisons. It must be emphasized that this cannot be interpreted as indicating bilateral symmetry of expression of traits. This can never be determined with certainty when dealing with the incomplete dental arcades typical of ossuary populations.

There are two possible reasons why no statistically significant difference in the dental sample comparisons is indicated by the cumulative χ^2 values. First of all, the adjusted χ^2_{yc} value was used in the majority of comparisons. This adjusted χ^2_{yc} value is a very conservative statistical parameter and thus minimizes the statistical differences in any given comparison. One other factor possibly contributes to the lack of statistically significant differences indicated by the cumulative χ^2 values. The χ^2 values, in most cases are calculated from comparisons based on simple presence or absence of a given trait. However, the dental morphological observations presented in tabular form in Chapter VI indicate that the differences between dental samples are reflected by degree of penetrance of a given trait (i.e. variations of expression within a trait category) rather than by presence or absence. By lumping the variations within each category, and examining them in terms of only presence or absence, statistical differences are again minimized.

Chapter VII

DISCUSSION AND CONCLUSIONS

(i) Analysis of Ossuary Dental Samples

A major concern of this thesis is the problems encountered in the analysis of ossuary dental samples, particularly in regards to the permanent crown morphology. As stated earlier, the dental sample from an ossuary population does not represent the dentition of individuals, but rather the tooth groups found in the dental arcade. Keeping this in mind, a number of factors have to be considered in order to gain reliable and valid data from comparative ossuary dental sample studies.

Perhaps the chief source of problems in studying ossuary dental samples is the fact that a large portion of the sample may be made up of loose teeth, many of which cannot be identified accurately as to their tooth group, or be used in reconstructing dental arcades (either completely or partially). As a result, a fairly strict procedure must be adhered to in order to make full use of this "lost" dental information.

The first and most basic step is the closely controlled excavation of the ossuary. Painstaking care must be taken in the removal of all dental material. At this stage, careful recording and labelling of all teeth

(particularly loose teeth) as to their "in situ" position is essential.

In many cases, however, the controlled excavation of an ossuary does not guarantee that the ossuary dental sample will be represented by complete, or partially complete, dental arcades, or that loose teeth can be readily associated with their tooth group. The Sopher ossuary dental sample falls into this category. The excavation of this ossuary was conducted with care by Dr. W.C. Noble. Unfortunately, bone preservation was extremely poor in this ossuary population, and as a result the dental sample is made up primarily of disassociated teeth. Problems of analysis due to poor preservation of the dental sample can be compounded for the dental researcher by careless storage procedures. Thus careful packing and storage of ossuary dental material is just as vital as careful excavation.

Another closely related problem concerning the high frequency of disassociated teeth found in Iroquoian ossuary dental samples is reliable tooth identification. Extreme care is required in sorting and identifying each tooth in the ossuary dental sample (and this is most emphatically stressed in identifying the loose disassociated teeth) in order to make valid observations. Tooth identification, to a large extent, depends on the researcher's subjective examination, which in turn is based on personal experience and the attempt to standardize tooth identification by adopting the methods and definitions employed by other

researchers. In my research I relied for the most part on definitions regarding tooth identification outlined in J.E. Anderson's The Human Skeleton (1969) and Kraus et al. Dental Anatomy and Occlusion (1969).

A problem encountered both in the process of tooth identification and in the analysis of crown morphology is the obliteration of dental traits by processes such as tooth wear (attrition) and caries. It was observed that certain crown morphological categories are much more sensitive to obliteration than others. Specifically, these include crown morphological categories which occur on the incisal surface of the incisors and canines. Each researcher must take into consideration the obliteration sensitivity of each crown morphological category, and of each tooth group he wishes to study.

A further area of concern in the analysis of ossuary dental samples is the problem of sexing teeth. Unless teeth are found intact in a complete cranium or mandible, there is little chance of determining the sex of the individual from which the teeth came. This leaves the researcher in the position of having to assume that the sex ratio is approximately the same for all ossuary dental samples being analysed. This assumption is only important for those dental traits which do show a sexual difference in expression. One factor which has been previously noted, and which is most relevant to the accurate sexing of individuals is

the asymmetrical expression of traits. Problems of analysis which arise from the difference in frequency of symmetrical/asymmetrical bilateral occurrence of dental traits between males and females (see Chapter II) can be eliminated even though the dental sample cannot be sexed accurately. The simplest and most effective means, and the method which has been adopted in this study, is the maintenance of totally independent observations, comparisons and discussions of the left and right dentition.

