

https://dspace.org/

A morphological and matrical study of the teeth, the jaws and the bony palate of several large groups of South African bantu-speaking negroids

Jacobson, Alexander

2015-06-29
http://hdl.handle.net/10539/18019

Downloaded from a DSpace repository. https://dspace.org/

TABLE 72

THE INCIDENCE OF SHOVEL-SHAPED MAXILLARY CENTRAL INCISORS IN SOUTH AFRICAN BANTU POPULATIONS

SEX	GROUP	SHOVEL-SHAPE						
		No.of teeth examined	Indeter-minate	No Shovel	Trace Shovel	Semi-Shovel	Shovel	TOTAL Shovel
MALES	Natal Nguni	71	16	46	9	0	0	9
	Cape Nguni	76	1	63	9	0	3	12
	Sotho	55	10	42	3	0	0	3
	Miscellaneous	64	9	52	1	0	2	3
	TOTAL:	266	36	203	22	0	5	27
FEMALES	Natal Nguni	32	7	19	5	1	0	6
	Cape Nguni	7	3	1	1	0	2	3
	Sotho	25	3	20	0	0	2	2
	Miscellaneous	6	0	6	0	0	0	0
	TOTAL:	70	13	46	6	1	4	11

TABLE 73

THE INCIDENCE OF SHOVEL-SHAPED MAXILLARY LATERAL INCISORS IN SOUTH AFRICAN BANTU POPULATIONS

SEX	GROUP	SHOVEL-SHAPE						
		No.of teeth examined	Indeter-minate	No Shovel	Trace Shovel	Semi-Shovel	Shovel	TOTAL Shovel
MALES	Natal Nguni	71	20	25	20	5	1	26
	Cape Nguni	84	8	56	18	2	0	20
	Sotho	78	18	33	18	9	0	27
	Miscellaneous	78	20	49	7	2	0	9
	TOTAL:	311	66	163	63	18	1	82
FEMALES	Natal Nguni	39	14	4	9	3	9	21
	Cape Nguni	20	10	3	5	0	2	7
	Sotho	47	11	19	15	0	2	17
	Miscellaneous	6	0	4	2	0	0	2
	TOTAL:	112	35	30	31	3	13	47

TABLE 74

PERCENTAGE DISTRIBUTION OF SHOVEL-SHAP

Race and Investigator	No. of teeth examined	UPPER CENTRAL INCISORS			
		No Shovel	Trace Shovel	Semi-Shovel	Sh
American White (Male) (Hrdlička 1920)	1000	66.5	24.5	7.6	1
American White (Female) (Hrdlička 1920)	1000	70.4	21.8	5.2	2
American Whites (Lasker 1957)	642	55.0	45.0		0
American Negro (Male) (Hrdlička 1920)	618	54.5	33.0	7.6	4.
American Negro (Female) (Hrdlička 1920)	1000	56.0	32.6	8.0	3.
Mongoloid (Hrdlička 1920)	24	0	8.5	29.0	62.
Eskimo (Hrdlička 1920)	40	0	15.0	47.5	37.
Aleut (Moorrees 1957)	75	0	2.7	34.7	62.
U.S. Indian (Hrdlička 1920)	277	2.0	9.0	24.0	67.
Pecos Indian (Nelson 1937)	324	2.2	8.3	15.4	74.
Pima Indian (Male) (Dahlberg 1951)	101	0	4.0	0	96.
Pima Indian (Female) (Dahlberg 1951)	125	0	1.0	0	99.
Bushmen (van Reenen 1966)	95	55.8	30.5	11.6	2.
Bantu (Carbonell 1963)	122 casts	65.5	18.0	14.7	1.
Bantu Males (present study 1967)	230	88.7	9.1	0	2.
Bantu Females (present study 1967)	57	80.6	10.5	1.8	7.

TABLE 74

PERCENTAGE DISTRIBUTION OF SHOVEL-SHAPED TEETH IN VARIOUS POPULATIONS

Race and Investigator	UPPER CENTRAL INCISORS						UPPER LATERAL INCISORS					
	No. of teeth examined	No Shovel	Trace Shovel	Semi-Shovel	Shovel	TOTAL	No. of teeth examined	No Shovel	Trace Shovel	Semi-Shovel	Shovel	TOTAL
American White (Male) (Hrdlička 1920)	1000	66.5	24.5	7.6	1.4	33.5	1000	50	36.4	8.8	1.4	50.0
American White (Female) (Hrdlička 1920)	1000	70.4	21.8	5.2	2.6	29.6	1000	59.6	29.9	7.4	1.0	40.4
American Whites (Lasker 1957)	642	55.0	45.0		0	45.0	642	50.0	50.0		0	50.0
American Negro (Male) (Hrdlička 1920)	618	54.5	33.0	7.6	4.9	45.5	618	42.1	38.0	12.8	4.5	57.9
American Negro (Female) (Hrdlička 1920)	1000	56.0	32.6	8.0	3.6	44.0	1000	47.5	35.1	11.1	3.8	52.5
Mongoloid (Hrdlička 1920)	24	0	6.5	29.0	62.5	98.0	24	0	0	25.0	75.0	100.0
Eskimo (Hrdlička 1920)	40	0	15.0	47.5	37.5	100.0	37	0	0	43.0	57.0	100.0
Aleut (Moorrees 1957)	75	0	2.7	34.7	62.6	100.0	70	0	2.9	31.4	65.7	100.0
U.S. Indian (Hrdlička 1920)	277	2.0	9.0	24.0	67.0	98.0	300	1.0	6.0	17.0	76.0	99.0
Pecos Indian (Nelson 1937)	324	2.2	8.3	15.4	74.1	97.8	338	1.4	9.2	17.4	72.0	98.6
Pima Indian (Male) (Dahlberg 1951)	101	0	4.0	0	96.0	100.0	93	1.0	13.0	0	81.0	99.0
Pima Indian (Female) (Dahlberg 1951)	125	0	1.0	0	99.0	100.0	119	0	7.0	0	82.0	100.0
Bushmen (van Reenen 1966)	95	55.8	30.5	11.6	2.1	44.2	109	33.9	27.5	24.8	13.8	66.1
Bantu (Carbonell 1963)	122 casts	65.5	18.0	14.7	1.6	34.5	122 casts	46.7	29.5	21.3	2.4	53.3
Bantu Males (present study 1967)	230	88.7	9.1	0	2.2	21.3	245	66.5	25.7	7.4	0.4	33.5
Bantu Females (present study 1967)	57	80.6	10.5	1.8	7.1	19.4	77	38.9	40.3	3.9	16.9	61.1

I.B. MEDIAN RIDGES AND LINGUAL TUBERCLES

On the lingual surface of maxillary incisors may be encountered a median, two lateral and two marginal ridges; five ridges in all with three intervening depressions. The median ridge is usually straight and vertical. Lateral ridges may be straight or slightly curved, whereas marginal ridges are curved and follow the mesial and distal margins of the teeth. Hrdlička (1920) observed that the two lateral ridges were the least stable in human dentitions.

The presence and relative development of individual ridges are variable from individual to individual. Frequently in the present material, only a single median ridge was present and prominent. On the other hand, two or three ridges may have been evident in varying degrees of prominence. Often the lingual surface of the maxillary incisors was smooth, with no trace of lingual ridges, tubercles or shovelling. In such teeth the lingual surface tended to be concavo-convex from incisal edge to gingival margin.

The ridging on the lingual surface of the maxillary incisors was classified according to the degree of prominence of the ridges, and whether the ridges were single or multiple. Ridges that were barely discernible were classified as "trace"; the other degrees of prominence were labelled "moderate" and "marked" (Fig.26). Median ridges were observed in shovel-shaped incisor



Fig. 26 Moderate ridging of lingual surfaces of maxillary incisor teeth

teeth, as well as in those with no evidence of shovelling.

The lingual surfaces of the incisors were studied also for the presence and size of lingual tubercles. Hrdlička (1920) referred to lingual tubercles as lingual cusps and defined them as being a more or less marked, single, double, or multiple protuberance from the heel of an incisor or a canine. Lingual tubercles may be absent, inconspicuous or replaced by an extension or fusion of the marginal ridges. On the other hand, they might develop to a moderate extent, or even into a large well developed and distinct accessory cusp. According to Hrdlička, a strong lingual cusp in an incisor may, in extreme cases, reach near to the cutting edge of the tooth and produce a form approaching that of a bicuspid. In other instances, the lingual tubercle is frequently divided into several cusplets and is found in teeth that are shovel-shaped as well as in teeth that are not. Weidenreich (1937) believed this tubercle to be a decidedly primitive character. It seems to occur in all living races of man, but in a human-like form has not as yet been signalled in any of the primates or lower mammals (Hrdlička 1920).

In the present study, the size of the lingual tubercle was graded as trace, moderate or marked. The exact determination of the size of the tubercles is not easy in that it is difficult to distinguish between s

confluence of marginal ridges and a trace of a tubercle (Pedersen 1947). In fact, Hrdlička (1920) stated that probably no two observers would reach precisely the same results on the same series of specimens, but he believed that the differences would not be serious enough to obscure the main facts. Pedersen (1947) distinguished between "marked tubercles" and "lingual cusps" proper. In the present study no attempt was made to distinguish between the above; both were classified as "marked" lingual tubercles. A "trace" tubercle was designated only when a small but definite eminence was present on the lingual surface of the incisor tooth. A "moderate" tubercle was determined as being intermediate in size between a "trace" and a "marked" tubercle (Figs. 27, 28 and 29). Where more than one tubercle was present, the overall extent of tubercle formation was assessed and designated.

PRESENT STUDY

The degree of ridging could be clearly determined in 165 maxillary central incisors in male Bantu crania. This included both left and right incisors from the same crania. Lingual ridges were present with varying degrees of prominence in 45 per cent of the sample (Table 75). Marked median and/or lateral lingual ridges were observed in only 3.4 per cent of the total with ridges. The remainder of the ridged teeth were either moderately (22.8 per cent) or slightly (18.8 per cent)



Fig. 27 Trace lingual tubercle on lateral incisor



Fig. 28 Moderate lingual tubercle (bifid example)



Fig. 29 Marked lingual tubercles

ridged. The lateral incisors of Bantu males exhibited a lower incidence of ridging since 32.2 per cent of the sample of 192 teeth in which the lingual surfaces could be determined exhibited some degree of ridging. Of the ridged lateral incisors, 1.6 per cent were markedly, 12.1 per cent moderately, and 18.5 per cent slightly ridged.

The Bantu females, on the other hand, presented a greater overall incidence of ridging of maxillary central and lateral incisors (viz. 60.0 per cent and 44.4 per cent, respectively) than the males, but evinced a total absence of marked lingual ridges. Thirty-five per cent of the total central incisors with ridges were moderately ridged, whereas the remaining 25 per cent of these teeth possessed traces of ridges. Of the ridged lateral incisors in the females, 16.6 per cent exhibited moderate ridges and 27.8 per cent had trace ridges.

In the tribal groups, Sotho males and females evinced a relatively lower incidence of smooth surfaced maxillary central and lateral incisor teeth (Tables 76 & 77). The only exception was provided by the lateral incisors of Natal Nguni females; of the 17 observable teeth, only 4 possessed smooth lingual contours. In the remaining tribal groups, approximately half or more of the incisor teeth had smooth lingual surfaces.

The maxillary central incisors of the Sotho showed a greater incidence of overall ridging than the other

groups. Thus, in males, 19 out of a total of 31 teeth, and in females, 10 out of a total of 15 teeth, showed some degree of ridging (Table 76). About half of the Cape Nguni males (21 out of a total of 41 teeth) had some degree of ridging on the lingual surfaces of their maxillary central incisors. The Sotho of both sexes evinced a higher incidence of overall ridging of the lateral incisor teeth than the other tribes. In males, 18 out of a total sample of 44 teeth, and in females, 12 out of a total of 17 teeth, possessed some degree of ridging (Table 77).

The total percentage incidence of lingual tubercles in the central and lateral incisors of Bantu females exceeded that of males. The total incidence of tubercles in the central incisors of males was 4.7 per cent and that of females 11.4 per cent (Table 78). The total incidence in the lateral incisors was 14.0 per cent and 16.9 per cent, for males and females respectively. The percentage incidence of large lingual tubercles in the maxillary incisors of both sexes was minimal. Of the 57 incisors observed in female skulls, in no instance was a large tubercle noted. Only 1.3 per cent of 230 male maxillary central incisors presented a large lingual tubercle. Three per cent of male maxillary central incisors possessed a moderate tubercle, as opposed to a figure of 14 per cent in females. Nc Bantu females indicated a slight lingual tubercle on their central

incisors, and only 0.4 per cent of Bantu male central incisors exhibited this feature. The overall tendency is for more Bantu females than males to possess a moderate lingual tubercle on the maxillary central incisors. On the maxillary lateral incisors, although Bantu males evinced a higher incidence of slight lingual tubercles, the general tendency was for females to show a higher incidence of lingual tubercles than males.

Of the tribal groups, the Cape Nguni males possessed a considerably higher incidence (7 out of a total sample of 75 teeth) of this tubercle on maxillary central incisors than did the others (Table 79). The incidence of lingual tubercles (3 out of a total of 60 teeth) on lateral incisor teeth in Sotho males, was less than in other tribal sub-groups (Table 80). Because of an insufficient sample, it would be premature to draw conclusions from these figures.

The commonest form of lingual surface on the maxillary incisor teeth of the Bantu was a smooth surface free of ridges, eminences or tubercles, depressions or shovelling. More than half (55 per cent) of the observable teeth of males exhibited this feature on their central incisor teeth and 67.8 per cent on their lateral incisors (Table 75). Bantu females, however, possessed a lesser incidence of smooth lingual surfaces on their central and lateral incisors, viz. 40 per cent and 55.5 per cent respectively.

DISCUSSION

According to Lasker (1950), one of the most conspicuous points of variability in the anterior teeth of man is the extent of the vertical ridges on the lingual surface. Median ridges on the lingual surface of maxillary incisors are a prominent feature in anthropoid apes (Hrdlička 1920, 1921). These ridges were likewise observed in a rather high proportion of East Greenland Eskimo upper incisors (Pedersen 1949). Moorrees (1957) noted a near absence of median ridges in Aleuts. The percentage incidence of marked lingual ridges in the Bantu was small. Of the males, 41.6 per cent and a considerable proportion (60.0 per cent) of the females, however, exhibited a slight or moderate degree of ridging on their central incisors. The lateral incisors of both sexes evinced a considerably lower incidence of these ridges (30.6 per cent and 40.4 per cent for male and female lateral incisors, as against 41.6 per cent and 60 per cent for male and female central incisors respectively). Unfortunately, a table of comparative population incidences could not be drawn up as no data are available for comparison. In the tribal groups the incidence of ridging in central and lateral incisor teeth is higher in Sotho males and females than in the others. The incidence was high also in the central incisors of Cape Nguni males. Unfortunately, the female sample of observable central incisor teeth in this group was too small to determine whether this was a characteristic of the Cape

Nguni

The number of maxillary central and lateral incisor teeth in which the presence or absence of lingual tubercles can be clearly discerned is generally greater than the number of teeth in which the presence or absence of ridges can be observed (Tables 75 & 78). The probable reason for this is that attrition is frequently responsible for half or more of the lingual surface (nearest the cutting edge) of upper incisors being abraded, making it difficult or impossible to categorize ridging accurately. The determination of tubercle size on the other hand is not usually affected, since these are higher in position and are close to the necks of the teeth.

The total incidence of lingual tubercles in the Bantu was relatively high, 4.7 per cent and 11.4 per cent for male and female central incisors respectively. In the lateral incisors, the total incidence was higher (14.0 per cent for males and 16.9 per cent for females).

Despite considerable interest in the lingual tubercle as a possibly primitive characteristic (Adloff 1908, Weidenreich 1937), or as a cingular remnant (Frisch 1965), only Pedersen (1949) and Carbonell (1963) have provided figures on the incidence in populations. According to Pedersen, marked dental tubercles were found on 4.3 per cent and 14.3 per cent of the upper central and lateral incisors respectively, of East Greenland Eskimos. The Japanese, Chinese and Tibetan groups, according to

Carbonell, exhibit the lowest frequency of lingual tubercles, namely, 1.4 per cent, while in Arabs it attains the figure of 21.0 per cent. According to Carbonell's frequency table on lateral incisors Arabs and East Greenland Eskimos possess the highest incidence of lingual tubercles, whereas Anglo-Saxons, Swedes, Bantu, Indian, Japanese, Tibetan and Chinese all have incidences below about 3.0 per cent (the incidence on central incisors was not mentioned). The incidence of lingual tubercles in Carbonell's study is illustrated graphically; the frequency figures are not mentioned in the text. The estimated incidence of lingual tubercles in Bantu in Carbonell's investigation is 2.5 per cent. This figure is considerably lower than either 11.4 per cent (for males) or 16.9 per cent (for females) in the lateral incisors of the present study. The frequency is likewise lower than in any single male or female series among the Bantu tribal groups. The discrepancy between Carbonell's result and the writer's may perhaps be explained by her sample being drawn from a different isolate, compared with the present author's sample. This possibility is the more likely since great variability in frequency obtains even among the different tribal groups of my sample (Table 80). Unfortunately Shaw (1931), in his study of Bantu teeth, did not provide any data which could be used for comparison.

The percentage of large lingual tubercles in the Bantu is minimal in both sexes. The incidence of moderate

and small lingual tubercles in the sample provided no evidence of sex differences.

Lingual tubercles are found in teeth that are shovel-shaped as well as in teeth that are not. Shovel-shaped incisors in early man, according to Carbonell (1963), were associated with the presence of a lingual tubercle. This association is consistent in the upper lateral incisors of Neandertal Man, Homo erectus pekinensis ("Sinanthropus") and Australopithecus (Weidenreich 1937, Vallois 1950-3, Robinson 1956). However, in modern man, the association of a shovel-shape with a lingual tubercle is infrequent, according to Dahlberg (1951),Moorrees (1957) and Carbonell (1963). Table 81 and Figure 30, which is a graphic illustration of frequency of lingual tubercles and shovel-shaped form on lateral incisors seems to suggest a negative correlation between shovelling and tubercles.

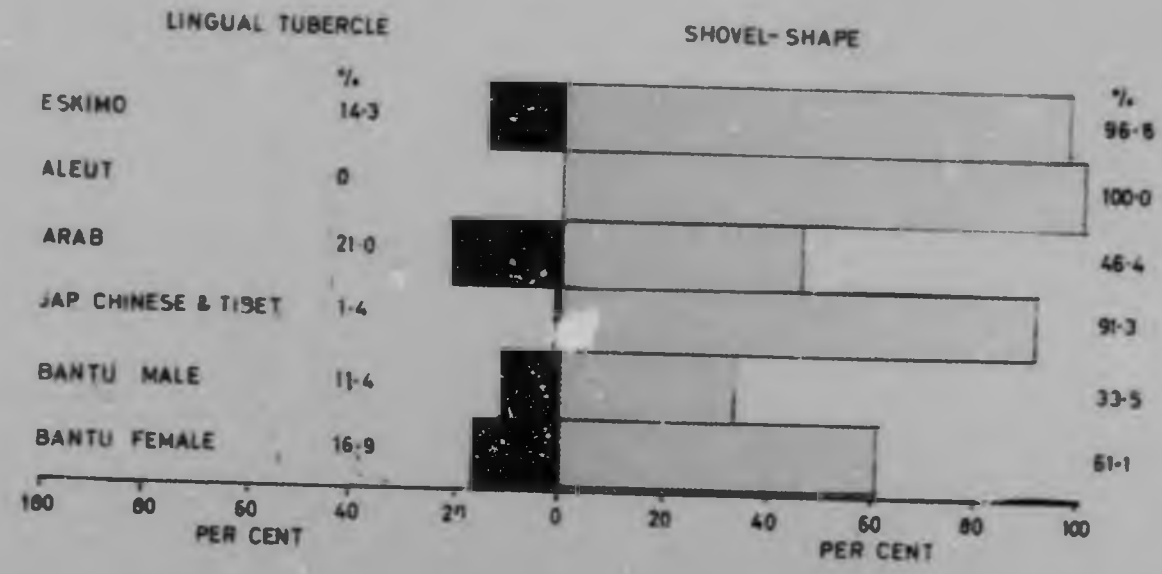


Fig. 30 Frequency of lingual tubercles and shovel-shaped form on lateral incisor teeth

TABLE 75

COMBINED PERCENTAGE INCIDENCE OF SMOOTH AND RIDGED LINGUAL SURFACES ON THE MAXILLARY CENTRAL AND LATERAL INCISORS IN THE SOUTH AFRICAN BANTU

	Sex	Total No. of teeth on which pattern could be determined	Smooth Surface	DEGREE OF RIDGING			
				Trace	Moderate	Marked	Total
Maxillary Central Incisors	Males	165	55	18.8	22.8	3.4	45.0
	Females	49	40	25.0	35.0	0	60.0
Maxillary Lateral Incisors	Males	192	67.8	18.5	12.1	1.6	32.2
	Females	79	55.5	27.8	16.6	0	44.4

Footnote: The percentages quoted are of the total number of maxillary incisor teeth in which the degrees of ridging could be detected.