Once the researcher has decided on the dental categories that he wishes to observe and record, he is faced with the problem of standardization of observations. The problem of standardization is perhaps the most important one facing the researcher, and thus a number of factors must be taken into consideration. At present, the genetic mechanism governing the absence, presence and degree of expression of dental categories is not fully understood. Whatever method of standardization is employed, the researcher must keep this fact in mind. Information concerning the absence, presence and expression of dental traits of the Ontario Iroquois is almost totally non-existent at the present time. In order to remedy this situation, future classification systems must cover a large range of dental expressions on the one hand, and have inherent in them a mode of condensing this large range of dental expressions into a simpler form (i.e. presence/absence of each category) on the other.

Finally, the classification system used must offer the optimum degree of standardization in order that researchers may be able to reduce the degree of subjectivity of the dental studies of the Ontario Iroquois. These above considerations have all been encorporated into my approach to the analysis of the ossuary dental samples in question. Each dental trait in this study has been defined as a category containing a number of variations which express the dental morphology of the tooth crown in regards to that particular category. The presence of one variation precludes the presence of all the other variations for that category. For example, the category of buccal shovel shaping of maxillary incisors (4.) has three variations:

4.1 no buccal shovel shape,

4.2 buccal semi-shovel shape,

and 4.3 marked buccal shovel shape.

This allows a detailed examination and presentation of the buccal shovel shaping of maxillary incisors. However, in doing the Chi-square statistical analysis (applying Yate's correction where necessary), and Fisher's test, it was necessary to represent each category in a 2 x 2 contingency table. The classificatory system used here enables the researcher to "stack" (or sum) variation units together within a category without reducing the validity of the observations made. Thus for the buccal shovel shape of maxillary incisors (4.), the buccal semi-shovel shape (4.2)

and the marked buccal shovel shape (4.3) were "stacked" together to indicate the presence of buccal shovel shaping (4.2,3) while the absence of buccal shovel shaping (4.1) represented the other set for the contingency table. This type of classificatory system allows the researcher a great deal of flexibility, enabling him to examine dental traits in detail, yet allowing him to adjust the data to limitations imposed in the study (i.e. statistical tests) without reducing the validity of his observations.

While this type of classificatory system appears to operate satisfactorily in most instances, there are at least four dental categories which can make biological sense when the variations within each are arranged in alternative ways (these four traits include maxillary premolar inclination of the buccal cusp ridges (5.), inclination of the lingual cusp ridges (6.), relative alignment of the lingual and buccal cusps (7.), and mandibular premolar fissure pattern (1.)). Until we have a better understanding of these dental categories, analysis of the comparative data must consider all of the alternative arrangements.

In an attempt to ensure the optimum control of standardization of the dental categories for this study and for future dental studies, I have utilized both a written and visual system. A written definition was provided for each dental category and for the variations within a category, with references to the literature on which these

definitions were based. The visual control involved reference to the photographs in Kraus et al. Dental Anatomy and Occlusion (1969) for the various dental variations of the categories. Unfortunately, not all the category variations referred to in this thesis are represented by photographs. Nevertheless, I believe the superior nature of these photographs justifies their use where applicable. By using the photographs in this book, I hoped to provide a reference in regards to standardization of dental observations which is readily available to any researcher. In order to ensure valid observation in dental studies and to encourage meaningful comparisons of dental studies, further methods of standardization may also prove useful if accepted by all researchers.

A primary aim of this thesis has been to develop a framework within which to study the dentition of the Ontario Iroquois as represented by the dental samples of ossuary populations. This must of course be the first step toward more detailed and comprehensive studies of Ontario Iroquois dentition, which, up until this point, have never been attempted. It is hoped that the questions raised by this study will perhaps motivate others to do further research in this field and to perhaps develop even more sophisticated methods and techniques.

(ii) Ontario Iroquois Dental Studies Today

The purpose of this section is to briefly summarize and discuss a few of the contemporary studies of the Iroquoian and pre-Iroquoian peoples of southern Ontario. My primary intention here is to precis the emphasis and scope of these studies with particular reference to their treatment of dental data. This discussion is presented here, rather than in the introductory chapter, because it indicates the limited extent of our present knowledge of Ontario Iroquoian and pre-Iroquoian dentition, and the need for standardization of future dental research.

Anderson's Osteology of the Bennett Site encorporates the dental analysis into a section of the skeletal analysis of the Bennett site burials which consist of thirteen graves involving fifteen individuals (Wright & Anderson 1969:11). The Bennett site is archaeologically identified as belonging to the late Pickering branch (circa 1260-1280 A.D.) (Noble, pers. comm.) of the Ontario Iroquois Tradition (Wright & Anderson 1969:77-79). Anderson demonstrated, on the basis of the incidence of dental caries and of dental attrition, that the economy of these individuals was based on agriculture rather than hunting and gathering. Apart from references to caries rate, degree of attrition, age based on tooth eruption, and the incidence of premortem tooth loss, no other observations on the dentition were made.

Cybulski's Skeletons of Surma Site presents the

dental analysis in a section of the skeletal analysis of the Surma site burials which consist of 22 individuals (Cybulski 1968:8). The Surma site is archaeologically identified as being representative of the transitional period between the late Middle Woodland and early Late Woodland periods (Cybulski 1968:8). In his analysis, Cybulski demonstrated on the basis of the dental caries rate, that these individuals' economy was based on incipient agricultural practices. Tooth eruption patterns were used to determine individuals' ages. Crowding, dental attrition, premortem loss, alveolar abscesses and a few of the commonly reported congenital abnormalities such as three-rooted lower molars are also reported in the dental analysis.

The only references to dental morphology in Cybulski's report concern the incidence of Carabelli's tubercle on the first maxillary molars and the occurrence of enamel extensions on maxillary and mandibular first, second and third molars. He fails however, to define morphologically what he means by Carabelli's tubercle (i.e. is it just a pronounced cusp with an independent apex that is being recorded?) nor does he make reference to the occurrence of Carabelli's tubercle on the second molar. No mention is made of what constitutes an enamel extension (i.e. length of extensions) or whether the extensions occur apically on the buccal, lingual, distal, or mesial side of the crown cervix.

Anderson's The People of Fairty contains a section

on dentition in the skeletal analysis of this Ontario Iroquois ossuary consisting of a minimum of 512 individuals (on the basis of the humeri count) (Anderson 1963:32). The Fairty ossuary is associated with the Robb site which is archaeologically defined as an early representative of the Middleport period of the Middle Ontario Iroquois Stage (Anderson 1963:28). Pre-mortem loss, incidence of caries, attrition and the condition of hypercementosis were observed in the dental analysis.

Dental morphological traits were limited to incisor shovel shaping, Carabelli's cusp, and parastyle of the Maxillary molar, maxillary and mandibular enamel extensions and the occurrence of common dental anomalies such as the peg shaped incisor. In regard to incisor shovel shaping, the only statement made in the report is that the incisors are shovel shaped. There is no distinction made between lateral and central incisor shovel shaping or between maxillary and mandibular shovel shaping. Furthermore, no observations or comments are made with regard to the degree of shovel shaping or whether it is lingual, or lingual and buccal in occurrence. In the analysis of Carabelli's cusp, the frequencies of the variations (pit, groove, cusp, independent cusp) of all the maxillary molars together are provided with no indication of the frequencies for either the first or the second maxillary molar being presented. Again in the case of enamel extensions, no frequencies are provided for the individual first, second or third molars.

Of importance, Anderson does note that statistical analysis on dental variation is affected by premortem and post-mortem loss and by the problem of loose teeth identification because of attrition and caries rates (Anderson 1963: 43).