TABLE 76

INCIDENCE OF SMOOTH AND RIDGED* LINGUAL SURFACES ON THE MAXILLARY CENTRAL INCISORS IN SOUTH AFRICAN BANTU TRIBAL GROUPS

Sex	Tribal Group	Total No. of teeth on which pattern could be determined	Smooth Surface	RIDGING PRESENT			
				Trace	Moderate	Marked	Total
Males	Natal Nguni	40	28	6	4	2	12
	Cape Nguni	41	20	9	12	0	21
	Sotho	31	12	7	10	2	19
	Miscellaneous	37	22	7	8	0	15
	TOTAL	149	82	29	34	4	67
Females	Natal Nguni	17	4	4	9	0	13
	Cape Nguni	2	1	0	1	0	1
	Sotho	15	5	6	4	0	10
	Miscellaneous	6	6	0	0	0	0
	TOTAL	40	16	10	14	0	24

*Does not refer to marginal ridges

TABLE 77

INCIDENCE OF SMOOTH AND RIDGED* LINGUAL SURFACES ON THE MAXILLARY LATERAL INCISORS IN SOUTH AFRICAN BANTU TRIBAL GROUPS

Sex	Tribal Group	Total No. of teeth on which pattern could be determined	Smooth Surface	RIDGING PRESENT			
				Trace	Moderate	Marked	Total
Males	Natal Nguni	24	20	2	2	0	4
	Cape Nguni	23	15	3	5	0	8
	Sotho	44	16	9	7	2	18
	Miscellaneous	33	23	9	1	0	10
	TOTAL	124	84	23	15	2	40
Females	Natal Nguni	14	10	2	2	0	4
	Cape Nguni	1	1	0	0	0	0
	Sotho	17	5	8	4	0	12
	Miscellaneous	4	4	0	0	0	0
	TOTAL	36	20	10	6	0	16

*Does not refer to marginal ridges.

TABLE 78

COMBINED PERCENTAGE INCIDENCE OF LINGUAL TUBERCLES ON MAXILLARY CENTRAL AND LATERAL INCISORS IN THE SOUTH AFRICAN BANTU

	Sex	Total No. of teeth on which pattern could be determined	TUBERCLES PRESENT			
			Trace	Moderate	Marked	Total
Maxillary Central Incisors	Males	230	0.4	3.0	1.3	4.7
	Females	57	0	14.0	0	14.0
Maxillary Lateral Incisors	Males	245	4.9	4.9	1.6	11.4
	Females	77	1.3	7.8	7.8	16.9

Footnote: The percentages quoted are of the total number of maxillary incisor teeth on which the presence or absence of lingual tubercles could be detected.

TABLE 79

INCIDENCE OF LINGUAL TUBERCLES ON MAXILLARY CENTRAL INCISORS IN SOUTH AFRICAN BANTU TRIBAL GROUPS

Sex	Tribal Group	Total No. of teeth on which pattern could be determined	Tubercles absent	TUBERCLES PRESENT			
				Trace	Moderate	Marked	Total
Male	Natal Nguni	55	51	1	1	2	4
	Cape Nguni	75	68	0	6	1	7
	Sotho	45	45	0	0	0	0
	Miscellaneous	55	55	0	0	0	0
	TOTAL	230	219	1	7	3	11
Female	Natal Nguni	25	21	0	4	0	4
	Cape Nguni	4	3	0	1	0	1
	Sotho	22	19	0	3	0	3
	Miscellaneous	6	6	0	0	0	0
	TOTAL	57	49	0	8	0	8

TABLE 80

INCIDENCE OF LINGUAL TUBERCLES ON MAXILLARY LATERAL INCISORS IN SOUTH AFRICAN BANTU TRIBAL GROUPS

Sex	Tribal Group	Total No. of teeth on which pattern could be determined	Tubercles absent	TUBERCLES PRESENT			
				Trace	Moderate	Marked	Total
Male	Natal Nguni	51	41	2	4	4	10
	Cape Nguni	76	67	3	6	0	9
	Sotho	60	57	2	1	0	3
	Miscellaneous	58	52	5	1	0	6
	TOTAL	245	217	12	12	4	28
Female	Natal Nguni	25	22	0	1	2	3
	Cape Nguni	10	6	0	2	2	4
	Sotho	36	32	0	2	2	4
	Miscellaneous	6	4	1	1	0	2
	TOTAL	77	64	1	6	6	13

Footnote: The percentages quoted are of the total number of maxillary incisor teeth on which the presence or absence of lingual tubercles could be detected.

TABLE 61

TABLE OF ASSOCIATED FREQUENCIES OF LINGUAL TUBERCLE AND SHOVEL-SHAPED FORM ON LATERAL INCISORS IN VARIOUS RACIAL GROUPS

Racial Group	PERCENTAGE FREQUENCY		Investigator
	Lingual Tubercle	Shovel-Shape	
East Greenland Eskimo	14.3	96.8	Pedersen (1949)
Aleut	0	100.0	Moorrees (1957)
Arabs	21.0	46.4	Carbonell (1963)
Japanese, Chinese and Tibetan	1.4	91.3	Carbonell (1963)
Bantu Males	11.4	33.5	Present Study (1967)
Bantu Females	16.9	61.1	Present Study (1967)

I.C. THE OUTLINE SHAPES OF THE MAXILLARY INCISOR TEETH

The outline shapes of the maxillary incisor teeth in man vary subtly among individuals. Williams (1914) grouped the incisor teeth in both man and primates into three fundamental types which he described as follows:-

Type I: "Characterized by parallel or nearly parallel lines which represent the proximal surfaces of the teeth for half or more than half of their length from their incisal edges".

Type II: "Characterized by these lines converging so markedly that they would meet, in most instances, at a point near the end of the root. These converging lines are sometimes nearly straight, but usually there is a very slight convexity of the mesial proximal surface and a slight concavity of the distal surface".

Type III: "Characterized by a delicate double curved line on its distal proximal surface, and sometimes, though less frequently, on the mesial surface. All of the surfaces and angles of the teeth of this form are more rounded and graceful than in either of the other two classes".

These basic tooth forms are generally designated square, tapering and ovoid. The combinations of these basic outline shapes are numerous. In fact Nagle and Sears (1962) noted that the variations in the natural teeth of man are so great that there are not enough geometric figures to match them. For practical purposes, however, only the three tooth forms of Williams were used in the present investigation.

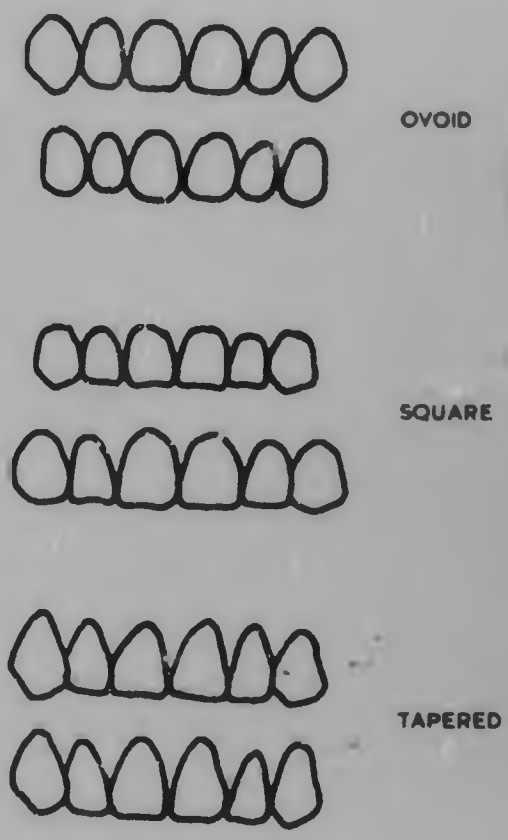


Fig. 31 Basic tooth forms of the maxillary incisor teeth (after Williams 1914)

PRESENT STUDY

In order to categorize the teeth as square, ovoid or tapering, the anterior four maxillary incisors of each Bantu skull were compared to an artificial tooth mould guide. These artificial tooth mould guides, which are used by dentists, represent excellent reproductions of the natural teeth of man, and by comparing these with skull teeth, reasonable accuracy in tooth classification can be achieved. Figure 51 is an outline drawing of the three basic tooth forms.

The three fundamental tooth shapes could not be clearly differentiated in all the skulls. Intermediate shapes such as square-ovoid, tapering-ovoid and tapering-square were added to the original classification, but the distinction between categories tend to become vague as to render the decision very subjective in certain instances. Any cranial teeth that could not be clearly classified into into one of the three primary categories were tabulated intermediate.

Tables 82 and 83 list the incidence and percentage of various tooth shapes in different South African Bantu groups. The number of crania in which teeth were difficult to clearly classify into the three fundamental groups was relatively high. This was owing partly to the intermediate tooth forms and partly to the large number of carious, worn, missing or fractured maxillary incisors which were excluded from the sample.

The incidence of square teeth in the tribal groups varied from approximately 13 per cent to 28 per cent of those which could be classified. The incidence of ovoid teeth in these groups varied from approximately 9 per cent to 27 per cent. The incidence of tapering teeth ranged from about 16 to 28 per cent. The range of incidences for the latter two incisor shape categories excludes the small Cape Nguni and Miscellaneous female groups. The incidence of tapered teeth in the male Natal Nguni is double the incidence of either square or ovoid tooth shapes, but it would be difficult to draw any conclusions from this single observation, particularly since these proportions do not obtain in the females of the same racial group.

The incidence of intermediate tooth shapes range from approximately 28 per cent to 45 per cent. The incidence of teeth falling into this category is higher than that of any of the three basic tooth shape categories.

In the Natal Nguni the incidence of square teeth in females (27.8 per cent) is nearly double that of males (13.7 per cent). The incidence of the intermediate tooth shape in the Natal Nguni males on the other hand is considerably higher than that of females (males 45.3 per cent, females 27.8 per cent). In the Sotho the sex difference in incidence of square teeth (males 13.5 per cent, females 13.6 per cent), ovoid teeth (males 25.8 per cent, females 27.3 per cent), tapering teeth (males 23.6 per cent, females 22.7 per cent) and intermediate tooth shapes (males 37.1 per cent, females 36.6 per cent) is minimal. Because of small female numbers, sex differences in the Cape Nguni and Miscellaneous groups are not meaningful.

In the total Bantu group, the intermediate tooth shape

is most common (42.7 per cent in males, 35.6 per cent in females). In males the basic three tooth shapes occur with almost equal frequency (square 18.8 per cent, ovoid 16.6 per cent, tapering 21.9 per cent). In females a quarter of the sample exhibit tapering teeth, slightly less than a quarter (22.1 per cent) of the total have ovoid teeth whereas 17.3 per cent of the teeth are square. Square teeth occur with almost equal frequency in Bantu males (18.8 per cent) and females (17.3 per cent). The incidence of ovoid and tapering teeth is slightly higher in females viz. ovoid 16.6 per cent in males, 22.1 per cent in females, tapering 21.9 per cent in males, 25.0 per cent in females respectively.

By and large, despite the smallness of the sample, it seems that each of the three main tooth forms viz. square, ovoid and tapering has an approximately equal chance of occuring in male and female Bantu. The frequency of occurrence of intermediate tooth forms is slightly more than one in three in both males and females.

DISCUSSION

Catergorizing teeth by comparing skull teeth with artificial tooth guides, although far more accurate than classification by inspection alone, is by no means infallible. The three fundamental tooth forms are readily identifiable, but it is the frequency of intermediate tooth shapes which makes accurate classification into the three main tooth shape groups difficult and ofttimes unreliable. Another factor which renders classification difficult to the variable medio-distal as well as gingivo-incisal convexities of the labial surfaces of incisor teeth. A severely labially convex tooth surface could create the illusion that the outline shape of a square tooth is ovoid. Furthermore, individual interpretations tooth shapes by various observers make comparisons difficult.

In his study of the Bantu, Shaw (1931) used the same classification of tooth shape, but his findings were vastly different from those of the present study. Shaw classified 50 per cent of the Bantu incisors as ovoid (Type III) teeth; the present study reflects an incidence of 16.6 per cent (male) and 22.1 per cent (female). The incidence of square (Type I) and tapered (Type II) teeth in the Bantu, according to Shaw, was 38 per cent and 12 per cent respectively. The incidence of square and tapered teeth in the Bantu in the present study is shown as 18.8 per cent and 21.9 per cent (males) and 17.3 per cent and 25 per cent (females) respectively. The diversity of these findings reflects to some degree the difficulties encountered

in endeavouring to classify tooth outline forms. Furthermore, Shaw classified all his teeth and did not leave nearly forty per cent of his sample in the intermediate category as in the present study.

There is no evidence to suggest that any particular incisor tooth form or shape is characteristic of the Bantu group. Neither does there appear to be any specific tooth shape by which one could identify any of the Bantu tribal groups. The findings in the present study would indicate that each of the three primary tooth forms have an approximately equal chance of occurring in any of the Bantu, whether male or female. The writer was unable to locate any other data for racial comparisons.

TABLE 82

MAXILLARY INCISOR SHAPES IN VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS	
INCISOR SHAPE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Square	13	10	21	1	12	6	[illegible]	1
Ovoid	13	6	9	5	23	12	14	0
Tapering	26	10	25	3	21	10	6	3
[illegible]	43	10	43	10	33	16	33	1
TOTAL	95	36	98	19	89	44	74	5

TABLE 83

PERCENTAGE INCIDENCE OF INCISOR SHAPES IN SOUTH AFRICAN BANTU TRIBAL GROUPS

	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS	
INCISOR SHAPE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Square	25	38.5	38.2	11.1	21.4	21.4	51.2	25
Ovoid	25	23.1	16.4	55.6	41.1	42.9	34.2	75
Tapering	50	38.4	45.4	33.3	37.5	35.7	14.6	0
TOTAL	100	100	100	100	100	100	100	100

TABLE 83

PERCENTAGE INCIDENCE OF INCISOR SHAPES IN SOUTH AFRICAN BANTU TRIBAL GROUPS

	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS	
INCISOR SHAPE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
Square	13.7	27.8	21.4	5.3	13.5	13.6	28.4	20
Ovoid	13.7	27.8	9.2	26.3	25.8	27.3	18.9	0
Tapering	27.3	16.6	25.5	15.8	23.6	22.7	8.1	60
Intermediate	45.3	27.8	43.9	52.6	37.1	36.4	44.6	20
TOTAL	100	100	100	100	100	100	100	100

TABLE 84

PERCENTAGE INCIDENCE OF INCISOR SHAPES IN THE SOUTH AFRICAN BANTU

	MALES		FEMALES	
INCISOR SHAPE	NO.	%	NO.	%
Square	67	18.8	18	17.3
Ovoid	59	16.6	23	22.1
Tapering	78	21.9	26	25.0
Intermediate	152	42.7	37	35.6
TOTAL	356	100%	104	100%

II. THE MORPHOLOGY OF THE MOLAR TEETH

II.A. THE NUMBER OF CUSPS ON THE MAXILLARY MOLARS

The maxillary first molar is normally quadricuspid, having four well-developed cusps. It is the most conservative tooth in the upper molar series and the least liable to show either progressive or retrogressive changes (Keith 1913). The second molar usually exhibits four cusps, three of which are well-developed, and the fourth of which is a cusplet, or in some instances it shows only three cusps. The third maxillary molars are less frequently quadricuspid and tend more frequently to be tricuspid.

The general trend in the dentition of man is towards simplification of the cuspal pattern. The formula for the number of molar cusps of the maxillary molar series is gradually changing from 4-4-4- to 4-4-3 and 4-3-3. This trend, according to Moorrees (1957), appears to be more marked in females than in males of all populations that have been studied. The process of molar reduction in number of cusps or in size occurs through the diminution in size or elimination of the distolingual cusp or hypocone. The occlusal shape of the molar is thus tending to change from a parallelogram to that of a triangle. With reduction in the number and size of the cusps, there is a reduction in the crown areas of these teeth.

PRESENT STUDY

In the present study the analysis was based on Campbell's (1925) method of classifying cusps. Campbell utilized a + sign to denote the presence of any eminence on the occlusal surface which was sufficiently developed to be termed a cusp. Instead of a + sign the writer has here used a ½ sign (figs. 32 to 36). Teeth in which the cusp patterns were doubtful owing to caries or attrition were excluded from the sample.

The Bantu males of the present series exhibited four well-developed cusps in 100 per cent of all maxillary first molars (Table 85). The females of this group likewise showed four well-developed cusps in 98.7 per cent of maxillary first molars. The remaining 1.3 per cent of the sample comprised two teeth with a slightly reduced distolingual cusp: they were classified as having 3½ cusps. (No attempt was made in this study to differentiate between a 4- and a 3+ cusp as in Dahlberg's (1949) classification. The latter figures denote a slightly or markedly reduced distolingual cusp).

The percentage incidence of four well-developed cusps in the maxillary second molars of the Bantu males and females was 72.3 per cent and 69.7 per cent respectively. Only a small percentage of these molars, viz. 8.7 per cent and 8.0 per cent respectively of the male and female Bantu, possessed 3 cusps.

Only a little over a quarter of the Bantu third

NUMBER OF CUSPS ON THE MAXILLARY MOLARS



Fig. 32 4 cusps



Fig. 33 3½ cusps



Fig. 34 3 cusps

NUMBER OF CUSPS ON THE MAXILLARY MOLARS



Fig. 35 2½ cusps



Fig. 36 2 cusps

molars were four-cusped viz. 29.2 per cent of the males and 26.5 per cent of the females. About a third (32.3 per cent males and 32.6 per cent females) of these molars possessed 3½ cusps, whereas nearly 40 per cent in both sexes were tricuspid, viz. 37.5 per cent of males and 39.4 per cent of females. In only 3 males (0.6 per cent) and 1 female (0.4 per cent) were 2½ cusps observed, whilst even fewer teeth evinced 2 cusps, viz. 0.4 per cent and 0.8 per cent of males and females respectively.

In the tribal groups (Tables 86 & 87), the Cape Nguni males revealed the highest incidence of four-cusped teeth in the second molars, but curiously, the females of the same group possessed the lowest incidence of four-cusped first, second and third maxillary molars in all series reviewed here. They revealed the highest percentage incidence of 3½- and 3-cusped teeth in all three maxillary molars.

DISCUSSION

Four fully-developed cusps were present in 100 per cent of all the Bantu male maxillary first molars examined and in 98.7 per cent of all the female maxillary molars. These figures compare reasonably well with those of Shaw (1931); he observed a quadricuspid pattern on 97.5 per cent of all the maxillary first molars (combined males and females) in the Bantu. Most racial groups reveal a high percentage of maxillary first molars with four cusps (Table 8[illegible]).

The maxillary second molars, however, exhibit far greater variation in the number of cusps in various population groups. In the present Bantu series, 72.3 per cent of males and 69.7 per cent of females had four cusps. These figures exceed those of most other racial groups with the exception of the Australian Aboriginals, Bushmen and and Aleut males (Table 89). The figures also differ radically from those of Shaw, who found that 48.7 per cent of his Bantu series possessed 4 cusps, whereas the remaining 51.3 per cent had 3½ cusps. Shaw evidently found no tricuspid maxillary second molars; the present investigation, however, revealed three-cusped molars in 8.7 per cent of the male sample and in 8.0 per cent of the female.

In third maxillary molars, 29.6 per cent and 26.5 per cent respectively of Bantu males and females possessed all four cusps. Approximately a third of both males and females had 3½ cusps and 37.5 per cent of males and 39.7 per cent of females evinced 3-cusped third molars. These figures again differ from those of Shaw, who noted that 17.1 per cent of his sample possessed 4 cusps, whereas the majority of third molars, viz. 77.7 per cent had only 3 cusps (Table 90). The judgement of cusps is a subjective assessment in some instances, which possibly accounts for these divergent findings on the same population groups.

The incidence of the combined 4- and 3½-cusped maxillary third molars is exceeded only by that of the

Australian Aboriginals; although the incidence of 4-cusped molar is higher in Aleut males, American and Pecos Indians, than in Bantu males or females (Table 90).

The Bantu, as a whole, possess a relatively conservative dentition, the Cape Nguni females, however, possessing the least conservative cusp numbers on their M^1, M^2 and M^3's. The sex difference in the Bantu tend to conform with observations on other racial groups, namely, that males are less inclined than females towards a reduction in the number of cusps in maxillary molars.