Anderson's The Serpent Mounds Site Physical Anthropology integrates the dental data with the skeletal data and comparisons. Dental observations are limited to crowding, attrition, infection (abscesses) and a few dental anomalies. Anderson was able to differentiate between the archaeologically defined Middle Woodland Mound hunting and gathering groups, and the Late Woodland Pit agricultural groups of the Serpent Mounds site on the basis of dental observations concerning caries rate, degree of attrition, premortem tooth loss and occurrence of dental enamel fracturing. This differentiation is also applied to the section on intersite comparisons.

Finally, Ossenberg's Osteology of the Miller Site also encorporates a dental study as a section of the skeletal analysis of the Miller site burials which consist of seven burial pits containing approximately 32 individuals. The Miller site is identified as an early Pickering village site (circa 800 A.D.) (Noble, pers. comm.). Age of the individuals was estimated on the basis of tooth eruption. Ossenberg noted that the dental conditions of the Miller individuals were similar to those of the Serpent Mound Late Woodland

pit groups whose economy was based on agriculture. Dental observations included attrition, caries, premortem tooth loss, hypercementosis, abscesses and periodontal disease.

Observations on dental morphology were limited to incisor shovel shaping, enamel extensions on mandibular molars, protosylids on mandibular molars, parastyles on maxillary molars and Carabelli's cusp on the maxillary first molar. The observations on these dental morphological categories are vague and over-generalized in most cases. Observations on incisor shovel shaping were reduced to the statement that the incisors were characteristically shovel shaped. The frequency of enamel extensions (defined only as a band of enamel extending apically between the roots) is only given for mandibular molars in general with no reference to the position (buccal, lingual, etc.) of the extension on the tooth.

This brief summary of the present state of Ontario dental analyses indicates their very limited nature. They have, as a general rule been relegated to a section of the skeletal analysis of the respective burials. The main emphasis of the dental studies has been the relationship between diet and dental conditions such as caries rate, rate and degree of attrition, alveolar abscesses and periodontal disease, and how this relationship can be used to determine the economic subsistence patterns of the Iroquoian and pre-Iroquoian peoples of southern Ontario.

Apart from the contribution of dental studies to our knowledge of subsistence and diet, dental analysis has played a minor role in studying Iroquoian and pre-Iroquoian burial populations. Observation of dental eruption patterns is used to determine ages of individuals of burial populations. However, no reference to the author's method of determining times of eruption of specific teeth is provided; in fact, no discussion of any kind is presented on this subject. Dental morphological categories are used in comparing skeletal populations and in particular studying the "in situ" theory of Iroquois origins, but only as a part of the total discussion of skeletal morphological traits. Furthermore, these dental morphological categories have been restricted in numbers and type to a few of the most classical North American Indian dental traits or anomalies. In addition to being few in number, they have been poorly defined, with little or no attempt to standardize definitions and observations. Finally, the analysis and discussion of many traits provides little or no information on the many potential manifestations of morphological features. All of these features of past dental analyses have made useful comparisons at best difficult, and more often, impossible. As a result, little discussion has been or can be generated concerning the dental morphology of the Iroquoian and pre-Iroquoian peoples of southern Ontario.

In summary, past dental analyses have concentrated

on the problems of economic subsistence, diet, disease and age estimations. Studies referring to dental morphology have contributed to the biological aspect of the "in situ" theory of Iroquoian origins but the dental morphological traits studied have been limited in number, and poorly defined.

At present, there exist no suitable dental morphological studies on the Ontario Iroquois and pre-Iroquois with which I can compare the data presented in this thesis. This total lack of comparative dental data, and the absence of a comprehensive and standardized framework in which to study the dentition of skeletal populations (particularly ossuary type populations) were prime factors taken into consideration in the process of research and analysis of this thesis. It is hoped that this study may stimulate further discussion and research on Ontario Iroquois and pre-Iroquois dentition; as the situation now stands, comprehensive, in-depth dental morphological studies are drastically needed.

(iii) Ontario Iroquois Biological Relationships

Thus far, the data indicate a statistically significant difference in terms of permanent dental crown morphology both between the two Neutral ossuary populations, Shaver Hill and Carton and between the Neutral ossuary

populations and the Huron ossuary population, Sopher. However, the number of statistically significant differences exhibited by the two Neutral/Huron comparisons is greater than the number of statistically significant differences between the two Neutral ossuary populations. As stated earlier, it was assumed that dental samples with a relatively low number of statistically significant differences share a closer biological affinity than samples which share a greater number of statistically significant differences. Thus, it may be stated that the two Neutral ossuary populations share a closer biological affinity than do either of the Neutral populations with the Huron ossuary population.