TABLE 85

FREQUENCY OF MAXILLARY MOLAR CUSPS IN THE SOUTH AFRICAN BANTU

	Cusps	Male	Female	Male	Female
				%	%
M^1	4	594	160	100.00	98.73
	3½	0	2	0	1.27
	TOTAL	594	162	100.00	100.00
M^2	4	433	122	72.29	69.71
	3½	114	39	19.03	22.29
	3	52	14	8.68	8.00
	2½	0	0	0	0
	TOTAL	599	175	100.00	100.00
M^3	4	144	35	29.21	26.52
	3½	159	43	32.25	32.58
	3	185	52	37.53	39.39
	2½	3	1	.61	.75
	2	2	1	.40	.76
	TOTAL	493	132	100.00	100.00

TABLE 86

INCIDENCE OF MAXILLARY MOLAR CUSP NUMBERS IN SOUTH AFRICAN BANTU TRIBAL GROUPS

	Cusps	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS	
		Male	Female	Male	Female	Male	Female	Male	Female
M^1	4	146	61	170	27	155	67	123	6
	3½	0	0	0	2	0	0	0	0
	TOTAL	146	61	170	29	155	67	123	6
M^2	4	110	44	143	15	103	56	77	7
	3½	33	15	12	12	45	11	24	1
	3	9	1	13	5	8	8	22	0
	2½	0	0	0	0	0	0	0	0
	TOTAL	152	60	168	32	156	75	123	8
M^3	4	31	18	44	0	34	16	35	1
	3½	34	14	48	11	50	18	27	0
	3	58	10	54	16	37	23	36	3
	2½	1	1	2	0	1	0	0	0
	2	1	1	1	0	0	0	0	0
	TOTAL	125	44	149	27	122	57	98	4

TABLE 87

PERCENTAGE INCIDENCE OF MAXILLARY MOLAR CUSP NUMBERS IN SOUTH AFRICAN BANTU TRIBAL GROUPS

CUSPS		NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS	
		Male	Female	Male	Female	Male	Female	Male	Female
M^1	4	100.00	100.00	100.00	93.10	100.00	100.00	100.00	100.00
	3½	0	0	0	6.90	0	0	0	0
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
M^2	4	72.37	73.33	85.12	46.88	66.03	74.67	62.61	87.50
	3½	21.71	25.00	7.14	37.50	28.84	14.67	19.51	12.50
	3	5.92	1.67	7.74	15.62	5.13	10.66	17.88	0
	2½	0	0	0	0	0	0	0	0
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
M^3	4	24.80	40.91	29.53	0	27.87	28.07	35.72	25.00
	3½	27.20	31.82	32.21	40.74	40.98	31.58	27.55	0.00
	3	46.40	22.73	36.25	59.26	30.33	40.35	36.73	75.00
	2½	.80	2.27	1.34	0	.82	0	0	0
	2	.80	2.27	.67	0	0	0	0	0
	TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 88

PERCENTAGE FREQUENCY OF MAXILLARY MOLAR CUSP NUMBERS IN VARIOUS MODERN HUMAN POPULATIONS #

MAXILLARY FIRST MOLARS

Population	No.of Teeth	NUMBER OF CUSPS 4½	4	3½	3	2½	2	Author
Bantu (M)	594		100					Present Study 1967
Bantu (F)	162		98.7					Present Study 1967
Bantu (M) & (F)	162		97.5	2.5				Shaw 1931
Bushman (M) & (F)	32		100					Drennan 1928
Melanesian (M) & (F)	266		98	2.0				Dahlberg 1945
Australian Aboriginal (M) & (F)	88	5.7	94.3					Campbell 1925
Aleut (M)	25*		100					Moorrees 1957
Aleut (F)	35*		100					Moorrees 1957
American Indian (M) & (F)	270		99.6#					Goldstein 1948
Pima Indian (M) & (F)	285		98.9	1.1				Nelson 1937
Eskimo (M)& (F)	38		90	5	5			Dahlberg 1945
American White (M) & (F)	106		95	3	2			Dahlberg 1945

Pederson's figures are not included in the above table as he lists the number of cusps and cusplets on molars separately.

* Denotes individuals, not teeth

0.4 per cent had 6 cusps

(M) Males
(F) Females

TABLE 8[illegible]

PERCENTAGE FREQUENCY OF MAXILLARY MOLAR CUSP NUMBERS IN VARIOUS MODERN HUMAN POPULATIONS

MAXILLARY SECOND MOLAR

POPULATION	No.of Teeth	NUMBER OF CUSPS 4½	4	3½	3	2½	2	AUTHOR
		%	%	%	%	%	%	
Bantu (M)	599		72.3	19.0	8.7			Present Study 1967
Bantu (F)	175		69.7	22.3	8.0			Present Study 1967
Bantu (M) & (F)	156		48.7		51.3			Shaw 1931
Bushman (M) & (F)	31		100					Drennan 1928
Melanesian (M) & (F)	216		50					Dahlberg 1945
Australian Aboriginal (M) & (F)	208	3.8	96.2					Campbell 1925
Aleut (M)	28*		78.6		21.4			Moorrees 1957
Aleut (F)	27*		59.2		40.8			Moorrees 1957
American Indian♂ (M) & (F)			59.3		39.4			Goldstein 1948
Pecos Indian (M) & (F)	278	.4	66.1	32.1	1.4			Nelson 1937
Eskimo (M) & (F)	29		14					Dahlberg 1945
American White (M) & (F)	92		38					Dahlberg 1945

♂ = 1.2% had 5 cusps

* = Denotes individuals, not teeth

(M) = Males

(F) = Females

TABLE 90

PERCENTAGE FREQUENCY OF MAXILLARY MOLAR CUSP PATTERNS IN VARIOUS MODERN HUMAN POPULATIONS

MAXILLARY THIRD MOLAR

Population	No.of Teeth	NUMBER OF CUSPS 4½	4	3½	3	2½	2	AUTHOR
		%	%	%	%	%	%	
Bantu (M)	493		29.2	32.3	37.5	0.6	0.4	Present Study 1967
Bantu (F)	132		26.5	32.6	39.4	0.8	0.8	Present Study 1967
Bantu (M) & (F)	152	2.6	17.1	2.6	77.7			Shaw 1931
Bushman (M) & (F)	26		12	38	50			Drennan 1928
Melanesian (M) & (F)	164		14	44	40			Dahlberg 1945
Australian Aboriginal (M) & (F)	156	5.8	71.2	20.5	2.5			Campbell 1925
Aleut (M)	15*		33.3		66.7			Moorrees 1957
Aleut (F)	14*		28.6		71.4			Moorrees 1957
American Indian (M) & (F)	158ø		36.7		53.8		4.4	Goldstein 1948
Pecos Indian (M) & (F)	227	4.8	33.4	21.2	40.6			Nelson 1937
Eskimo (M) & (F)	11		18		82			Dahlberg 1945
American White (M) & (F)	83		21	24	55			Dahlberg 1945

*Denotes individuals, not teeth.

ø 1.2% had 6 cusps, 3.7% had 5 cusps

(M) Males

(F) Females

II.B. TUBERCLE OF CARABELLI

The tubercle of Carabelli is an accessory cusoule of variable size which frequently occurs on the mesiolingual aspect of the primary and permanent molars of man. According to Adloff (1907) (cited by Gregory 1922), the possession of a Carabelli tubercle is a primitive human character which sharply separates man from the anthropoid apes. This tubercle has been regarded as a characteristic feature of the hominid dentition and is almost unknown in pongids (Robinson 1956). Weidenreich (1937) believed that Carabelli tubercles began to appear only subsequent to the time of Homo erectus pekinensis ("Sinanthropus") and that, consequently, this feature is a recent development in hominids. Robinson (1956), however, pointed out that well-developed Carabelli tubercles occur in some early hominids such as Paranthropus.

The Carabelli tubercle in the permanent upper molars is more commonly seen in Caucasoids than in other racial groups (Gregory(1922) Krogman(1927)). This view is supported by Hanihara (1963) who showed the incidence to be very high in Caucasoids and relatively less in Japanese and Negro children.

The shape and size of the Carabelli's tubercle are variable, as is the conliguration of the groove which divides this tubercle from the mesiolingual cusp. The groove tends, in some instances, to form a pit which, according to Hanihara (1963) shows a different pattern of

inheritance from the Carabelli cusp. Begg (1957) suggested that the tubercle of Carabelli, instead of being useless, was very important to man, because it came into occlusion in Stone Age man and compensated for the attritional reduction in the area of occlusal contact, by providing more occlusal surface for mastication in first molars. Hanihara reviewed the literature pertaining to the differences between the Carabelli tubercle and pit. He concluded that further studies were required to distinguish accurately between the two and that comparative studiee among various racial groups might be of value.

Frisch (1965) believed that the Carabelli tubercle is a true derivative of the former lingual cingulum. According to him it may be said to have no taxonomic significance, inasmuch as it cannot be used to measure the greater or lesser phylogenetic proximity of man to the living pongids.

The classification of the Carabelli tubercle has always presented a problem. Size has been mainly used to determine the categories. Classification has been confused to some extent by a variety of grooves, furrows and pits in the same area. These, according to Dahlberg (1963), are all variations related to the cingulum and probably the result of interplay of many genes.

Batujeff (1696), Bolk (1915), Hellman (1928) and Dietz (1944) recognised four variations of the tubercle. Shapiro (1949) studied the form of the groove rather than

the shape or size of the tubercle and recognised no fewer than nine types of Carabelli groove. In American Indian dentition, Dahlberg (1951) identified seven classes or types of Carabelli's tubercle. Hanihara (1963) in his study of Japanese-American hybrids classifies five types of tubercles. Van Reenen (1964) sub-divided his findings into only two categories, complete and incomplete tubercles. Most authors (Shaw 1931, Nelson 1938, Moorrees 1957, Carbonell 1960) reported the overall incidence without specifying the sub-types.

PRESENT STUDY

In the present investigation, the classification of Carabelli's tubercles was based on that of Dietz (1949). He in turn followed Batujeff (1896), who differentiated between Carabelli's tubercle and a fissure which he considered was related to the tubercle, and also graded the different sizes of the tubercles. The following types of Carabelli features were differentiated: cuspoid, lobular, ridged and pitted (fig. 37 , 38, 39 & 40).

In several specimens, the tubercle form for a given tooth varied on opposite sides. Therefore, in determining the frequency of the several morphological types, the total number of teeth was counted, irrespective of the number of skulls in which they occurred.

The tubercles were photographed and compared by inspection with standards for purposes of grading. Teeth in which the presence or absence of the tubercle could not

TUBERCLE OF CARABELLI



Fig. 37 Cuspcid type



Fig. 38 Lobular type



Fig. 39 Ridged type



Fig. 40 Pitted type

clearly be determined, because of attrition, fracture or caries, were omitted.

The percentage incidence of any trace of the Carabelli's tubercle in maxillary first molars of male and female Bantu was relatively high, viz. 42.63 per cent and 48.84 per cent respectively (Table 91). In second molars the incidence was less, viz. 7.8; per cent and 9.25 per cent for males and females respsctively and in third molars even less, viz. 4.92 per cent in males and 3.05 per cent in females. Fairly well-developed Carabelli tubercles (lobular and cuspoid types) were observed in 17.73 per cent of male Bantu maxillary first molars and 13.18 per cent of females first molars. These larger tubercles were seen in only 1.39 per cent of maxillary second molars of males and not at all in females. In maxillary third molars, the percentage incidence of marked cusps was slightly higher, namely, 2.26 per cent in males and 1.52 per cent in females. The incidence of large tubercles was higher in males than in females, yet the overall incidence of Carabelli feature was higher in females for both the first and second maxillary molars.

In the Natal Nguni, Cape Nguni and Sotho, the percentage incidence of various sized tubercles of Carabelli was generally much the same (Tables 92 & 93). In the Miscellaneous Bantu Group, males exhibited a relatively low incidence (27.5 per cent) of this tubercle

in the upper first molars. The female sample of this group was too small to be considered separately. The Sotho females evinced a relatively high percentage incidence (22.8 per cent) of larger (lobular or cuspoid) tubercles in their maxillary first molars, as opposed to their complete absence in the Cape Nguni female. It is difficult to draw any conclusions from these observations.

DISCUSSION

No trace of this feature occurred in Pedersen's (1949) collection of East Greenland Eskimo skulls. This is in conformity with other studies on Mongoloid populations, where the incidence is very low. Evidence on the low incidence of this feature in Mongoloids is adequately recorded by Moorrees (1957). The highest incidence on record for this group is that of Hirakawa (1938, 1940), cited by Robinson (1956), for a sample of Japanese where the percentage occurrence was 10.7.

Hanihara (1963) indicated that the percentage incidence of Carabelli tubercle is high in Caucasoids but relatively less in the Negro. Shaw (1931) in his study of the Bantu found this tubercle to be present on the upper molar teeth, on both sides, in only five of the 41 skeletal specimens and in four out of 248 living natives. The incidence is thus a little over three per cent for the skulls and less than two per cent in the living.

The present investigation contrasts severely with the findings of Shaw, but closely approximates the

findings of Shapiro (1949). Shapiro did not differentiate between sexes; however, Table 94 indicates the close similarity between his findings and mine.

The present findings, as well as those of Shapiro, therefore suggest that the incidence of the tubercle in the Bantu is considerably higher than in Mongoloids, but less than in Causcasoids (See Table 94).

The relatively wide divergence in results could be attributed in part to variations in the criteria for determining the incidence of the tubercle. Since the methods of estimating the size of the tubercle are based on arbitrary standards, it becomes difficult to compare results accurately without a generally accepted international set of standards, such as Dahlberg has provided. The divergent results on the other hand may also reflect normal variability.

Shaw's figures on the Bantu and those of Shapiro's and the writer's cannot be readily reconciled. Shaw gives the impression that he counted only fully developed tubercles. His only reference to the tubercle was as follows:

> "The tubercle of Carabelli was present in the upper first molar teeth, on both sides, in five skeletal specimens, and in four cases in the living native".
>
> "The significance of this cusp has been dealt with at length by numerous writers - Carabelli, Adloff, Kramberger, Gallipe, Campbell and others. It is not, therefore, proposed to dwell further upon its significance here" (p.47).

The low incidence would lead the writer to suggest that Shaw possibly included only the well-developed cuspoid or lobular type of tubercle (of both sides) in his observations - and then only on M^1.

The comparative data gathered from Caucasoid, Mongoloid and Negroid population groups reveals that the Carabelli tubercle is a feature found largely in modern white people of European origin. The absence or low incidence of the tubercle in Mongoloid groups would tend to indicate that genetic mechanisms are involved in its occurrence in various racial populations. The taxonomic significance and importance of the Carabelli tubercle has been reviewed by Frisch (1965).

TABLE 93

THE INCIDENCE OF THE CARABELLI TUBERCLE
IN THE BANTU

Tooth	SHAPIRO 1949	PRESENT STUDY		
	Combined Sexes	Males	Females	Combined
	%	%	%	%
M^1	46.0	42.63	4[illegible]4	43.90
M^2	8.9	7.84	9.25	8.17
M^3	4.7	4.92	3.05	4.52

TABLE 92

INCIDENCE OF TUBERCLE OF CARABELLI ON MAXILLARY MOLARS OF VARIOUS SOUTH AFRICAN TRIBAL GROUPS

MAXILLARY FIRST MOLAR

DESCRIPTION	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Absent	61	30	73	15	75	19	79	2	288	66
Pitted	16	9	9	4	13	2	4	0	42	15
Ridged	25	15	32	6	13	6	13	4	83	13
Lobular	11	6	18	0	21	4	10	0	60	10
Cuspoid	5	3	12	0	9	4	3	0	29	7
TOTAL	118	63	144	25	131	35	109	6	502	129

MAXILLARY SECOND MOLAR

DESCRIPTION	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Absent	133	48	145	32	133	67	118	10	529	157
Pitted	5	2	4	0	6	1	4	0	19	3
Ridged	4	9	9	1	5	3	0	0	18	13
Lobular	0	0	1	0	6	0	0	0	7	-
Cuspoid	1	0	0	0	0	0	0	0	1	-
TOTAL	143	59	159	33	150	71	122	10	574	173

MAXILLARY THIRD MOLAR

DESCRIPTION	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Absent	120	41	136	26	123	56	95	4	464	127
Pitted	1	0	2	0	2	0	2	0	7	0
Ridged	2	2	2	0	1	0	1	0	6	2
Lobular	2	0	5	0	4	0	0	1	11	1
Cuspoid	0	0	0	0	0	0	0	1	0	1
TOTAL	125	43	145	26	120	56	98	6	488	131

PERCENTAGE INCIDENCE OF TUBERCLE OF CARABELLI ON MAXILLARY MOLARS OF VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MAXILLARY FIRST MOLAR

DESCRIPTION	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Absent	51.7	47.6	50.7	60.0	57.2	54.3	72.5	33.3	57.37	51.16
Pitted	13.6	14.3	6.3	16.0	9.9	5.7	3.7	0	8.37	11.63
Ridged	21.2	23.8	22.2	24.0	9.9	11.1	11.9	66.7	16.53	24.03
Lobular	9.3	9.5	12.5	0	16.0	11.4	9.2	0	11.95	7.75
Cuspoid	4.2	4.8	8.3	0	6.9	11.4	2.8	0	5.78	5.43
									100.00	100.00

MAXILLARY SECOND MOLAR

DESCRIPTION	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Absent	93.0	81.4	91.2	96.3	88.7	94.4	96.7	100	92.16	90.75
Pitted	3.5	3.4	2.5	0	4.0	1.4	3.3	0	3.31	1.74
Ridged	2.8	15.3	5.7	3.7	3.3	4.2	0	0	3.14	7.51
Lobular	0	0	0.6	0	4	0	0	0	1.22	0
Cuspoid	.7	0	0	0	0	0	0	0	.17	0
									100.00	100.00

MAXILLARY THIRD MOLAR

DESCRIPTION	NATAL NGUNI		CAPE NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Absent	96.0	95.1	93.8	100	94.2	100	96.9	66.7	95.08	96.95
Pitted	.8	0	1.4	0	1.7	0	2.0	0	1.43	-
Ridged	1.6	4.9	1.4	0	.8	0	1.0	0	1.23	1.53
Lobular	1.6	0	3.5	0	3.3	0	0	16.7	2.26	.76
Cuspoid	0	0	0	0	0	0	0	16.7	-	.76
									100.00	100.00

TABLE 91

PERCENTAGE INCIDENCE OF THE TUBERCLE (OR GROOVE) OF CARABELLI IN M^1 OF VARIOUS RACIAL GROUPS : TABLE ADAPTED FROM SHAPIRO (1949)

Race	Group	Author	Number examined	Total with Tubercle or Trace
CAUCASOID	European	Bolk (1914)	2325	61.7
	European	Dietz (1944)	747	72.3
	European	Fabian (1928	556	70.41
	European	Sprawson (1922)	100	65.0
MONGOLOID	Chinese	Oshima (1938)	1250	2.1
	Japanese	Hirakawa(1940)	946	10.77
	West Greenlanders)	Pederson (1949)	400 Appr.	0.0
	East Greenlanders)	Pederson (1949)	106	.06
	Pecos Indians	Nelson (1938)	225	8.8
AUSTRALOID	Australian Aboriginal	Campbell (1925)	60	33.3
NEGROID	Bantu	Shapiro (1949)	163	45.9
	Bushman	Shapiro (1949)	33	39.9
	Bushman	Van Reenen (1964)	?	29.0 Appr.
	Bantu	Present Study (1967)	629	43.9

II.C. THE CUSP AND GROOVE PATTERNS OF THE MANDIBULAR MOLARS

The basic lower molar pattern comprises five cusps. Three of these are located buccally to the other two and the relationship of the cusps to one another is such that the grooves between them converge to resemble the letter Y when viewed from the occlusal aspect. Gregory (1916) observed that man, the great apes, and the Dryopithecinae have this Y-shaped system of transverse grooves of the mandibular molars. He named this configuration the "Dryopithecus" pattern, because he considered the Dryopithecus group to be ancestral to the anthropoid apes and to be related to man. The term "Y5" is used to identify this cusp number and groove pattern in lower molars (Fig. 41). The method of determining cusp pattern has been adequately described by Gregory and Hellman (1926) and Hellman (1928). In brief, the Dryopithecus pattern refers to the Y arrangement described above. In a modified Dryopithecus form, known as the Y4 pattern, the cusp numbers are reduced to four but the Y-shaped fissure remains intact (Fig. 42). In contradistinction, the +5 pattern (Fig. 43) is one in which the primitive cusp formula is retained but the groove system is changed to form a cross. This is achieved through the loss of a comparatively small part of the fissure along with the hypoconulid. In the +4 pattern (Fig. 44) the cusp number and groove system are both changed.



Fig. 41 Y5 pattern



Fig. 42 Y4 pattern



Fig. 43 +5 pattern



Fig. 44 +4 pattern



Fig. 45 C6 cusp pattern



Fig. 46 C7 cusp pattern

Hellman (1928) showed that modifications of the basic five-cusped Dryopithecus pattern could be used for differentiating populations and thus possibly for racial classification. He classified the fissure pattern into two categories: (a) the more primitive type in which a distinct Y is present, and (b) the more advanced type in which the greater part of the pattern is cruciform. These two categories each contain two types:
(a) those with five cusps and (b) those with four cusps. In this fashion a series is obtained as follows: Y5, Y4, +5 and +4. Hellman regarded this as being the order of advancement away from the original Dryopithecus pattern. Robinson (1956), on the other hand, regarded it as a moot point whether Y4 or +5 must be accepted as the more primitive. According to him, it seemed more probable that the true series is Y5, +5, +4 with Y4 as a relatively recent and uncommon variant of minor significance.

An extra cusp occurs occasionally along the distal margin of the occlusal surface of lower molars in the Bantu. This is termed tuberculum sextum or the sixth cusp (C6) (Fig. 45). Another accessory cusp is frequently located between the two lingual cusps; this is the seventh cusp (C7)(Fig. 46). Chagula (1960) departs from these classifications in that he includes the Y6 and +6 cusp patterns. These Y6 and +6 patterns have been previously described by Goldstein (1948) and Schumar. and Brace (1954). In this study, the writer has preferred to abide by the

traditional method of classification of the lower molars as used by Hellman (1928). The accessory cusps, sixth (C6) and seventh (C7), will be referred to by the classical terminology, namely, as the tuberculum sextum and the accessory median lingual cusp.

PRESENT STUDY

The study was confined to those molars with clearly visible cusp and groove patterns on the occlusal surfaces. Teeth in which the occlusal surfaces were severely worn due to attrition were not included in the sample. These, as well as the missing, carious or fractured teeth account for the different total numbers of the first, second and third molars examined. No attempt was made to grade the size of the cusps.

The most frequent cusp pattern on the M_1's of both males and females in the Bantu is the Y5 pattern (Table 95). In Bantu males, 90.7 per cent of M_1's exhibit this pattern, and in females 84.6 per cent.

The M_2's of the Bantu are in the main four-cusped (Table 96). Approximately 66 per cent of these teeth in both sexes have four-cusped M_2's. Only 7.0 per cent of males and 6.1 per cent of females have the Y5 cusp pattern on these molars. However, 26.4 per cent of males and 28.2 per cent of females possess 5 cusps, but with a + pattern instead of a Y pattern.

In M_3's (Table 97), the percentage incidence of the Y pattern is considerably higher in Bantu females than in

males. The females exhibit a Y5 pattern in no fewer than 39.6 per cent of the sample as opposed to a male percentage of only 6.6. The figure of 39.6 per cent for Y5 on mandibular 3rd molars is the highest for all racial series available (Table 114). There appears to be no significant difference in the percentage incidence of the Y5 molar pattern in the M_1's of the various Bantu tribal groups (Tables 98 & 99). In the M_2's, the Cape Nguni show a lesser tendency towards retaining the Y5 pattern, only 2.59 per cent of males and none of the females exhibiting this pattern (Tables 100 & 101). Most of the Bantu groups possess a +4 molar pattern in the M_2's, the Miscellaneous group evincing the highest incidence, namely, 71.84 per cent in the males and 81.82 per cent in the females. Because of the small female sample in this group, no conclusions can be drawn from the figures. The Miscellaneous males, however, do possess a higher incidence of +4 molar patterns than the other tribes.

In the M_3's five cusps are present in about 60 to 70 per cent of both sexes in the various groups (Tables 102 and 103), the only exception being the Miscellaneous male group, in which about 48 per cent possess five-cusped molars. The +5 pattern is the commonest pattern of this tooth in both sexes. The second commonest pattern of M_3's of both sexes is of the +4 type.

The percentage incidence of the tuberculum sextum in the Bantu males is 0.2 per cent, 0.7 per cent and

3.2 per cent for M_1, M_2 and M_3 respectively. In the females, the incidence is about the same, 2.4 per cent in M_1's, 0.76 per cent in M_2's and 3.21 per cent in M_3's (Table 104). Comparing these figures with those of other populations, we find that the percentage incidence of this accessory cusp in the Bantu series is almost the lowest of all racial groups (Table 105).

In the tribal groups (Tables 106,107,108,109,110 and 111) the percentage incidence of the tuberculum sextum in the M_1's and M_3's of Natal Nguni females is 6.39 per cent and 15.38 per cent respectively; the M_1's and M_3's of the remaining tribal female groups show no sixth tubercles. The Natal and Cape Nguni males exhibit a 5.17 per cent and 6.52 per cent incidence of this tubercle respectively on the M_3's. These figures are slightly higher than those of the other male tribal groups studied. The incidence of the accessory median lingual cusp in the Bantu series is almost the highest among the populations considered in Table 105. American Negroes, likewise, exhibit a high incidence (22 per cent) of this cusp in their M_1's. This figure is a little higher than that of the Bantu male for the same tooth, but closely approximates the incidence of this cusp in the M_1's of Bantu females.

The incidence of the accessory median lingual cusp in adequate samples of the tribal sub-groups is variable and ranges from approximately 12 per cent to 25 per cent In M_1's, 4.5 per cent to 13 per cent in M_2's and 7.5 per cent to 38 per cent in M_3's (Tables 106,107,108,109,110 & 111).

The incidence of this cusp in the M_1's, M_2's and M_3's in the Natal Nguni females is higher than in the remaining groups.

DISCUSSION

The Bantu exhibit a fairly high incidence of Y5 cusp and groove pattern in their M_1's. Among populations which have a higher incidence of this Y5 cusp pattern are the American Negroes, West African Negroes, Melanesians, American Indians, Chinese, Asiatic Mongoloids, Eskimos and Australian Aboriginals (Table 112). Possibly the Bushmen exhibit a higher incidence of this Y pattern, but, unfortunately, Drennan (1928) confined his observations on Bushmen molars to cusp numbers only. In the Bushmen, 100 per cent of the group exhibited 5 cusps.

The shift from 5 cusps to 4 cusps on M_2's in the Bantu is rather marked. Whereas only 7 per cent and 6.1 per cent of Bantu male and female second molars show the Y5 cuspal pattern, approximately two-thirds of the whole sample have a four-cusped pattern. The highest incidence of the +5 pattern in M_2's occurs in the Aleut males, 73.7 per cent. On M_2's, the Eskimo, American Indian, Australian aboriginal and female Aleuts have a higher incidence of +5 cusp patterns than either male or female Bantu.

The incidence of the Y5 molar pattern in M_3's in Bantu males is low (6.6 per cent). The only populations that evince a lower incidence are the American Negro,

American White male and the Ancient European White (Table 62). The female Bantu, unlike the male, exhibit an astonishingly high incidence of Y5 pattern, viz. 39.6 per cent. This figure is the highest among the population groups; the next highest figure for this molar pattern is that of the West African Negro whose incidence (20 per cent) is only about half that of Bantu females (Table 96). In M_3's of the Bantu, it is the females who exhibit a higher incidence of the Y5 cusp pattern, namely, 39.6 per cent in females and 6.6 per cent in males (Table 97). Also, 77.5 per cent of the M_3's in female Bantu possess 5 cusps as opposed to 62.5 per cent of males. These findings are contrary to the general rule.

Dahlberg (1945) and Lasker (1957) claim that M_1 is least affected by the tendency towards modification of the Y5 cusp pattern to simpler patterns, and M_3 the most. The present study supports the first contention that M_1 is the most conservative, but it would appear that in the Bantu the trend in M_2's is as dramatic as in M_3.

It is generally conceded that the changes in cusp numbers and pattern are genetic in origin. We are ignorant of the factors involved in the determination of dental form, but it has been demonstrated that some teeth are more susceptible to change than others. Butler (1939) advanced his field concept in an endeavour to explain these variations. He speculated that groups of teeth are repeated organs that occupy different positions in a

continuous morphogenetic field. The field can undergo changes in structure and position in the course of evolution, and thus changes in the differentiation of the dentition may be explained. Some variations are distributed along the gradient of incidence and degree of development in such a way that they appear most frequently on certain teeth and less frequently on teeth lying further away from the point of maximum incidence.

A range of incidence of the Y5 cusp pattern in the lower molars of Mongoloids, Caucasoids and Negroids was drawn up from Tables 112,113 and 114 (Table 115). In M_1's the incidence of the Y5 cusp pattern appears to be higher in Negroids (77.9 per cent to 99.0 per cent). Except for the low incidence in Aleuts (40 per cent in males and 44.5 per cent in females), Mongoloids too possess a high incidence of the Y5 cusp pattern. All Mongoloids, with the exception of the Aleut and Peco Indians, exhibit an incidence of over 90 per cent. The Caucasoid range of population frequencies for this pattern is the lowest of the three groups (83.0 per cent to 97.0 per cent).

In the M_2's, the incidence of the Y5 cusp pattern is greatest in Negroids (0.5 per cent to 17.0 per cent). Except for the relatively high incidence of this pattern in East Greenland Eskimos (19.0 per cent), the Mongoloid incidence figures (0 to 19.0 per cent) are generally lower than those of Negroids. The range of incidence is lowest among the Caucasoids (0 to 2.0 per cent).

The Y5 cusp pattern in M_3's is generally highest in the Negroids (4.0 per cent to 39.6 per cent). In Mongoloids, all, with the exception of East Greenland Eskimos (17.7 per cent) and Pecos Indians (8.4 per cent), exhibit a 0 incidence of this Y5 cusp pattern. The Caucasoid incidence ranges from 4.0 per cent to 6.0 per cent. The incidence of the Y5 cusp pattern in lower molars, as judged from the above tables, is highest among Negroids and lowest in Caucasoids.

TABLE 95

INCIDENCE OF CUSP NUMBERS AND PATTERNS ON LOWER FIRST MOLARS OF THE SOUTH AFRICAN BANTU

CUSP PATTERN	NO. OF TEETH		PERCENTAGE	
	Males	Females	Males	Females
Y5	460	104	90.7	84.6
+5	43	18	8.5	14.6
Y4 } +4 }	4	1	0.8	0.8
TOTAL	507	123	100.0	100.0

TABLE 96

INCIDENCE OF CUSP NUMBERS AND PATTERNS ON LOWER SECOND MOLARS OF THE SOUTH AFRICAN BANTU

CUSP PATTERN	NO. OF TEETH		PERCENTAGE	
	Males	Females	Males	Females
Y5	38	8	7.0	6.1
+5	143	37	26.4	28.2
Y4 } +4 {	360	86	66.6	65.7
TOTAL	541	131	100.0	100.0

TABLE 97

INCIDENCE OF CUSP NUMBERS AND PATTERNS ON LOWER THIRD MOLARS OF THE SOUTH AFRICAN BANTU

CUSP PATTERN	NO. OF TEETH		PERCENTAGE	
	Males	Females	Males	Females
Y5	31	74	6.6	39.6
+5	261	71	55.9	37.9
Y4) +4 {	175	42	37.5	22.5
TOTAL	467	187	100.0	100.0

FOOTNOTE: The figures refer to the number of teeth, not of individuals.

TABLE 98

INCIDENCE OF CUSP NUMBERS AND PATTERNS OF THE LOWER FIRST MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

CUSP PATTERN	NATAL NGUNI Male	Female	CAPE NGUNI Male	Female	SOTHO Male	Female	MISCELLANEOUS Male	Female
Y5	115	41	119	20	123	39	103	4
+5	8	5	17	4	6	7	12	2
Y4	1	1	0	0	0	0	0	0
+4	2	0	0	0	1	0	0	0
TOTAL	126	47	136	24	130	46	115	6

TABLE 99

PERCENTAGE INCIDENCE OF CUSP NUMBERS AND PATTERNS ON THE LOWER FIRST MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

CUSP PATTERN	NATAL NGUNI Male	Female	CAPE NGUNI Male	Female	SOTHO Male	Female	MISCELLANEOUS Male	Female
Y5	91.27	87.23	87.50	83.33	94.62	84.78	89.56	66.66
+5	6.35	10.66	12.49	16.68	4.62	15.21	10.43	33.33
Y4	0.79	2.13	0	0	0	0	0	0
+4	1.58	0	0	0	0.77	0	0	0

TABLE 100

INCIDENCE OF CUSP NUMBERS AND PATTERNS ON THE LOWER SECOND MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

CUSP PATTERN	NATAL NGUNI Male	Female	CAPE NGUNI Male	Female	SOTHO Male	Female	MISCELLANEOUS Male	Female
Y5	11	6	4	0	18	2	5	0
+5	31	9	48	9	43	19	21	0
Y4	6	1	10	2	11	2	3	2
+4	86	29	93	13	78	28	74	9
TOTAL	134	45	155	24	150	51	103	11

TABLE 101

PERCENTAGE INCIDENCE OF CUSP NUMBERS AND PATTERNS ON THE LOWER SECOND MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

CUSP PATTERN	NATAL NGUNI Male	Female	CAPE NGUNI Male	Female	SOTHO Male	Female	MISCELLANEOUS Male	Female
Y5	8.21	13.33	2.59	0	12.0	3.92	4.85	0
+5	23.14	20.00	30.98	37.5	28.67	32.75	20.39	0
Y4	4.48	2.22	6.45	8.33	7.33	3.92	2.91	18.18
+4	64.17	64.44	60.01	54.17	52.00	54.90	71.84	81.82

TABLE 102

INCIDENCE OF CUSP NUMBERS AND PATTERNS ON THE LOWER THIRD MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

Cusp Pattern	NATAL	NGUNI	CAPE	NGUNI	SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Y5	6	1	5	1	16	1	4	1
+5	63	23	91	16	68	30	39	2
Y4	3	1	2	0	3	0	0	0
+4	44	14	38	11	41	15	44	1
3 cusps	0	0	2	0	0	0	2	0
TOTAL	116	39	138	28	128	46	89	4

TABLE 103

PERCENTAGE INCIDENCE OF CUSP NUMBERS AND PATTERNS ON THE LOWER THIRD MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

Cusp Pattern	NATAL	NGUNI	CAPE	NGUNI	SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Y5	5.17	2.56	3.62	3.57	12.50	2.17	4.49	25.0
+5	54.31	58.97	65.95	57.14	53.12	65.22	43.82	50.00
Y4	2.59	2.56	1.45	0	2.34	0	0	0
+4	37.93	35.90	27.53	39.29	32.04	32.61	49.44	25.00
3 cusps	0	0	1.45	0	0	0	2.25	0

TABLE 104

PERCENTAGE DISTRIBUTION OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON LOWER MOLARS OF THE SOUTH AFRICAN BANTU

	TUBERCULUM SEXTUM						ACCESSORY MEDIAN LINGUAL CUSP					
	M_1		M_2		M_3		M_1		M_2		M_3	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
No. of Teeth	1	3	4	1	15	6	72	28	29	9	50	26
Percentage	0.2	2.4	0.74	0.76	3.21	3.21	14.20	22.76	5.36	4.86	10.71	13.90

TABLE 105

PERCENTAGE DISTRIBUTION OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON LOWER MOLARS OF VARIOUS POPULATIONS

POPULATION	TUBERCULUM SEXTUM			ACCESSORY MEDIAN LINGUAL CUSP			AUTHOR
	M_1	M_2	M_3	M_1	M_2	M_3	
Bantu Male	0.2	0.7	3.2	14.2	5.4	10.7	Present Study
Bantu Female	2.4	0.8	3.2	22.8	4.9	13.9	Present Study
American Negro	2.0	8.0	33.0	22.0	4.0	6.0	Hellman 1928
East African Negro*	6.6	0.3	2.4				Chagula 1960
West African Negro*	3.0	6.0	16.0	12.0	5.0	6.0	Hellman 1928
Melanesian	9.0	5.0	9.0	6.0	1.5	3.0	Dahlberg 1945
American Indian	6.0	16.0	32.0	0	0	6.0	Hellman 1928
Asiatic Mongoloid	0	15.0	29.0	11.0	0	6.0	Hellman 1928
Eskimo	1.0	20.0	28.0	0	0	0	Hellman 1928
East Greenland Eskimo	1.4	10.4	16.4	0	2.6	0	Pederson 1949
Ancient European White	0	2.0	3.0	2.0	0	0	Hellman 1928
American White Male	0	0	3.0	3	2	0	Hellman 1928
Australian Aboriginal	8.0	43.0	54.0	0	0	7	Hellman 1928

*Determined from Y6 and +6 figures quoted.

FOOTNOTE: Unless stated, the males and females of the different population groups, are combined.

TABLE 106

INCIDENCE OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON THE LOWER FIRST MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

ACCESSORY CUSPS	NATAL	NGUNI	CAPE	NGUNI	SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Tuberculum Sextum	1	3	0	0	0	0	0	0
Median Lingual	23	12	20	4	15	10	14	2

TABLE 107

PERCENTAGE INCIDENCE OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON THE LOWER FIRST MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

ACCESSORY CUSPS	NATAL	NGUNI	CAPE	NGUNI	SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Tuberculum Sextum	0.79	6.39	0	0	0	0	0	0
Median Lingual	18.25	25.53	14.7	16.68	11.54	21.73	12.17	33.33

TABLE 108

INCIDENCE OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON THE LOWER SECOND MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

ACCESSORY CUSPS	NATAL	NGUNI	CAPE	NGUNI	SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Tuberculum Sextum	1	1	2	0	0	0	1	0
Median Lingual	11	6	7	0	9	3	2	0

TABLE 109

PERCENTAGE INCIDENCE OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON THE LOWER SECOND MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

ACCESSORY CUSP	NATAL		NGUNI		SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Tuberculum Sextum	0.75	2.22	1.30	0	0	0	0.97	0
Median Lingual	8.21	13.33	4.53	0	6.0	5.88	1.94	0

TABLE 110

INCIDENCE OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON THE LOWER THIRD MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

ACCESSORY CUSP	NATAL		NGUNI		SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Tuberculum Sextum	6	6	9	0	0	0	0	0
Median Lingual	9	15	15	3	19	8	7	0

TABLE 111

PERCENTAGE INCIDENCE OF TUBERCULUM SEXTUM AND ACCESSORY MEDIAN LINGUAL CUSPS ON THE LOWER THIRD MOLARS OF VARIOUS SOUTH AFRICAN BANTU GROUPS

ACCESSORY CUSP	NATAL		NGUNI		SOTHO		MISCELLANEOUS	
	Male	Female	Male	Female	Male	Female	Male	Female
Tuberculum Sextum	5.17	15.38	6.52	0	0	0	0	0
Median Lingual	7.76	38.46	10.87	10.71	14.85	17.39	7.86	0

TABLE 11B

PERCENTAGE DISTRIBUTION OF CUSP PATTERNS OF MANDIBULAR FIRST MOLARS OF VARIOUS POPULATIONS

(The numbers of individuals examined are shown in parentheses)

POPULATION GROUP	NUMBER OF MOLARS	Y5	+5	Y4 and +4	AUTHOR
South African Bantu Male	507 (356)	90.7	8.5	0.8	Present Study
South African Bantu Female	123 (104)	84.6	14.6	0.8	Present Study
American Negro	179 (119)	98.0	1.0	1.0	Hellman 1928
East African Negro*	244 (133)	77.9	10.6	4.9	Chagula 1960
West African Negro	97 (49)	99.0	0	1.0	Hellman 1928
Melanesian	237 (?)	92.0	4.0	4.0	Dahlberg 1945
Chinese	26 (19)	100.0	0	0	Hellman 1928
American Indian	97 (55)	100.0	0	0	Hellman 1928
Pecos Indian ≠	332 (164)	88.6	10.8	0.6	Nelson 1937
Aleutian Male	? (20)	40.0	60.0	0	Moorrees 1957
Aleutian Female	? (9)	44.5	55.5	0	Moorrees 1957
Asiatic Mangoloid	36 (21)	100.0	0	0	Hellman 1928
Eskimo	29 (30)	97.0	3.0	0	Hellman 1928
Eskimo (East Greenland)	143 (?)	94.4	2.8	1.4	Pederson 1949
American White Male	98 (61)	87.0	2.0	11.0	Hellman 1928
Ancient European White	54 (42)	83.0	0	17.0	Hellman 1928
Australian Aboriginal	18 (20)	100.0	0	0	Hellman 1928

* 4.9 per cent Y6 cusps, 1.7 per cent +6 cusps

≠ 1.4 per cent of the sample was classified as C6.