Before further comments can be made concerning the biological affinity of protohistoric Neutral ossuary populations and the biological affinity of protohistoric Neutral and Huron ossuary populations, two limitations on the interpretation of biological affinities of populations should be mentioned.

The first of these is the difficulty of determining the significance of temporal distance between the three ossuary populations in this study. Anderson (1968) has demonstrated in his study of the Serpent Mounds site that there were microevolutionary trends in morphological traits over a temporal distance and that three distinct stages in this trend could be identified. It should be pointed out that the temporal distance between the three stages is of a

much longer time period than encountered in this study. The significant point, however, is that greater temporal distances between ossuary populations increase the likelihood of microevolutionary change in morphological characters of the ossuary populations.

The earliest population in this study is the protohistoric Huron Sopher ossuary which dates 1580 - 1610 A.D.; next in time is the protohistoric Neutral Carton ossuary dating 1590 - 1610 A.D. with the protohistoric Neutral Shaver Hill ossuary dating 1600 - 1620 A.D. The dating of these ossuaries is not precise and thus the temporal distance between the ossuary populations may in fact be somewhat greater or smaller than estimated.

There is a temporal distance of approximately one generation between Sopher and Carton and again one generation between Carton and Shaver Hill. The close biological affinity of the two protohistoric Neutral ossuary populations suggests that no microevolutionary changes occurred over a single generation. The temporal differences between Shaver Hill/Sopher and Carton/Sopher are two and one generations respectively. However, there are more statistically significant differences indicated in the Carton/Sopher comparison than in the Shaver Hill/Sopher comparison, which indicates that the number of statistically significant differences in this case is not a direct function of temporal distance. This suggests that microevolutionary trends in

permanent crown morphology are not a significant factor over a two generation temporal distance, and that microevolutionary trends are not a major influence on the results of this study. However, I would agree with Halpren (1973) that further studies are required on the problem of microevolutionary trends among the Ontario Iroquois before a conclusive statement on their influence upon the results of this study can be put forward.

A second limitation that must be examined is a statistical consideration. Gaherty (1970:109) has noted that the use of Chi-squares is a crude statistical method as it is dependent on differences being greater or smaller than a specific value while the magnitude of the differences is not taken into consideration. As applied to this thesis, the Chi-square statistical method (along with the Fisher test) has indicated a biological divergence both between the two protohistoric Neutral populations and between the protohistoric Neutral and the protohistoric Hurons. The magnitude of this biological divergnce, however is more difficult to determine. Another limitation of the Chi-square method is its dependence on sample size (Gaherty 1970:124) the smaller the sample size, the greater the chance of underestimating the population distance. This was overcome in this study by the use of the Fisher's test to determine the exact probability where N equals 8 to 50.

In Chapter IV it was pointed out that there were from

five to eight tribes which made up the Neutral Confederacy (Noble, 1972; White, 1972). One tribe or subdivision of the Neutral nation was located in the Westover area, and another was located in the Milton area. These subdivisions are apparently representative of political units expressed as village clusters in each of the tribal areas of the Neutral Confederacy.

The Shaver Hill ossuary population, which may be considered representative of the Westover tribal area (Noble, pers. comm.), and the Carton ossuary population, which may be considered representative of the Milton subdivision during the protohistoric period (Noble, pers. comm.), represent distinguishable socio-political units within the Neutral Nation. In addition, the data indicate that they also represent distinguishable biological units. Nevertheless, the biological affinity of these populations relative to that between the Neutral and Huron populations suggests a degree of "biological exchange" between the two Neutral subdivisions. While ethnographic information on Neutral kinship and marriage practices is limited, this "biological exchange" between Neutral tribal units could indicate that some exogamous procreative control existed between these units during the protohistoric period.