FOOTNOTE: Unless otherwise stated, the males and females of the different population groups are combined

TABLE 113

PERCENTAGE DISTRIBUTION OF CUSP PATTERNS ON MANDIBULAR SECOND MOLARS OF VARIOUS POPULATIONS

(The numbers of individuals examined are shown in parentheses)

POPULATION GROUP	NUMBER OF MOLARS	Y5	+5	Y4 and +4	AUTHOR
South African Bantu Male	541 (356)	7.0	26.4	66.6	Present Study
South African Bantu Female	123 (104)	6.1	28.2	65.7	Present Study
American Negro	218 (119)	6.0	24.0	70.0	Hellman 1928
East African Negro ≠	317 (167)	5.4	12.9	81.4	Chagula 1960
West African Negro	96 (49)	17.0	8.0	75.0	Hellman 1928
Melanesian	194 (?)	0.5	12.0	87.5	Dahlberg 1945
Chinese	21 (19)	0	19.0	81.0	Hellman 1928
American Indian	99 (55)	1.0	31.0	69.0	Hellman 1928
Pecos Indian	313 (164)	8.3	24.3	67.4	Nelson 1937
Aleutian Male	? (19)	0	73.7	26.3	Moorrees 1957
Aleutian Female	? (17)	0	35.3	64.7	Moorrees 1957
Asiatic Mongoloid	39 (21)	0	31.0	69.0	Hellman 1928
Eskimo	30 (30)	6	37.0	57.0	Hellman 1928
Eskimo* (East Greenland)	115 (?)	19.0	42.0	39.0	Pederson 1949
American White Male	110 (61)	0	1.0	99.0	Hellman 1928
Ancient European White	54 (42)	2.0	11.0	86.0	Hellman 1928
Australian Aboriginal	21 (20)	5.0	43.0	52.0	Hellman 1928

≠ 0.3 per cent of sample was Y6

* 15.0 per cent of sample listed as unclassified.

FOOTNOTE: Unless otherwise stated, the males and females of the different population groups, are combined

TABLE 114

PERCENTAGE DISTRIBUTION OF CUSP PATTERNS ON MANDIBULAR THIRD MOLARS OF VARIOUS POPULATIONS

(The numbers of individuals examined are shown in parentheses)

POPULATION GROUP	NUMBER OF MOLARS	Y5	+5	Y4 and +4	AUTHOR
South African Bantu Male	541 (356)	6.6	55.9	37.5	Present Study
South African Bantu Female	123 (104)	39.6	37.9	22.5	Present Study
American Negro	187 (119)	4.0	63.0	33.0	Hellman 1928
East African Negro ≠	255 (153)	12.5	44.4	40.7	Chagula 1960
West African Negro	88 (49)	20.0	59.0	20.0	Hellman 1928
Melanesian	164 (?)	11.0	64.0	19.0	Dahlberg 1945
Chinese	16 (19)	0	50.0	50.0	Hellman 1928
American Indian	84 (55)	0	75.0	24.0	Hellman 1928
Pecos Indians	249 (164)	9.4	51.0	40.6	Nelson 1937
Aleutian Male	? (8)	0	87.5	12.5	Moorrees 1957
Aleutian Female	? ((6)	0	100.0	0	Moorrees 1957
Asiatic Mongoloid	31 (23)	0	77.0	23.0	Hellman 1928
Eskimo	29 (29)	0	52.0	48.0	Hellman 1928
Eskimo (East Greenland)*	55 (?)	12.7	61.5	9.1	Pederson 1949
American White Male	74 (61)	4.0	34.0	62.0	Hellman 1928
Ancient European White	35 (92)	6.0	34.0	60.0	Hellman 1928
Australian Aboriginal	23 (20)	14.0	72.0	14.0	Hellman 1928

≠2.0 per cent and 0.4 per cent had Y6 and +6 cusps respectively

*16.4 per cent of the sample was unclassified.

FOOTNOTE: Unless otherwise stated, males and females of the different population groups are combined.

TABLE 115

RANGE OF POPULATION FREQUENCIES OF Y5 CUSP PATTERN IN MANDIBULAR MOLARS OF MONGOLOID, CAUCASOID AND NEGROID DENTAL SERIES

RACIAL GROUP	PERCENTAGE INCIDENCE OF Y5 PATTERN		
	M_1	M_2	M_3
Mongoloids	40 - 100	0 - 19.0	0 - 12.7
Caucasoids	83.0 - 87.0	0 - 2.0	4.0 - 6.0
Negroids	77.9 - 99.0	0.5 - 17.0	4.0 -39.6

II. D. BUCCAL GROOVES AND PITS

On the buccal surface of mandibular molars, grooves of varying depth usually separate the buccal cusps. Where three buccal cusps are present, two grooves may be observed, the mesial groove usually being more marked than the distal. At the lower termination of the mesial groove a pit is frequently found. Arkövy (1904) contended that the frequent occurrence of buccal pits is indicative of advanced evolution of a human racial group. This statement was vigorously refuted by Pedersen (1949). According to Pedersen, these pits were early observed to be common and pronounced in the Eskimo. In semi-civilized and civilized Eskimo, such pits are reported to be favourite starting spots for acute dental caries. In fact, according to him, they are the first to be affected in the Eskimo.

Dahlberg (1950) believed that a relationship exists between protostylids of mandibular molars and the depth of the buccal grooves. The protostylids to which he referred are supernumerary or paramolar cusps which are restricted to the mesial portion of the buccal surfaces of mandibular molars. The seemingly residual evidences of the paramolar cusp, he contended, commonly take the form of pits and distal deviations of the gingival end of the buccal groove on modern lower molars. He noted too that in different American Indian groups, buccal grooves are deep and frequently end in an enlarged pit.

Similarly, Moorrees (1957) observed deep buccal grooves in the Aleut molars, but these were not found to end in enlarged pits.

PRESENT STUDY

In the present study the presence or absence of buccal grooves on mandibular molars was noted; when present, the grooves were subjectively assessed as deep, moderate or slight (Fig. 47, 48 and 49). In many instances a buccal pit was noted with or without a groove. When a pit was observed, it was tabulated as such, whether or not it was associated with a buccal groove (Fig. 50). The incidence of deep buccal grooves in first and second mandibular molars of both sexes in the Bantu is very low (Tables 116 & 117), viz. between 3.69 per cent and 6.67 per cent. In third mandibular molars the percentage incidence is even less, viz. 2.48 per cent for males and 2.54 per cent for females.

The percentage incidence of moderately deep buccal grooves in the first and second molars of both sexes is remarkably similar and within one per cent of each other. The incidence of moderate grooves in the first molar is approximately 58 per cent in both sexes and in the second molar is 50 per cent in both sexes. The incidence of moderately deep grooves in the third mandibular molars is less in both sexes, namely, 30.79 per cent in males and 36.44 per cent in females.

A slight groove or a complete absence of buccal grooves or pits was noted in 32.29 per cent of first

BUCCAL GROOVES AND PITS



Fig. 47 Deep groove



Fig. 48 Moderately deep groove



Fig. 49 Slight groove



Fig. 50 Buccal pit

molars in males and 22.96 per cent in females. In second molars the figures for a trace or lack of groove for both sexes were the same, namely, 38 per cent. The mandibular third molars of both sexes had the smoothest buccal surfaces, that is, the incidence of slight or absent grooves is higher in males (63.64 per cent) and is likewise high (56.78 per cent) in females.

Buccal pits occur in 6.09 per cent of male Bantu mandibular first molars and in 11.85 per cent of female first molars (Tables 116 & 117). The second molars of both sexes have a slightly lower incidence of pits, 4.63 per cent in males and 6.61 per cent in females. The third molars exhibit even fewer pits, viz. 3.09 per cent and 4.24 per cent for males and females respectively. It may be noted that the percentage incidence of buccal pits is higher in females in all the lower molar teeth.

In the Bantu tribal group the percentage incidence of deep buccal grooves in all the molars of all groups is low, the Natal Nguni females exhibiting the highest incidence, viz. 15.69 per cent. The percentage incidence of moderately deep grooves varies from 42 per cent to 80.95 per cent in the first and the second molars. In the third mandibular molars, the Natal Nguni exhibit the highest incidence of moderate grooves (52.63 per cent), whereas the Cape Nguni possess the lowest incidence, 28.57 per cent. The small sample of Miscellaneous females is not included in the comparison of these frequencies.

A trace or absence of grooves was observed on no fewer than 36.17 per cent of Sotho male first molars and in only 9.80 per cent of Natal Nguni female first molars. In the second molars, the range extended from 50 per cent in Sotho females to 14.29 per cent in Cape Nguni females. The range of frequencies for third molars (excluding the small Miscellaneous female group) is slightly narrower, from 67.46 per cent in Sotho males (the highest figure) to 39.47 per cent of Natal Nguni (the lowest incidence).

The highest incidence of molar buccal pits in first and second molars is in the Natal Nguni male and female samples and in the Sotho males. In third molar teeth the Natal Nguni females and Sotho males tend to have the highest incidence of buccal pits.

DISCUSSION

Unlike the Aleut, the Bantu have a low incidence of deep buccal grooves on mandibular molars. In fact, a fair percentage of Bantu lower molars possess no or slight buccal grooving. Compared to the frequency in East and West Greenland and Central Eskimo, the incidence of buccal pits in Bantu is likewise low.

The incidence of varying depths of buccal grooves and pits in the mandibular molars of Bantu tribal subgroups is so varied as to be of doubtful significance.

Because of the paucity of material in the literature, it is difficult at this stage to attribute much real significance to the incidence of buccal grooves or pits on mandibular molar teeth.

TABLE 116

INCIDENCE OF BUCCAL GROOVES AND PITS IN THE MANDIBULAR MOLAR TEETH OF VARIOUS SOUTH AFRICAN TRIBAL GROUPS

MANDIBULAR FIRST MOLAR

DESCRIPTION	NATAL		NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Deep	8	8	8	1	1	0	3	0	20	9
Moderate	78	26	86	17	79	31	71	5	314	79
Slight or Absent	46	5	45	6	51	17	33	3	175	31
Pit	7	12	14	2	10	2	2	0	33	16
								TOTAL	542	135

MANDIBULAR SECOND MOLAR

DESCRIPTION	NATAL		NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Deep	10	2	14	1	5	3	7	0	36	6
Moderate	77	19	73	17	60	21	61	3	271	60
Slight or Absent	39	15	65	3	70	25	34	4	208	47
Pit	9	7	3	0	10	1	3	0	25	8
								TOTAL	540	121

MANDIBULAR THIRD MOLAR

DESCRIPTION	NATAL		NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Deep	5	1	44	0	1	2	2	0	12	3
Moderate	40	20	48	2	32	14	29	1	149	43
Slight or Absent	72	15	91	20	85	28	60	4	308	67
Pit	2	2	4	0	8	3	1	0	15	5
								TOTAL	484	118

TABLE 117

PERCENTAGE INCIDENCE OF BUCCAL GROOVES AND PITS IN THE MANDIBULAR MOLAR TEETH OF VARIOUS SOUTH AFRICAN TRIBAL GROUPS

MANDIBULAR FIRST MOLAR

DESCRIPTION	NATAL		NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Deep	5.76	15.69	5.23	3.83	0.71	0	2.75	0	3.69	6.67
Moderate	56.12	50.98	65.21	65.38	56.03	62.0	65.16	62.5	57.93	58.52
Slight or Absent	33.09	9.80	29.41	23.08	36.17	34.0	30.26	37.5	32.29	22.96
Pit	5.04	23.53	9.15	7.70	7.09	4.0	1.63	0	6.09	11.85
								TOTAL	100.00	100.00

MANDIBULAR SECOND MOLAR

DESCRIPTION	NATAL		NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Deep	7.41	4.65	9.03	4.76	3.45	6.0	6.67	0	6.67	4.96
Moderate	57.04	44.19	47.09	80.95	41.38	42.0	58.09	42.86	50.18	49.59
Slight or Absent	28.89	34.88	41.94	14.29	48.28	50.0	32.38	57.14	38.52	38.84
Pit	6.67	16.28	1.94	0	6.89	2.0	2.86	0	4.63	6.61
								TOTAL	100.00	100.00

MANDIBULAR THIRD MOLAR

DESCRIPTION	NATAL		NGUNI		SOTHO		MISCELLANEOUS		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Deep	4.20	2.63	2.72	0	0.79	4.26	2.17	0	2.48	2.54
Moderate	33.61	52.63	32.65	28.57	25.40	29.79	31.52	20.0	30.79	36.44
Slight or Absent	60.50	39.47	61.90	71.43	67.46	59.58	65.22	80.0	63.64	56.78
Pit	1.68	5.26	2.72	0	6.35	6.38	1.09	0	3.09	4.24
								TOTAL	100.00	100.00

II. E. PARAMOLAR CUSPS

The term 'paramolar cusp' (or tubercle) is applied to an accessory cusp which, according to Bolk (1916), occurs on the buccal surfaces of second and third molars. These cusps, he contended, were derived from supernumerary teeth, the paramolars, which fused during development to the permanent teeth. Bolk assumed that supernumerary teeth were atavisms. In fact, whenever extra cusps occurred, he considered them as reversions or representatives of lost parts of the dentition.

Pedersen (1949) observed a first upper molar with a paramolar tubercle in an East Greenland Eskimo. The same author quoted no fewer than [illegible] other writers who observed similar isolated cases of this paramolar cusp appearing on first molars. Dahlberg (1945) likewise reported the presence of paramolar cusps or protostylids on permanent first molars. He observed protostylids in no fewer than 31 per cent of 16 permanent mandibular molars in 80 casts of Pima Indian dentitions. Pedersen (1949) noticed that the incidence of such cusps was higher in some races, such as the Eskimo, than in Whites. Moorrees (1957) was not able to locate any paramolar cusps or protostylids on any of the Aleut molars or premolars.

PRESENT STUDY

Evidence of paramolar cusps was sought on the buccal surfaces of the maxillary and mandibular teeth. Where present, cusp sizes were designated large, moderate and

PARAMOLAR CUSPS



Fig. 52 Large paramolar cusp located on buccal surface of M^3



Fig. 53 Moderate paramolar cusp on buccal surface of M^3



Fig. 54 Small paramolar cusp on buccal surface of M_3

trace (Figs. 51, 52 and 53).

Paramolar cusps were rare in the Bantu teeth examined. Thus, in 502 maxillary first molars of male Bantu, only two large and one moderately sized paramolar cusps were observed (Table 118). Two large paramolar cusps were seen on 574 second maxillary molars of males. In 488 third maxillary molars of males, only two large and one moderately sized cusps were located.

Of the 139 maxillary first molar teeth in Bantu females, not a single paramolar cusp was seen. One large and one moderately sized paramolar cusp were observed in 173 second maxillary molars in females, and no evidence of paramolar cusps was shown in 131 third maxillary molar teeth.

In the mandibular dentition (Table 119), traces of tubercles were noted in 3 out of 542 mandibular first molars of Bantu males. A trace of a paramolar cusp was noted in the buccal surface of one second mandibular molar tooth of 540 male M_2's examined. In the third molars of the lower jaw, a larger number of paramolar cusps was noted; 2 large, 7 moderate and no fewer than 9 small paramolar cusps were observed in 484 teeth.

The female Bantu evinced no trace of paramolar cusps in any of their 135 first or 121 second mandibular molar teeth. In the third mandibular molars of females, the numbers of large, moderate and trace cusps were 1, 3 and 2 respectively out of 163 teeth.

Most of the small number of paramolar cusps recorded in the lower jaw in my Bantu series occurred in the Nguni group (21 out of 28 cusps observed in mandibular molars) (Tables 120 & 121). This is not true, however, for the maxillary molars. The total number of paramolar cusps for both sexes (upper and lower molars) is as follows: Natal Nguni 13, Cape Nguni 12, Sotho 10 and Miscellaneous 6.

DISCUSSION

The incidence of paramolar cusps, particularly in the mandibular dentition, is highest in the third molars. This is in keeping with the general phenomenon that the incidence of paramolar cusps is higher in third molars than in first molars. Dahlberg (1945) attributes this phenomenon to the fact that the first permanent molars are more stable and less variable in pattern since they have smaller coefficients of variation. He believed also that a genetic influence is responsible for the presence of paramolar cusps and that they are not the result of some environmental factor operating during development.

The occurrence of paramolar cusps in upper and lower molars of both sexes is not notably higher in any single tribal group. The occurrence of paramolar cusps in the mandibular molars of the two Nguni groups, however, is appreciably higher than that of other tribes.

TABLE 118

OCCURRENCE OF PARAMOLAR CUSPS ON THE MAXILLARY MOLAR TEETH IN SOUTH AFRICAN BANTU

TOOTH	PARAMOLAR CUSP	MALES	FEMALES
M^1	Large	2	0
	Moderate	1	0
	Trace	0	0
	Total Present	3	0
	Absent	499	139
M^2	Large	2	1
	Moderate	0	1
	Trace	0	0
	Total Present	2	2
	Absent	572	171
M^3	Large	2	0
	Moderate	1	0
	Trace	0	0
	Total Present	3	0
	Absent	485	131
All Upper Molars	Large	6	1
	Moderate	2	1
	Trace	0	0
	Total Present	8	2
	Absent	1556	441

TABLE 119

OCCURRENCE OF PARAMOLAR CUSPS ON THE MANDIBULAR MOLAR TEETH IN SOUTH AFRICAN BANTU

TOOTH	PARAMOLAR CUSP	MALES	FEMALES
M_1	Large	0	0
	Moderate	0	0
	Trace	3	0
	Total Present	3	0
	Absent	539	135
M_2	Large	0	0
	Moderate	0	0
	Trace	1	0
	Total Present	1	0
	Absent	539	121
M_3	Large	2	1
	Moderate	7	3
	Trace	9	2
	Total Present	18	6
	Absent	466	157
All Lower Molars	Large	2	1
	Moderate	7	3
	Trace	13	2
	Total Present	22	6
	Absent	1544	413

TABLE 120

OCCURRENCE OF PARAMOLAR CUSPS ON THE MAXILLARY MOLARS IN VARIOUS SOUTH AFRICAN TRIBAL GROUPS

MOLAR TEETH	TRIBAL GROUP AND SEX	CUSP SIZE LARGE	MODERATE	TRACE	TOTAL
All Maxillary Molars	Natal Nguni males	0	0	0	0
	Cape Nguni males	2	0	1	3
	Sotho males	2	1	0	3
	Miscellaneous males	2	0	2	4
"	Natal Nguni females	1	0	0	1
	Cape Nguni females	0	0	0	0
	Sotho females	0	1	0	1
	Miscellaneous females	0	1	0	1

TABLE 121

OCCURRENCE OF PARAMOLAR CUSPS ON THE MANDIBULAR MOLARS IN VARIOUS SOUTH AFRICAN TRIBAL GROUPS

MOLAR TEETH	TRIBAL GROUP AND SEX	CUSP SIZE LARGE	MODERATE	TRACE	TOTAL
All Mandibular Molars	Natal Nguni males	1	4	2	7
	Cape Nguni males	1	1	7	9
	Sotho males	0	2	3	5
	Miscellaneous males	0	0	1	1
"	Natal Nguni females	1	2	2	5
	Cape Nguni females	0	0	0	0
	Sotho females	0	1	0	1
	Miscellaneous females	0	0	0	0

SUMMARY

I. THE MORPHOLOGY OF THE MAXILLARY INCISOR TEETH

A. SHOVEL-SHAPED INCISORS

Shovelling of incisor teeth occurs in all races, the incidence varying with different population groups. In Bantu Negroids, the figures show the incidence of marked shovelling of maxillary central and lateral incisors in both sexes to be relatively low.

The incidence of all degrees of shovelling in both sexes tends to be higher in lateral incisors than in central incisors.

There is a sex difference, Bantu females evincing a greater incidence of shovelling in both central and lateral incisors than Bantu males.

The incidence of overall shovelling among the Bantu tribes is lowest in the Miscellaneous male and female groups. The Natal Nguni females revealed a particularly high incidence of shovel-shaped lateral incisor teeth.

A comparison of the incidence of shovelling among population groups reveals that the incidence in the South African Bantu is the lowest of all races. The incidence in the Bantu approximates that of the American Negro.

B. MEDIAN RIDGES AND LINGUAL TUBERCLES

The lingual surfaces of maxillary incisor teeth were examined for the presence of median ridges and lingual tubercles. It was found that the commonest form of lingual surface on the maxillary incisor teeth in the Bantu is a smooth surface free of ridges or tubercles. In males, more than half, viz. 55 per cent of the observable teeth exhibit this feature on their central incisor teeth, whereas 67.8 per cent of lateral incisors have similarly smooth lingual surfaces. In females, the incidence of smooth lingual surfaces is slightly less, viz. 40 per cent and 55.5 per cent of central and lateral incisors respectively.

Lingual ridges of central incisors in Bantu males are present in varying degrees of prominence in 45 per cent of the sample. Marked ridges are present in only 3.4 per cent of the teeth. Lateral incisors in males evince a lower incidence (32.2 per cent) of ridged teeth. Only 1.6 per cent of lateral incisors teeth have marked ridges.

In females, the overall incidence of ridging is higher than in males, viz. 60 per cent of central incisors and 44.4 per cent of lateral incisors. In no instances are marked lingual ridges noted in females.

In the tribal groups, Sotho males, and Sotho and Natal Nguni females evince a relatively lower incidence of smooth surfaced maxillary central and lateral

incisor teeth. In the remaining tribal groups, approximately half or more of the incisor teeth have smooth lingual surfaces. The samples are too small, however, to draw any conclusions from these observations.

Owing to a lack of available data a table of racial comparisons could not be drawn up.

The incidence of lingual tubercles of varying sizes in central incisors in the Bantu is relatively high, viz. 4.7 per cent in males and 11.4 per cent in females. The incidence of marked lingual tubercles is minimal.

The overall incidence of lingual tubercles in lateral incisor teeth is slightly higher than in central incisors, viz. 14.0 per cent and 16.9 per cent in males and females, respectively. Marked tubercles are infrequently located in these teeth.

The overall incidence of tubercles present in central and lateral incisors is higher in females than in males.

No obvious tribal differences in the incidence of tubercles could be determined.

In racial comparisons, the available data indicate that the South African Bantu tends to possess a relatively high incidence of lingual tubercles in maxillary incisor teeth.

There is no evidence of frequent association of lingual tubercles with shovel-shaped incisor teeth in modern man.

C. OUTLINE SHAPES OF MAXILLARY TEETH

Three basic tooth shapes, namely, square, tapering and ovoid, were recognised in the classification of the outline shapes of maxillary incisor teeth in the Bantu. Intermediate shapes such as square-ovoid, tapering-ovoid and tapering square were classified as intermediate.

In the total Bantu group, intermediate tooth shapes are most common (42.7 per cent in males), 35.6 per cent in females).

Square, ovoid and tapering teeth appear to have an equal chance of occurring in both males and female Bantu. No notable sex differences were observed in the total group.

In the tribal groups there is no conclusive evidence to suggest that there is any specific tooth form or shape by which any of the Bantu tribes could be identified.

Although sex differences were noted in the tribal groups, particularly the Natal Nguni, the sample is too small for these figures to be meaningful.

II. MOLAR TEETH

A. THE NUMBER OF CUSPS ON THE MAXILLARY MOLARS

The maxillary first molars are usually quadricuspid. In the Bantu four fully-developed cusps are seen in 100 per cent of all maxillary first molars in males and in 98.7 per cent of all female first molars. In the case of maxillary second molars, approximately 70 per cent of both sexes have four cusps, whereas a little over a quarter of the third molars of both sexes possess four cusps. About a third of the maxillary third molars have 3½ cusps, whereas approximately 40 per cent of these teeth in both sexes are tricuspid.

The sex differences in the Bantu conform with observations on other racial groups in that the males are less inclined towards a reduction in the number of cusps in the maxillary molars.

In the tribal sub-groups, the Cape Nguni appear to have the least conservative cusp pattern. The males of this group possess the highest incidence of quadricuspid second molars, whereas the females possess the lowest incidence of four-cusped first, second and third molars. This group reveals the highest incidence of 3 and 3½ cusped teeth in all three maxillary molars.

Most racial groups possess a high percentage of maxillary first molars with 4 cusps. In second molars, however, the variation in the number of quadricuspid

teeth is greater ; only the Australian Aboriginals, Bushmen and Aleut males possess a higher incidence of 4 cusped maxillary second molars than the Bantu.

The incidence of four-cusped third molars is higher in the Aleut males, American and Pecos Indians, than in either Bantu males or females. The incidence of the combined 4 and 3½ cusped maxillary third molars in the Bantu is exceeded only by that in the Australian Aboriginals.

B. THE TUBERCLE OF CARABELLI

In the Bantu, the percentage incidence of any trace of Carabelli's cusp in maxillary first molars in both sexes is relatively high, the incidence being slightly higher in females.

In second molars the incidence of this cusp is considerably less, and in third molars, even less.

The incidence of this cusp in maxillary second molars in females is slightly higher, and in third molars, slightly lower than in males.

The incidence of large tubercles is higher in males than in females, yet the overall incidence of Carabelli features is higher in females for both the first and second maxillary molars.

The incidence of the various sized Carabelli cusps in the sub-groups is not sufficiently variable to indicate any notable tribal differences.

The incidence of Carabelli's cusp in the Bantu tends to be higher than in Mongoloids, but less than in Caucasoids.

C. CUSP AND GROOVE PATTERNS OF THE MANDIBULAR MOLARS

The basic lower molar pattern in the human has five cusps and a Y-shaped groove system, the Dryopithecus pattern. The basic cusp numbers and groove patterns of these teeth are frequently modified and as such are useful in differentiating population groups. The traditional method of classification of lower molars by cusp numbers and groove pattern is used in the present study.

The most frequent cusp pattern on the M_1's in both Bantu males and females is the Y5 pattern, viz. 90.7 per cent and 84.6 per cent in males and females respectively.

The M_2's of the Bantu are mainly four-cuspid; approximately 56 per cent of these teeth in both sexes are quadricuspid.

The percentage incidence of Y5 pattern in third molars in males is 6.6 per cent whereas in females the incidence is as high as 39.6 per cent.

In the tribal sub-groups, there is no notable difference in the percentage incidence of the Y5 molar patterns in the lower first molars.

The second molars of the Cape Nguni show a lesser tendency towards retaining the Y5 pattern; the other groups mainly possess the +4 molar pattern, the Miscellaneous group evincing the highest incidence, viz. 71.87 per cent in males and 81.82 per cent in

females.

Five cusps are present in 60 to 70 per cent of M_3's of both sexes of the various tribal groups, with the exception of the Miscellaneous group in which only 48 per cent possess 5 cusps. The +5 groove system is the modal pattern of this tooth in both sexes. The balance of M_3's of both sexes are mainly of +4 pattern.

The overall incidence of the Y5 pattern in first, second and third molars is generally highest in Negroids. Mongoloids possess a fairly high incidence of this molar pattern, higher than Caucasoids but lower than Negroids.

The overall incidence of the tuberculum sextum in the Bantu is not high; the incidence in females, however, is higher than in males.

In the tribal sub-groups, the incidences of the tuberculum sextum in the M_1's and M_3's of both sexes in the Natal Nguni are higher than in other groups.

The percentage incidence of the tuberculum sextum in the Bantu compared with that of other populations is almost the lowest of all racial groups.

The incidence of the accessory median lingual cusp is higher in the mandibular first and third molars of both sexes in the Natal Nguni than in the remaining tribal groups.

The overall incidence of the accessory median lingual cusp in the Bantu is almost the highest of all population groups for which data are available.

D. BUCCAL GROOVES AND PITS

The incidence of deep buccal grooves in the M_1's and M_2's in both Bantu sexes is low. The percentage incidence is even less in M_3's.

Moderate grooves are present in about half of all M_1's and M_2's of both sexes. The incidence is lower in M_3's, viz. approximately 31 per cent and 36 per cent in males and females respectively.

A trace or complete absence of buccal grooves or pits is noted in about a third of male M_1's and in approximately 23 per cent of female first molars. In the M_2's of both sexes, 38 per cent lacked grooves or pits. Approximately 60 per cent of the M_3's of both sexes evinced smooth buccal surfaces, the incidence being slightly higher in males

The incidence of buccal pits in lower molars is highest in M_1's and lowest in M_3's. Also the percentage incidence of these pits in lower molars is higher in females than in males.

The incidence of varying depths of buccal grooves and pits in the mandibular molars of tribal groups is so varied as to be of doubtful significance.

Racial comparisons are not tabulated owing to lack of available data.

E. PARAMOLAR CUSPS

The incidence of paramolar cusps on the buccal surfaces of molar teeth varies in different racial groups.

In the Bantu paramolar cusps are relatively rare. In the skulls examined only 6 large, 1 moderately sized and 3 slight cusps were located on all maxillary male molars. The incidence of paramolar cusps in females is lower; only a single large and 2 moderately sized cusps were noted on their maxillary molars.

The incidence of paramolar cusps in the mandibular molar teeth is slightly higher than in maxillary teeth. In males, 2 large, 7 moderate and 13 slight cusps were found in all the upper molars. The incidence in females is lower, viz. only 1 large, 3 moderate and 2 slight cusps.

The occurrence of paramolar cusps in upper and lower molars of both sexes is not notably higher in any single tribal group.

Insufficient data could be gathered for racial comparisons.

CHAPTER 7

A. ODONTOMETRY

A. ODONTOMETRY ON THE SOUTH AFRICAN BANTU NEGROIDS

SUMMARY

B. COMPARISON OF TOOTH MEASUREMENTS OF VARIOUS SOUTH AFRICAN TRIBAL GROUPS

SUMMARY

C. COMPARATIVE TOOTH DIMENSIONS AND INDICES OF THE BANTU COMPARED WITH THOSE OF OTHER POPULATIONS

SUMMARY.

.....

A. ODONTOMETRY OF THE SOUTH AFRICAN BANTU NEGROIDS

Yates and Healy (1951) stated that, although measurements of teeth may be limited in scope, nevertheless when there are no differences in basic anatomical features or easily recognizable differences in shape, the metrical approach is the only one possible. The advantage of the metrical approach to teeth is that it offers a source of accurate and objective data which can be subjected to statistical analysis. Yet, according to Moorrees (1957), little progress in dental anthropometry has been made because data have been obtained on relatively few populations. Samples have usually been small, measuring techniques have varied, and proper statistical treatment of the data has frequently been omitted. He was able to locate only ten publications on this subject which furnished sufficient statistical information to make the findings useful for comparison.

METHODS OF MEASUREMENT AND INDICES

Methods of measuring tooth crowns have been given by most authors such as Hrdlička (1923), Campbell (1925), Martin (1928), Shaw (1931), Pederson (1949), Selmer-Olsen (1949) and Moorrees (1957). It is difficult to measure teeth satisfactorily as there are a number of limiting factors. The difficulties involved in measuring teeth have been thoroughly discussed in an excellent article by

Goose (1963). A few difficulties mentioned are:-

1. The shape of the tooth is often complex, for example, a molar has cusps of varying sizes, and surfaces of varying curvatures.

2. Attrition may alter the size and shape.

3. Tartar may obscure the actual tooth and add to its apparent size.

4. Measuring errors resulting from slight differences in technique can be high in some instances.

5. Measurements are sometimes made on plaster casts and these do not necessarily correspond with those on the original teeth.

As Goose pointed out, it is theoretically possible to measure an unlimited number of variables in the shape of a tooth. In practice, investigators have usually measured only a limited number of diameters. Attrition, in older individuals, or as in Bushmen and Australian aboriginals, markedly reduces the mesiodistal dimensions of the teeth. Most authors appear to have ignored dental attrition in their metrical work; others such as Hrdlička (1938) have attempted to correct for the loss of tooth substance.

Miles (1962) investigated the possibility of assessing individual age from the amount of attrition in dentitions. He concluded that it could be assessed in contemporary subjects who experience a good deal of attrition, and whose third molars erupt and become fully functional. Because of the varied diet and because the rate of attrition

in the Bantu is not excessive, a satisfactory method of compensating for interproximal attrition could not be readily applied to this group.

In the present study, tooth measurements were taken directly on the teeth in the crania with a Boley gauge. The points of the instrument were carefully sharpened to make accurate measurements possible. Where necessary, before measuring the teeth, tartar was removed from them with a dental scaler.

Shaw (1931) found that even with exact definition of measurements, it was impossible to obtain greater accuracy than 0.5 mm. Nelson (1938) maintained that a metrical accuracy of 0.1 mm is easily attained in mesiodistal and labiolingual dimensions. Pederson (1949) and Schuman and Brace (1957) stated that on repeated measurements by the same person, the difference was at most not more than 0.2 mm. Goose (1963) claimed that an accuracy of 0.1 mm is readily attained. In the present investigation, repeated measurements by the same person on a number of teeth indicated that teeth could be measured accurately to 0.1 mm.

DEFINITION OF DENTAL MEASUREMENTS OF TOOTH SIZE

1. Mesiodistal crown diameter (M-D)

This measurement represents the greatest dimension of the crown of the tooth between the adjacent contact points (or where they would be) or areas in the case of cheek teeth and the maximum mesiodistal dimension in the case of incisors and canines. According to

Goose (1963) this method is the most satisfactory, since the contact points are a natural anatomical feature, and in the event of rotation of a tooth, other measurements, such as the maximum mesiodistal diameter, may give a [redacted] larger value. In measuring molars the calibrated shaft of the instrument is parallel to the occlusal and labial surfaces of the crown.

2. Buccolingual crown diameter (B-L)

The buccolingual diameter is taken at right angles to the mesiodistal one and represents the distance between the labial and lingual surfaces of the tooth crown. The parallel beaks of the gauge are kept parallel to the long axis of the tooth and the greatest buccolingual diameter thus measured.

3. Crown area (M-D x B-L)

The crown area is determined by the product of the mesiodistal and buccolingual diameters. This calculation provides some indication of the robustness or overall size of the tooth, but does not take into account the differences in shape. As Moorrees (1957) pointed out, the area computed in this manner is inaccurate, since a cross-section of the tooth crown parallel to the occlusal surface is not rectangular, but shows various geometric figures such as ovals, parallelograms, etc. The calculated area however is an accurate representation of the rectangle into which the tooth could be fitted and is an effective method of calculating tooth size for comparative purposes.

The Crown Module has been included among the dental indices by several authors (De Terra 1905, Shaw 1931) and is

half the sum of the mesiodistal and buccolingual diameters. The module was intended to provide an overall picture of size, but not of shape. The value of this index, as pointed out by Pederson (1949) and Moorrees (1957), is small and it appears to have fallen into disuse.

In most cases sixteen teeth each in the upper and in the lower jaws were measured. Where corresponding teeth from both the left and right sides were measured, the average of the left and right measurements was used in the analysis where only the left or the right side measurement was available, this single measurement was used. The analysis the form of a one-way analysis of variance and a 5 ent level of significance was used throughout.

OBSERVATIONS

Mesiodistal Crown Diameters

The mediodistal crown diameters of the maxillary and mandibular teeth in Bantu males and females are summarized in Tables 122 & 123.

In the maxilla, all of the teeth in the Bantu males, with the exception of the second premolars, are significantly larger (at the 5 per cent level) than the corresponding teeth of the females. The mean dimensions of the second premolar teeth in the males are slightly larger (6.8 mm) than those of the females (6.71 mm), but not at a significant level.

Sexual dimorphism of the teeth was determined by computing the sex ratios, i.e. the male means divided by

the corresponding female means. For all absolute measurements the ratios are greater than unity. This was expected since male teeth are larger than female teeth. While most of the measurements show a significant sexual difference, the sex ratios are not constant for different teeth. The most pronounced sex difference (Table 124) is shown by the maxillary canines and third molars (sex ratios 1.054 and 1.051 respectively), whereas the maxillary first and second premolars show the smallest difference with sex ratios of 1.016 and 1.013 respectively.

In the mandibular arch the greatest sex differences are noted in the canines, third and second molars (sex ratios 1.063, 1.031 and 1.030 respectively), whereas the central and lateral incisors show the smallest sex differences (ratios 1.005 and 1.011 respectively).

The greatest variability in mesiodistal crown diameters in Bantu maxillae is evinced by the lateral incisors of males and females (coefficients of variability 9.5 per cent and 9.72 per cent respectively), and by the third molars in males and females (C.V. 7.88 per cent and 10.91 per cent respectively). The maxillary first molars of both sexes show the least degree of variability (C.V. 4.96 per cent in males, 4.89 per cent in females).

In the mandible, the mean dimensions of all the teeth in the Bantu males, except the central and lateral incisors, are significantly larger at the level of 5 per cent than those of females.

The mandibular central incisors and second premolars in males, and lateral incisors and third molars of both sexes show the greatest degree of variability (C.V. all above 7.0 per cent). The mandibular central incisors and second premolars also have high variability (3rd and 4th) in females. The mandibular first molars in males (C.V. 5.24 per cent) and mandibular first premolars in females (C.V. 4.92 per cent) evince the least variable mesiodistal crown dimension.

Buccolingual Crown Diameters

The data on the buccolingual crown diameters are summarized in Tables 125 & 126. In Table 125 it will be noted that in every instance the buccolingual dimensions of the maxillary teeth in Bantu males are significantly larger than those of the corresponding teeth of Bantu females.

The greatest sex differences (Table 127) in maxillary buccolingual crown dimensions, as in maxillary M-D dimensions, occur in canines and third molars with sex ratios of 1.076 and 1.073 respectively. The maxillary central incisors, second premolars and first molars evince the smallest differences, i.e. 1.023, 1.026 and 1.027 respectively.

The mean buccolingual dimensions of all the mandibular teeth in males, with the exception of the central incisors, are significantly larger than those of the female Bantu (Table 126). The mean lower central incisor dimension of the male is slightly larger than the corresponding female dimension, but not at a significant level.

Table 127 shows the greatest sex difference in bucoolingual crown dimension to be in the mandibular canines (sex ratio 1.083). Although most dimensions show a significant sex difference, the smallest sex ratios occur in the mandibular central incisor, second premolar and first molar teeth (sex ratios being 1.021, 1.022 and 1.019 respectively).

The greatest degree of variability in bucoolingual crown dimensions of maxillary teeth in males is noted in lateral incisors and second premolars; both have coefficients of variability of 8.04 per cent. The least variable buccolingual crown diameter in male maxillae is that of the first premolar and first molar teeth with coefficients of variability of 4.6 per cent and 5.08 per cent respectively. The upper third molar in females has the most variable bucoolingual dimension (C.V. 10.46 per cent), whereas the upper first molars, first premolars and second molars have the least variability with coefficients of variability of 5.28 per cent, 5.61 per cent and 5.84 per cent respectively.

In the mandibular arch, the buccolingual diameter of the lower canine (C.V. 6.88) is the most variable.

The least variable teeth in males are the first and second molars with coefficients of variability of 4.91 per cent and 5.16 per cent respectively. The lower central incisors (C.V. 7.43 per cent) and third molars (C.V. 7.0 per cent) in females exhibit the greatest variability. The lower first molars (C.V. 4.96 per cent) are the least variable.

Crown Areas

The crown areas for the maxillary and mandibular teeth in male and female Bantu are tabulated in Tables 128 & 129. All crown areas of the Bantu males, with the exception of those of the lower central incisor, are significantly greater than the respective crown areas of the females. The absence of a significant difference for the crown area of I_1, is obviously related to the absence of a significant difference between the sexes in the mesiodistal or buccolingual dimensions of the lower central incisor.

The greatest sex differences (Table 130) in maxillary crown areas occur in the canines (sex ratio 1.134) and third molars (sex ratio 1.115). The smallest sex differences in maxillary teeth were evinced by central incisors, first and second premolars and first molars which had sex ratios of 1.046, 1.068, 1.063 and 1.055 respectively.

In the mandibular arch the greatest sex difference in crown area is evident in the lower canine (sex ratio 1.155). The smallest sex ratios are those of the lower central incisor (1.024), lateral incisor (1.038), first premolar (1.044) and first molar (1.052).

The coefficients of variability in maxillary teeth of males are relatively high, all being above 8.9 per cent. The male maxillary teeth with the highest variability of crown area are lateral incisors (C.V. 14.95 per cent) and third molars (C.V. 12.91 per cent). The least variable teeth in this arch are the first and second molars (C.V. 9.83 per cent and 8.90 per cent respectively).

In the maxillary arch of females, the teeth with the greatest variability in crown area, are as in males the lateral incisors (C.V. 14.97 per cent) and the third molars (17.90 per cent). The latter tooth is the most variable of all the teeth of both jaws and both sexes. The least variable upper tooth crown areas in females are those of canines, first and second premolars and first molars with C.V. of 7.24 per cent, 8.48 per cent, 9.72 per cent and 8.61 per cent respectively.

In the mandibular arch of males, the most variable crown areas occur on central incisors (C.V. 12.54 per cent) and third molars (C.V. 13.87 per cent). All the crown areas are relatively highly variable, the lowest C.V., namely that of the lower first molars, being as high as 9.32 per cent; all the other teeth have coefficients above 10 per cent.

In females, the lower central incisors (C.V. 15.79 per cent), lateral incisors (C.V. 14.90 per cent) and third molars (C.V. 14.12 per cent) all possess highly variable crown areas, whereas the lower first premolars (C.V. 9.43 per cent), first molars (C.V. 9.76 per cent) and second molars (C.V. 9.78 per cent) are the least variable.

MEASUREMENT OF TOOTH SHAPE

Crown shape index

The crown shape index expresses the relationship between the buccolingual and mesiodistal dimensions of the crown of a tooth and is calculated according to the formula:

$$\frac{\text{Buccolingual crown diameter}}{\text{mesiodistal crown diameter}} \times 100 = \text{crown shape index}$$

This measurement does not convey an accurate picture of crown form, but is widely used to indicate relative dimensions of the crown. The crowns of molar teeth in man are relatively short in mesiodistal diameter and broad in buccolingual diameter compared to the corresponding teeth in the anthropoid apes which are longer (M-D) and narrower (B-L).

Crown indices were calculated on all the teeth on which measurements could be effected. Broken and excessively worn teeth were not included in the sample.

In dealing with absolute measures, Pearson and Davin (1924) considered the coefficient of variation a fitting measure of variability, especially according to them, when dealing with lengths "continuously filled with organic matter". In the case of indices of angles, the validity of the coefficient of variation as a measure of variation is open to criticism and in those cases it is sounder to use standard deviation.