This study indicates that the degree of "biological exchange" between Neutral and Hurons would have been relatively low in comparison to the "biological exchange" between Neutral

populations. We know that during the historic period, the Neutrals were at peace with the Hurons (J.R. XXI:193-195) and felt free to visit the Hurons and to go to Huronia in time of famine (J.R. XXVII:25; XX:47-49). Sagard notes however, that the relations between Huron and Neutral peoples were not always friendly (Wrong 1939:151). Unfortunately, the relationship and contact between Hurons and Neutrals of the protohistoric period is not fully understood.

One problem encountered in determing the basis of the biological differences between protohistoric Huron and Neutral ossuary populations is the historically known practice of adoption of individuals from outside the population. It is noted that the Hurons would often give a prisoner of war to a family that had lost relatives to the enemy and thus the adopted captive would become a fully recognised member of Huron society (J.R. VII:101; XXIII:33). To what extent these practices of adoption would influence the dentition of a specific ossuary population remains undetermined. However, such elements of intrusion into Ontario Iroquois populations must always be taken into account when examining ossuary populations, particularly when discussing their possible influence on data referring to biological affinity.

The data indicating a closer biological affinity between the two protohistoric Neutral ossuary populations

than between either Neutral population and the protohistoric Huron population parallel the present archaeological model of J.V. Wright, i.e. the Hurons, Petuns, Neutrals and Eries of the Late Ontario Iroquois Stage diverged from a common Middleport Ontario Iroquois Stage beginning about 1400 A.D. (Wright 1966:xii). In other words, the degree of biological divergence appears to parallel the archaeological divergence while having been determined totally independently of the archaeological data.

One element of the apparent biological divergence between protohistoric Neutrals and Hurons which merits further research is the temporal one. If the biological data can be assumed to parallel the archaeolological data, then it might be expected that there would be a progressively greater biological divergence (at least in terms of permanent crown morphology) between the Hurons and Neutral populations from prehistoric through protohistoric to historic times. Necessary then would be an examination of the microevolutionary trends of prehistoric, protohistoric and historic ossuary populations of both Neutrals and Hurons, in order to establish whether this is in fact supported by the available evidence.

The problems inherent in the interpretation of the data put forward in this thesis, and briefly presented in this chapter, point towards further research in the area of dental morphology which must be undertaken in order to fully

understand the nature of the biological development of the historically known Neutral-Erie and Huron-Petun branches of the Ontario Iroquois. It is hoped that this study has demonstrated that dental morphology has its own contribution to make to the ongoing study of the Ontario Iroquois. It is also hoped that this study can offer a basis or point of view from which a meaningful dialogue in terms of the dental morphology of the Ontario Iroquois can begin.

(iv) Summary

1. It has been demonstrated that the protohistoric Neutral ossuary populations represented by the Shaver Hill and Carton samples manifest a closer biological affinity (in terms of dental morphology) than do either Neutral population with the protohistoric Huron ossuary population represented by the Sopher sample.

2. An evaluation of the present condition of Iroquoian dental studies indicates the need for more in-depth dental studies based on a much broader classification system of dental morphological features. This thesis will hopefully provide a preliminary step toward this end.

3. Finally, the lack of standardization of methodology and terminology which has so limited the usefulness of dental morphological studies to date, must be remedied before further major dental analyses in the field

of Iroquoian dental morphology is undertaken. This is vital in order that future dental research produce useful comparative data. Again, it is hoped that this thesis can contribute to achieving that end.

BIBLIOGRAPHICAL CODE

AARO	Annual Archaeological Report of Ontario
AJA	American Journal of Anthropology
AJHG	American Journal of Human Genetics
AJMD	American Journal of Mental Deficiency
AJO	American Journal of Orthodontics
AJPA	American Journal of Physical Anthropology
AOB	Archives of Oral Biology
BR	Biological Review
CA	Current Anthropology
DC	Dental Cosmos
DP	Dental Progress
FS	Journal of Forensic Sciences
JADA	Journal of the American Dental Association
J of A	Journal of Anthropology
JDR	Journal of Dental Research
JO	Journal of Orthodontics
JPD	Journal of Prosthetic Dentistry
OSMP	Oral Surgery, Medicine and Pathology

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