OBSERVATIONS

The crown indices for the maxillary and mandibular teeth in the Bantu males and females are summarized in Tables 131 & 132. In the maxilla only four teeth, namely, the canine, first premolar, second and third molars, show a significant difference in crown index between the sexes at the 5 per cent level. The sex differences between the mean crown indices for the rest of the teeth in the Bantu are small.

In the mandible, in spite of the differences in the absolute mesiodistal and buccolingual dimensions between

the sexes (the females being smaller), the ratio of these two measurements is significantly different in only two teeth, namely, the canine and the first premolar. The indices of both these teeth have relatively large numerators, which indicates that these teeth are relatively broader buccolingually in Bantu males than in females. The mean indices for the first, second and third mandibular molars are very slightly higher in the females. This means that the female lower molar teeth are very slightly, relatively but not absolutely, broader buccolingually (or smaller mesiodistally), than the males, but at a level which is not significant.

In the maxillary arch, the largest sex differences in crown shape indices are evinced by canines (sex ratio 1.021), first premolars (sex ratio 1.020) and third molars (1.023), whereas the smallest differences are seen in central incisors and first molars with sex ratios of .992 and .996 respectively (Table 133). In the lower jaw the sex differences are generally small. Larger and similar differences are seen in central and lateral incisors, canines and first premolars with sex ratios of 1.017, 1.016, 1.016 and 1.014 respectively. The remaining teeth in the arch possess smaller and likewise similar sex ratios, viz. second premolars (.998), first molars (.991), second molars (.997) and third molars (.996).

In males, the greatest degree of variability in crown shape indices in the maxillary arch is evident in the third molars (S.D. 9.42 per cent) and lateral incisors (S.D.7.95 per

cent), whereas the least variable tooth crown shapes are those of first molars (S.D. 5.39 per cent), central incisors (S.D. 6.13 per cent) and first premolars (S.D. 6.17 per cent).

In the lower jaw of males, the most variable crown shape indices are those of central and lateral incisors with S.D.'s of 8.68 per cent and 8.15 per cent respectively. The least variable crown shape indices are those of first, second and third molars with S.D's of 3.93 per cent, 4.41 per cent and 4.56 per cent respectively.

In females, the greatest variability in crown shape indices in the upper jaw is seen (as in males) in third molars (S.D. 9.76 per cent). The second premolars (S.D. 8.56 per cent), first molars (S.D. 8.44 per cent) and lateral incisors (S.D. 8.22 per cent) too are greatly variable. The lowest degree of variability is seen in the central incisor (S.D. 5.72 per cent).

In the mandibular arch of females, the most variable crown shapes (as in males) are evinced by the central and lateral incisors which have S.D's of 8.05 per cent and 7.75 per cent respectively. The least variable crown shapes in this jaw, as in males, are those of the first, second and third molars with S.D. of 4.42 per cent, 4.15 per cent and 4.65 per cent respectively.

SUMMARY AND CONCLUSIONS

Table 134 is a summary of data on tooth size and shape in South African Bantu Negroids. The calculated crown areas of all the male teeth, with the exception of the lower

central incisors, are significantly larger than those of females. This was not unexpected in that all the mean buccolingual dimensions (with the exception of I_1), and all the mean mesiodistal dimensions of the maxillary teeth (with the exception of P^2) and all the mandibular teeth (except I_1 and I_2) are significantly larger in males.

Although most of the absolute dimensions of the male teeth are larger than those of females, the only male teeth which are significantly broader buccolingually (or shorter in M-D) are the maxillary canines, first premolars, second and third molars, and canines and first premolars in the mandibular arch.

The greatest degree of sexual dimorphism according to tooth size and shape in the upper jaw is seen in canines and third molars. In the lower jaw it is the canines which evince the greatest sex difference in size and shape. This is not surprising when one considers that the same teeth of both jaws exhibit the highest sex ratios in their mesiodistal and buccolingual dimensions.

The teeth with the smallest sex differences in size only are the maxillary second premolars and mandibular central incisors. This is in accord with the similarly small sex differences noted in their mesiodistal and buccolingual dimension individually.

In addition to these teeth, the crown area of the maxillary first incisors and first premolars, as well as of the mandibular lateral incisors, first and second premolars show small sex differences. This factor is a reflection of

tooth size only and not of shape. The mesiodistal and buccolingual dimensions of these mandibular teeth are not the least sexually different. Although the product of two dimensions may be similar, either dimension could differ markedly indicating a difference in shape but not necessarily in overall size.

The teeth with the smallest sex differences in shape are the upper and lower first molars of both sexes. The shape of the lower second premolars and of all lower molars are likewise only minimally sexually dimorphic.

Teeth which exhibit the greatest variation in size are the maxillary lateral incisors and third molars of both sexes, the mandibular central incisors and third molars of both sexes, and mandibular lateral incisors of females. The mesiodistal crown dimensions of the same teeth are the most variable and probably account for most of the variance in crown area of these teeth. The lateral incisors and third molars also (and not unexpectedly) exhibit the greatest degree of variation in crown shape in the upper jaw. In the lower jaw, in addition to the central incisor, the lateral incisors evince great variation in crown shape. The high coefficient of variability of their mesiodistal crown dimensions probably accounts for the high degree of crown shape variation.

The teeth with the least degree of variation in crown shape are those of the central incisors in the upper jaw, and the first, second and third molars of the lower jaw in both sexes.

Most of the findings on dental variability in the present study are in accord with common observation that the teeth which exhibit the greatest variation in dimensions are maxillary lateral incisors and third molars, and mandibular central incisors and third molars of both sexes. The observations on sexual dimorphism in the Bantu likewise yield no unusual results in that males almost invariably have greater crown dimensions than females in all groups where the findings are reported separately for the sexes

TABLE 122

THE MESIODISTAL CROWN DIAMETERS OF MAXILLARY TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	144	8.82*	6.95	10.50	3.55	.66	7.43%	.055
I^2	195	7.14*	5.15	12.20	7.05	.68	9.50%	.048
C	270	7.91*	6.50	9.00	2.50	.43	5.46%	.026
P^1	295	7.27*	6.30	8.60	2.30	.43	5.86%	.025
P^2	294	6.80	5.75	8.10	2.35	.38	5.62%	.022
M^1	292	10.64*	9.30	12.50	3.20	.53	4.96%	.031
M^2	303	10.32*	8.60	12.75	4.15	.71	6.85%	.041
M^3	265	9.24*	6.30	11.0	4.70	.73	7.88%	.045

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	47	8.60	7.00	10.00	3.00	.58	6.77%	.085
I^2	71	6.85	4.75	8.50	3.75	.66	9.72%	.079
C	93	7.50	6.80	8.20	1.40	.38	5.11%	.040
P^1	94	7.15	6.30	8.40	2.10	.40	5.54%	.041
P^2	93	6.71	5.90	7.65	1.75	.41	6.08%	.042
M^1	92	10.43	9.10	11.50	2.40	.51	4.89%	.053
M^2	99	10.03	8.60	11.90	3.30	.62	6.18%	.062
M^3	81	8.79	4.40	10.30	5.90	.96	10.91%	.107

*Significant at the 5% level

TABLE 123

THE MESIODISTAL CROWN DIMETERS OF MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROES

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	181	5.33	4.35	6.90	2.55	.42	7.97%	.032
I_2	223	6.06	4.50	8.00	3.50	.47	7.71%	.031
C	264	7.33*	6.00	8.55	2.55	.45	6.14%	.028
P_1	300	7.38*	6.20	9.00	2.80	.46	6.18%	.026
P_2	293	7.44*	6.20	9.00	2.80	.54	7.19%	.031
M_1	277	11.39*	10.00	13.55	3.55	.60	5.24%	.036
M_2	284	11.03*	9.40	13.10	3.70	.74	6.71%	.044
M_3	278	11.20*	6.10	14.00	7.90	.87	7.78%	.052

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	61	5.30	4.50	6.20	1.70	.35	6.59%	.045
I_2	83	5.99	5.10	7.00	1.90	.42	7.01%	.046
C	96	6.89	6.20	7.60	1.40	.38	5.64%	.039
P_1	101	7.22	6.30	8.20	1.90	.35	4.92%	.035
P_2	92	7.28	6.20	8.90	2.70	.48	6.56%	.050
M_1	84	11.10	10.00	12.55	2.55	.64	5.74%	.070
M_2	78	10.75	9.70	12.00	2.30	.58	5.36%	.065
M_3	73	10.66	8.75	12.50	3.75	.87	8.00%	.102

*Significant at the 5% level.

TABLE 124

SEX RATIOS FOR MESIODISTAL CROWN DIAMETERS OF MAXILLARY AND MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

TOOTH	MAXILLA			MANDIBLE		
	MALE MEAN	FEMALE MEAN	SEX RATIO	MALE MEAN	FEMALE MEAN	SEX RATIO
Central Incisor	8.82	8.60	1.025	5.33	5.30	1.005
Lateral Incisor	7.14	6.85	1.042	6.06	5.99	1.011
Canine	7.91	7.50	1.054	7.33	6.89	1.063
First Premolar	7.27	7.15	1.016	7.30	7.22	1.022
Second "	6.80	6.71	1.013	7.44	7.28	1.023
First Molar	10.64	10.43	1.020	11.39	11.10	1.027
Second "	10.32	10.03	1.028	11.08	10.75	1.030
Third "	9.24	8.79	1.051	11.20	10.86	1.031

TABLE 125

THE BUCCOLINGUAL CROWN DIAMETERS OF MAXILLARY TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	144	7.31*	6.20	8.70	2.50	.45	6.22%	.038
I^2	195	6.73*	4.90	8.20	3.30	.54	8.04%	.039
C	270	8.72*	7.40	10.55	3.15	.59	6.80%	.036
P^1	295	9.69*	8.20	11.05	2.85	.44	4.60%	026
P^2	294	9.61*	8.10	11.10	3.00	.77	8.04%	.045
M^1	292	11.63*	10.00	13.65	3.65	.59	5.08%	.035
M^2	303	11.93*	10.20	14.55	4.35	.69	5.80%	.040
M^3	265	11.64*	9.05	14.25	5.20	.78	6.72%	.048

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	47	7.14	6.20	8.30	2.10	.50	7.06%	.073
I^2	71	6.42	5.00	7.35	2.35	.51	7.99%	.061
C	93	8.10	6.45	9.50	3.05	.57	7.02%	.059
P^1	94	9.34	8.20	10.70	2.50	.52	5.61%	.054
P^2	93	9.36	7.95	11.00	3.05	.58	6.16%	.060
M^1	92	11.32	9.75	12.70	2.95	.60	5.28%	.062
M^2	99	11.53	9.75	13.90	4.15	.67	5.84%	.068
M^3	81	10.84	4.70	12.65	7.95	1.13	10.46%	.126

* Significant at the 5% level

TABLE 126

THE BUCCOLINGUAL CROWN DIAMETERS OF MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V	S.E
I_1	180	5.83	4.80	7.30	2.50	.39	6.71%	.029
I_2	223	6.27*	5.30	7.40	2.10	.37	5.95%	.025
C	264	8.05*	6.65	10.00	3.35	.55	6.88%	.034
P_1	300	8.28*	6.75	10.65	3.90	.51	6.14%	.029
P_2	293	8.58*	6.85	10.40	3.55	.52	6.04%	.030
M_1	277	10.86*	9.20	12.40	3.20	.53	4.91%	.032
M_2	284	10.74*	9.40	13.20	3.80	.55	5.16%	.033
M_3	278	10.59*	6.40	12.70	6.30	.71	6.72%	.043

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	61	5.71	4.60	6.80	2.20	.42	7.43%	.054
I_2	83	6.12	5.30	7.50	2.20	.40	6.63%	.044
C	96	7.43	6.30	8.90	2.60	.48	6.52%	.049
P_1	103	7.96	6.95	9.05	2.10	.48	5.97%	.047
P_2	92	8.39	7.35	9.20	1.85	.44	5.26%	.046
M_1	84	10.65	9.50	12.00	2.50	.53	4.96%	.059
M_2	73	10.46	9.40	12.55	3.15	.55	5.29%	.063
M_3	73	10.27	8.20	12.40	4.20	.72	7.0[illegible]	.084

* Significant at the 5% level

TABLE 127

SEX RATIOS FOR BUCCOLINGUAL CROWN DIAMETERS OF MAXILLARY AND MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

Tooth	MAXILLA			MANDIBLE		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio
Central Incisor	7.31	7.14	1.023	5.83	5.71	1.021
Lateral "	6.73	6.42	1.048	6.28	6.12	1.027
Canine	8.72	8.10	1.076	8.05	7.43	1.083
First Premolar	9.69	9.34	1.037	8.28	7.96	1.040
Second "	9.61	9.36	1.026	8.58	8.39	1.022
First Molar	11.63	11.32	1.027	10.86	[illegible]	1.019
Second "	11.93	11.53	1.034	10.74	10.46	1.026
Third "	11.64	10.84	1.073	10.59	10.27	1.031

TABLE 128

THE CROWN AREAS OF MAXILLARY TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	144	64.27*	47.68	86.13	38.45	7.66	11.92%	.638
I^2	195	47.83*	27.57	85.40	57.83	7.15	14.95%	.512
C	271	68.99*	48.04	90.73	42.69	7.55	10.95%	.459
P^1	295	70.42*	44.45	90.47	46.02	7.74	11.00%	.451
P^2	293	65.93*	45.38	86.40	41.02	7.74	11.74%	.452
M^1	292	123.46*	86.45	160.02	73.57	12.13	9.83%	.710
M^2	303	123.78*	89.08	179.78	90.70	11.02	8.90%	.633
M^3	265	107.28*	79.00	151.03	72.03	13.85	12.91%	.851

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	47	61.39	48.98	83.00	34.02	7.65	12.46%	1.115
I^2	71	44.14	23.75	58.40	34.65	6.61	14.97%	.784
C	93	60.79	45.14	77.90	32.76	4.40	7.24%	.457
P^1	94	65.90	53.67	79.44	25.77	5.59	8.48%	.646
P^2	93	62.01	49.68	79.17	29.49	6.03	9.72%	.720
M^1	92	117.00	91.93	139.70	47.77	10.07	8.61%	1.187
M^2	78	115.31	83.94	155.91	71.97	12.57	10.90%	1.423
M^3	81	96.16	20.68	127.69	107.01	17.21	17.90%	1.912

* Significant at the 5% level

TABLE 129

THE CROWN AREAS OF MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	180	31.21	22.08	43.55	21.47	3.91	12.54%	.292
I_2	223	38.17*	25.65	49.70	24.05	4.13	10.83%	.277
C	264	58.93*	41.80	81.50	39.70	6.88	11.68%	.424
P_1	300	61.31*	44.53	92.12	47.59	7.26	11.84%	.419
P_2	293	63.82*	42.19	94.62	52.43	7.50	11.76%	.438
M_1	277	124.00*	98.00	168.01	70.01	11.55	9.32%	.694
M_2	284	119.44*	92.18	172.92	80.74	13.25	11.09%	.786
M_3	279	118.52*	51.48	167.63	116.15	16.44	13.87%	.984

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	61	30.46	24.09	53.04	28.95	4.81	15.79%	.616
I_2	83	36.76	28.08	71.13	43.05	5.48	14.90%	.601
C	96	50.99	40.24	64.45	24.21	5.48	10.75%	.560
P_1	101	57.26	45.99	72.03	26.04	5.40	9.43	.538
P_2	92	61.08	48.41	77.80	29.39	6.37	10.44%	.665
M_1	84	117.82	97.37	148.09	50.72	11.49	9.76%	1.254
M_2	78	112.29	93.59	145.61	52.02	10.96	9.78%	1.243
M_3	73	111.59	72.57	144.20	71.20	15.75	14.12%	1.844

* Significant at the 5% level

TABLE 139

SEX RATIOS FOR CROWN AREAS OF MAXILLARY AND MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

TOOTH	MAXILLA			MANDIBLE		
	Males	Females	Sex Ratio	Males	Females	Sex Ratio
Central Incisor	64.27	61.39	1.046	31.21	30.46	1.024
Lateral "	47.83	44.14	1.083	38.17	36.76	1.038
Canine	68.99	60.79	1.134	58.93	50.99	1.155
First Premolar	70.42	65.90	1.068	61.31	57.26	1.070
Second "	65.93	62.01	1.063	63.82	61.08	1.044
First Molar	123.46	117.00	1.055	124.00	117.82	1.052
Second "	123.78	115.31	1.073	119.44	112.29	1.063
Third "	107.28	96.16	1.115	118.52	111.59	1.062

TABLE 131

CROWN INDICES OF MAXILLARY TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	144	82.69	69.60	110.15	40.55	6.13	7.42%	.511
I^2	135	94.09	57.30	121.20	63.90	7.95	8.40%	.569
C	270	110.45*	95.10	138.50	42.40	6.77	6.13%	.412
P^1	295	133.28*	107.60	150.00	42.40	6.17	4.63%	.359
P^2	293	140.74	122.50	160.80	38.30	7.82	5.55%	.457
M^1	292	109.54	96.60	130.30	33.70	5.39	4.92%	.316
M^2	303	116.05*	98.65	137.90	39.25	6.47	5.57%	.373
M^3	265	126.39*	95.50	162.60	67.10	9.42	7.45%	.579

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I^1	47	83.32	71.05	100.00	28.95	5.72	6.86%	.834
I^2	71	94.43	68.70	124.10	55.40	8.22	8.70%	.975
C	93	108.10	91.95	129.25	37.30	6.89	6.37%	.714
P^1	94	130.55	109.70	150.00	40.30	6.63	5.08%	.684
P^2	93	139.26	120.70	163.40	42.70	8.56	6.14%	.887
M^1	92	109.94	96.50	157.05	60.55	8.44	5.68%	.880
M^2	99	114.46	99.00	129.60	30.60	6.53	5.70%	.656
M^3	81	123.45	106.80	155.50	48.70	9.76	7.90%	1.064

* Significant at the 5% level. Note: The number of observations are greater for Crown Index than for Crown Area in the case of females as a reading was taken only where both right and left teeth were measured.

TABLE 132

CROWN INDICES OF MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

MALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	180	109.80	94.60	134.45	39.85	8.68	7.91%	.647
I_2	223	104.00	77.50	131.00	53.50	8.15	7.84%	.546
C	254	109.49*	90.95	129.70	38.75	6.36	5.80%	.391
P_1	300	112.11*	84.50	137.15	52.65	6.56	5.85%	.381
P_2	293	115.66	92.70	136.70	44.00	7.53	6.51%	.440
M_1	277	95.51	83.95	107.00	23.05	3.93	4.11%	.236
M_2	284	97.02	85.60	115.25	29.65	4.41	4.54%	.262
M_3	279	94.63	83.50	109.70	26.20	4.56	4.82%	.273

FEMALES

	Number	Mean	Range		Size of Range	S.D.	C.V.	S.E.
I_1	61	107.93	85.95	127.40	41.45	8.05	7.46%	1.031
I_2	83	102.27	85.70	131.50	45.80	7.75	7.58%	.851
C	96	107.75	92.40	127.10	34.70	6.81	6.32%	.695
P_1	101	110.55	95.15	125.70	30.55	6.22	5.62%	.619
P_2	92	115.89	94.25	135.15	40.90	7.29	6.29%	.760
M_1	64	96.31	86.95	107.10	20.15	4.42	4.59%	.483
M_2	78	97.28	87.45	108.45	21.00	4.15	4.27%	.470
M_3	73	94.96	82.85	108.60	25.75	4.65	4.90%	.545

* Significant at the 5% level

TABLE 133

SEX RATIOS FOR CROWN INDICES OF MAXILLARY AND MANDIBULAR TEETH IN SOUTH AFRICAN BANTU NEGROIDS

TOOTH	MAXILLA			MANDIBLE		
	Males	Females	Sex Ratio	Males	Females	Sex Ratios
Central Incisor	82.69	83.32	.992	109.80	107.93	1.017
Lateral "	94.69	94.43	1.002	104.00	102.27	1.016
Canine	110.45	108.10	1.021	109.49	107.75	1.016
First Premolar	133.28	130.55	1.020	112.11	110.55	1.014
Second "	140.74	139.26	1.010	115.66	115.89	.998
First Molar	109.54	109.94	.996	95.51	96.31	.991
Second "	116.05	114.46	1.013	97.02	97.28	.997
Third "	126.39	123.45	1.023	94.63	94.96	.996

TABLE 134

SUMMARY OF MEASURES OF TOOTH SIZE AND SHAPE IN SOUTH AFRICAN BANTU NEGROIDS

MESIODISTAL CROWN DIAMETER

Character	Maxilla		Mandible	
Significant sex difference	All male teeth > female except P^2		All male teeth > female except I_1 and I_2	
Sex Ratio:				
Greatest	C and M^3		C, M_2 and M_3	
Least	M^1 and P^2		I_1 and I_2	
Variability	Males	Females	Males	Females
Greatest	I^2 and M^3	I^2 and M^3	I_1, I_2, P_2, M_3	I_2 and M_3
Least	M^1	M^1	M_1	P_1

TABLE 134 (contd.)

BUCCOLINGUAL CROWN DIAMETER

Character	Maxilla		Mandible	
Significant sex difference	All male teeth > female		All male teeth > female except I_1	
Sex Ratio				
Greatest	C and M^3		C	
Least	I^1, P^2 and M^1		I_1, P_2 and M_1	
Variability	Males	Females	Males	Females
Greatest	I^2 and M^2	I^2 and M^3	$\overline{C}$	I_1 and M_3
Least	P^1 and M^1	P^1, M^1 and M^2	M_1 and M_2	M_1

TABLE 134 (contd.)

CROWN AREA

Character	Maxilla		Mandible	
Significant sex difference	All male teeth > female		All male teeth > female except I_1	
Sex ratio				
Greatest	$\underline{C}$ and M^3		$\overline{C}$	
Least	I^1, P^1 and P^2		I_1, I_2, P_2, M_1	
Variability	Males	Females	Males	Females
Greatest	I^2 and M^3	I^2 and M^3	I_1 and M_3	I_1, I_2 and M_3
Least	M^1 and M^2	$\underline{C}$, P^1, P^2 and M^1	M_1	P_1, M_1 and M_2

TABLE 134 (contd.)

CROWN SHAPE INDEX

Character	Maxilla		Mandible	
Significant sex difference	C, P^1, M^2, M^3		C and P_1	
Sex ratio:				
Greatest	C, P^1 and M^3		I_1, I_2, C, P_1	
Least	I^1 and M^1		P_2, M_1, M_2 and M_3	
Variability:	Males	Females	Males	Females
Greatest	I^2 and M^3	I^2, M^1 and M^3	I^1 and I^2	I^1 and I^2
Least	I^1, P^1 and M^1	I^1	M_1, M_2 and M_3	M_1, M_2 and M_3

B. COMPARISON OF TOOTH MEASUREMENTS OF VARIOUS SOUTH AFRICAN TRIBAL GROUPS

The metrical traits of the teeth of the four South African Bantu categories, Natal Nguni, Cape Nguni, Sotho and Miscellaneous, were compared, males and females being analysed separately.

The traits which were compared were the crown area and the crown shape index, as defined previously. Where a significant difference between the mean crown areas of any two tribal groups was found, the analysis was repeated for the B-L and M-D measurements separately, in order to ascertain which of the two measurements was mainly responsible for such difference.

OBSERVATIONS

TOOTH AREA

Maxillary Teeth

In Table 135 the average crown areas for the maxillary teeth of different Bantu tribal groups are shown. The analyses of variance revealed that significant differences among the crown areas are present in the following teeth in males, C, P^1, M^1 and M^2.

C. The mean crown area of the maxillary canines in the Miscellaneous males (72.49) is significantly higher, at the 5 per cent level, than the crown areas of Natal Nguni (68.32), Cape Nguni (69.72) and Sotho (67.64).

P^1. The mean crown area of the first premolar in Sotho males (68.58) is significantly lower, and the mean crown area of Miscellaneous males (73.49) significantly higher than that of either the Natal (70.53) or Cape Nguni (70.89) groups.

M^1 The mean maxillary first molar crown area in the Natal Nguni males (120.65) and Cape Nguni males (127.23) are significantly lower and higher respectively than the crown areas of the Sotho (121.41) and Miscellaneous (125.19) groups.

M^2. The mean crown area of the maxillary second molars in Natal Nguni males (120.63) is significantly lower, and in Cape Nguni males (126.85) significantly higher, than in Sotho (122.75) and Miscellaneous (124.13) males.

On performing analyses of variance for the individual measurements of these four tooth types, the following conclusions were reached:

C The mean differences between crown areas of canine teeth were owing to differences in the mesiodistal (M-D) mean diameter, the Miscellaneous having a mean M-D length of 8.11 and the Natal and Cape Nguni and Sotho having mean diameters of 7.88, 7.95 and 7.82 respectively (Table 136). The B-L diameter of this tooth is also appreciably greater for the Miscellaneous (8.93) than for the other three groups, viz. Natal Nguni 8.65, Cape Nguni 8.76 and Sotho 8.93.

P^1. The mean differences between crown areas of maxillary first premolar teeth are due to differences in both the buccolingual (B-L) and mesiodistal (M-D) mean measurements. Although the analyses of variance did not show significant differences in either of these measurements, their combined effect was to create significant differences in crown area. For example, the B-L and M-D mean diameters in Sotho males is 9.61 and 7.21 respectively. These mean dimensions are only slightly (but not significantly) lower than the B-L mean diameters of 9.69, 9.70 and 9.86, and the M-D mean dimensions of 7.27, 7.28 and 7.44 of the Natal and Cape Nguni and Miscellaneous groups respectively. Likewise, the mean B-L (9.86) and M-D (7.44) diameters of these teeth in Miscellaneous males are higher, but not significantly so, than the mean dimensions in the two Nguni and the Sotho tribal groups.

M^1. The differences between crown areas of maxillary first molars in males are due to significant differences in both the buccolingual (B-L) and mesiodistal (M-D) mean diameters. The respective B-L and M-D mean crown diameters of 11.46 and 10.51 in the Natal Nguni are significantly lower than the mean B-L diameters of 11.77, 11.59 and 11.57, and the mean M-D diameter of 10.79, 10.59 and 10.70 for the Cape Nguni, Sotho and Miscellaneous tribal groups respectively. Likewise the B-L mean diameter (11.77) and M-D (10.79) mean diameter of the Cape Nguni are significantly higher

than the mean diameters of the Natal Nguni, Sotho and Miscellaneous.

M^2. The differences among mean crown areas of second maxillary molars, as in M^1s, are owing to significant differences in both buccolingual (B-L) and mesiodistal (M-D) mean measurements. The mean B-L and M-D crown diameters of the Natal Nguni second maxillary molars in males are 11.77 and 10.17 respectively. These dimensions are significantly lower than the B-L mean diameters of 12.03, 11.90 and 12.13, and the M-D mean diameters of 10.52, 10.25 and 10.38 of the Cape Nguni, Sotho and Miscellaneous tribal groups respectively. Also, as in the case of M^1s, the B-L mean diameter (12.03) and M-D mean diameter (10.52) of the Cape Nguni are significantly higher than the mean dimensions for each of the Natal Nguni, Sotho and Miscellaneous groups.

In females, no significant differences in crown areas among the four tribal groups are noted.

Mandibular Teeth

Table 137 shows the average crown areas for the mandibular teeth of different Bantu groups. The analyses of variance revealed that significant differences among the crown areas are present in the following teeth in males: I_2, P_1, M_1 and M_2.

I_2. The mean crown area of the mandibular lateral incisors of Cape Nguni males is 39.17 which is significantly higher (at the 5 per cent level) than the mean crown areas in

the Natal Nguni (37.52), Sotho (37.34) and Miscellaneous (38.98) tribal groups.

$\underline{P_1}$ The mean crown area of P_1 in the Miscellaneous male group is 64.18, which is significantly higher than the mean crown areas of similar teeth in the Natal Nguni, Cape Nguni and Sotho groups whose mean crown areas for this tooth are 60.39, 61.88 and 60.52 respectively.

$\underline{M_1}$. The mean crown area of this tooth in the Natal Nguni males (120.35) is significantly lower than the mean crown areas of similar teeth in the other tribal groups, i.e. Cape Nguni (127.22), Sotho (122.51) and Miscellaneous (123.78). The mean crown areas of this tooth in the Cape Nguni and Miscellaneous male groups are significantly higher than in the Natal Nguni and Sotho.

$\underline{M_2}$. The mean crown area (122.45) of the mandibular second molar tooth in Cape Nguni males is significantly larger than those of the Natal Nguni, Sotho and Miscellaneous groups whose crown areas are 117.87, 117.01 and 121.69 respectively.

On performing an analysis of variance on the individual measurements for these four mandibular teeth the following conclusions were reached:

$\underline{I_2}$. The differences among crown areas of mandibular lateral incisor teeth may be attributed to significant differences in the mean mesiodistal (M-D) crown diameters (Table 138). The M-D diameter of 6.24 for the Cape Nguni is significantly higher than these dimensions in the Natal Nguni (5.96),

Sotho (6.06) and Miscellaneous (6.08) groups. The high B-L diameter (6.38) of this tooth also contributes to the large crown area.

$\underline{P_1}$. The differences among mean crown areas of mandibular first premolar teeth in males are mainly due to significant differences in the mean buccolingual (B-L) crown diameter measurements. The mean B-L diameter of this tooth in the Miscellaneous group (8.51) is significantly larger than the mean B-L diameters of the same teeth in the Natal Nguni (8.22), Cape Nguni (8.32) and Sotho (8.19). The M-D diameter of this tooth (7.55) in the Miscellaneous group is likewise larger than those of the Natal Nguni (7.34), Cape Nguni (7.42) and Sotho (7.33).

$\underline{M_1}$. The differences among mean crown areas of the mandibular first molar teeth are owing to significant differences in both the mean buccolingual (B-L) and the mean mesiodistal (M-D) crown diameter measurements. The mean B-L crown diameter in the Natal Nguni is 10.73. This dimension is significantly lower than the B-L crown diameters of the Cape Nguni (10.99), Sotho (10.77) and Miscellaneous (11.10) groups. The mean M-D crown diameter of this tooth in the Natal Nguni (11.20) is likewise significantly lower than the respective crown diameters of the Cape Nguni (11.55), Sotho (11.34) and Miscellaneous (11.58). The mean B-L diameters of this tooth in the Cape Nguni (10.99) and Miscellaneous (11.10) groups are significantly higher than the mean dimensions for this tooth in the Natal Nguni (10.73) and

Sotho (10.77). The M-D diameters of these teeth in the Cape Nguni (11.55) and Miscellaneous (11.58) groups are likewise significantly larger than the respective crown diameters of the Natal Nguni (11.20) and Sotho (11.34).

M_2. The differences among mean crown areas of male mandibular second molar teeth are attributable to significant differences in the mesiodistal (M-D) measurements. The mean M-D crown diameter of this tooth in Cape Nguni (11.25) is significantly higher than this dimension in the Natal Nguni (11.00), Sotho (10.97) and Miscellaneous (11.11) tribal groups.

The mandibular teeth in females revealed no significant differences in mean crown areas among the various tribal groups.

Crown Indices

Tables 139 and 140 reflect the average crown shape indices of the maxillary and mandibular teeth in the various tribal groups. An analysis of variance on the individual measurements for these four types of teeth revealed that there are no significant differences in mean crown shape indices among the tribal groups in either males or females.

DISCUSSION

The survey reveals that although there are no significant differences in the crown shapes of teeth among various Bantu tribal groups, there are however significant differences

in tooth dimensions and tooth crown areas among the male groups. The various measurements which differ significantly are listed in Tables 141 & 142.

The Natal Nguni, it will be noted, possess smaller maxillary and mandibular first molars and maxillary second molars. The difference in size of these teeth is attributed to their significantly lesser mean M-D and B-L crown diameters.

The Cape Nguni, on the other hand, possess characteristically large maxillary and mandibular first and second molar teeth. The large crown areas of these teeth are owing to their significantly larger M-D and B-L crown diameters. The mandibular lateral incisor in the Cape Nguni tends to be mesiodistally narrower and consequently significantly smaller in crown size than the corresponding teeth in other tribal groups.

The Sotho tend to possess large maxillary first premolars. The large size of these premolars in Sotho males are owing to their slightly, but not significantly larger M-D and B-L crown diameters. The Sotho also possess the smallest I^2, $\underline{C}$, P^1, and I_2, $\bar{C}$, M_2 and M_3 in males; and the smallest I^2, $\underline{C}$, P^1, P^2 and $\bar{C}$, P_1, M_1, M_2 and M_3 in females.

The Miscellaneous male groups likewise possess large maxillary first premolars and, as in the Sotho, their larger size is attributed to their slightly (but not significantly) larger M-D and B-L crown dimensions. The maxillary canines of this group also tend to be large owing to their significantly larger mean M-D crown diameter. The characteristically large maxillary first molars of this group are

attributed to their significantly larger M-D and B-L crown dimensions.

The survey and analyses of variance in individual tooth size and crown shape index for the Bantu female groups revealed only small inter-group differences, none of which proved to be significant.

SUMMARY

The Natal Nguni males possess smaller maxillary and mandibular first molars and maxillary second molars. The difference in size of these teeth is owing to their significantly lesser mean M-D and B-L crown diameters.

The Cape Nguni males on the other hand have large maxillary and mandibular first and second molar teeth. The large crown areas of these teeth are owing to their significantly larger M-D and B-L crown diameters. The mandibular lateral incisor teeth of this group tend to be smaller owing to the significantly lesser mean M-D diameter of this tooth.

The maxillary first premolar teeth in Sotho males possess significantly larger crown areas. The mean M-D and B-L crown diameters of these teeth are slightly, but not significantly, greater than corresponding mean dimensions of the combined group. The Sotho possess the smallest I^2, $\underline{C}$, P^1, and I_2, $\bar{C}$, M_2 and M_3 in males; and the smallest I^2, $\underline{C}$, P^1, P^2 and $\bar{C}$, P_1, M_1, M_2 and M_3 in females.

The Miscellaneous males, as in the Sotho, possess significantly larger maxillary first premolar teeth. Their large size is owing to their slightly, but not significantly,

large M-D and B-L crown diameters. The crown sizes of the maxillary canines and first molars of the Miscellaneous male group are characteristically large, owing to the significantly larger M-D crown diamter of the canine, and the greater M-D and B-L crown dimensions of the molar.

The Bantu females of the various tribes evinced small but not significant, differences in tooth crown sizes.

TABLE 135

MEAN CROWN AREAS OF MAXILLARY TEETH IN VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MALES									FEMALES							
Natal Nguni		Cape Nguni		Sotho		Misc.		Tooth	Natal Nguni		Cape Nguni		Sotho		Misc.	
No.	Mean	No.	Mean	No.	Mean	No.	Mean		No.	Mean	No.	Mean	No.	Mean	No.	Mean
41	63.22	49	65.29	38	63.48	16	65.58	I^1	18	61.06	7	64.99	18	60.46	4	60.74
54	47.20	61	49.03	56	47.05	24	48.00	I^2	26	44.99	11	43.98	30	43.03	4	47.46
78	68.32	83	69.72	81	67.64	29	72.49	C*	32	61.44	16	61.61	41	59.88	4	61.61
88	70.53	92	70.89	83	68.58	32	73.49	P^{1*}	24	66.97	13	66.15	34	65.14	4	65.24
87	65.71	92	66.14	81	66.86	33	67.22	P^2	22	62.77	12	63.53	33	60.93	3	62.33
84	120.65	93	127.23	83	121.41	32	125.19	M^{1*}	28	117.14	13	116.53	27	117.60	4	113.37
88	120.63	93	126.85	87	122.75	35	124.13	M^{2*}	28	117.95	15	116.71	30	112.72	5	111.87
77	105.51	85	108.52	75	106.54	28	110.38	M^3	27	95.24	16	95.67	35	97.01	3	97.19

*For these male categories significant differences were found at the 5 per cent level of probability.

TABLE 136

BUCCOLINGUAL (B-L) AND MESIODISTAL (M-D) CROWN DIMENSIONS OF MALE MAXILLARY TEETH IN VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MEAN B-L CROWN DIAMETERS									MEAN M-D CROWN DIAMETERS							
Natal Nguni		Cape Nguni		Sotho		Misc.		Tooth	Natal Nguni		Cape Nguni		Sotho		Misc.	
No.	Mean	No.	Mean	No.	Mean	No.	Mean		No.	Mean	No.	Mean	No.	Mean	No.	Mean
78	8.65	83	8.76	81	8.65	28	8.93	C	78	7.88	83	7.95	81	7.82	28	8.11
88	9.69	92	9.70	83	9.61	32	9.86	P^1	88	7.27	92	7.28	83	7.21	32	7.44
84	11.46	93	11.77	83	11.59	32	11.57	M^1	84	10.51	93	10.79	83	10.59	32	10.70
88	11.77	93	12.03	87	11.90	35	12.13	M^2	88	10.17	93	10.52	87	10.25	35	10.38

TABLE 137

MEAN CROWN AREAS OF MANDIBULAR TEETH IN VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MALES									FEMALES							
Natal Nguni		Cape Nguni		Sotho		Misc.		Tooth	Natal Nguni		Cape Nguni		Sotho		Misc.	
No.	Mean	No.	Mean	No.	Mean	No.	Mean		No.	Mean	No.	Mean	No.	Mean	No.	Mean
53	30.35	60	31.59	50	31.51	17	31.[illegible]	I_1	22	31.11	7	30.06	28	30.25	4	29.02
69	37.52	76	39.17	57	37.34	21	38.9[illegible]	I_2*	30	36.15	10	40.60	38	36.39	5	35.44
78	57.91	85	60.31	74	57.66	27	60.99	C	35	51.17	13	52.69	43	50.36	5	50.65
89	60.39	92	61.88	85	60.52	34	64.18	P_1*	35	57.79	18	58.63	44	56.36	4	56.24
88	62.92	91	64.42	84	63.47	30	65.56	P_2	32	61.94	13	62.22	43	60.29	4	59.01
83	120.35	90	127.22	77	122.51	27	128.78	M_1*	29	118.67	15	121.01	35	115.99	5	116.13
81	117.87	91	122.45	85	117.01	27	121.69	M_2*	27	113.05	14	113.24	33	111.72	4	108.56
79	117.12	90	121.00	82	116.91	28	119.21	M_3	24	114.59	15	111.19	31	109.80	3	107.96

TABLE 138

BUCCOLINGUAL (B-L) AND MESIODISTAL CROWN DIMENSIONS OF MALE MANDIBULAR TEETH IN VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MEAN B-L CROWN DIAMETERS									MEAN M-D CROWN DIAMETERS							
Natal Nguni		Cape Nguni		Sotho		Misc.		Tooth	Natal Nguni		Cape Nguni		Sotho		Misc.	
No.	Mean	No.	Mean	No.	Mean	No.	Mean		No.	Mean	No.	Mean	No.	Mean	No.	Mean
69	6.27	76	6.38	57	6.15	21	6.38	I_2	69	5.96	76	6.24	57	6.06	21	6.08
89	8.22	92	8.32	85	8.19	34	8.51	P_1	89	7.34	92	7.42	85	7.33	34	7.55
83	10.75	90	10.99	77	10.77	27	11.10	M_1	83	11.20	90	11.55	77	11.34	27	11.58
81	10.70	91	10.82	85	10.62	27	10.93	M_2	81	11.00	91	11.25	85	10.97	27	11.11

TABLE 139

MEAN CROWN INDICES OF MAXILLARY TEETH OF VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MALES									FEMALES								
Natal Nguni		Cape Nguni		Sotho		Misc.		Tooth	Natal Nguni		Cape Nguni		Sotho		Misc.		
No.	Mean	No.	Mean	No.	Mean	No.	Mean		No.	Mean	No.	Mean	No.	Mean	No.	Mean	
41	82.06	49	83.26	38	81.95	16	84.31	I^1	18	83.79	7	82.15	18	84.04	4	80.04	
54	95.65	61	95.05	56	93.46	24	94.54	I^2	26	94.18	11	93.27	30	95.20	4	93.51	
78	109.84	83	110.61	81	110.76	28	110.79	C	32	107.21	16	107.78	41	108.73	4	109.91	
88	133.55	92	133.03	83	133.52	32	132.59	P^1	33	131.83	17	129.17	39	129.76	5	132.91	
87	141.63	92	141.94	81	141.61	33	141.94	P^2	33	140.28	15	136.58	41	139.47	4	138.75	
84	109.30	93	109.40	83	109.56	32	110.53	M^1	35	110.58	16	110.73	37	109.20	4	107.9	
88	116.24	93	115.02	87	116.47	35	117.30	M^2	33	114.16	18	114.50	43	114.53	5	125.75	
77	125.58	85	125.20	75	128.22	28	127.32	M^3	27	125.41	16	123.71	35	120.89	3	134.27	

TABLE 140

MEAN CROWN INDICES OF MANDIBULAR TEETH IN VARIOUS SOUTH AFRICAN BANTU TRIBAL GROUPS

MALES									FEMALES								
Natal Nguni		Cape Nguni		Sotho		Misc.		Tooth	Natal Nguni		Cape Nguni		Sotho		Misc.		
No.	Mean	No.	Mean	No.	Mean	No.	Mean		No.	Mean	No.	Mean	No.	Mean	No.	Mean	
53	109.35	60	110.61	50	108.30	17	112.78	I_1	22	108.72	7	108.39	28	107.73	4	104.13	
69	105.45	76	104.34	57	101.55	21	104.68	I_2	30	103.51	10	100.99	38	101.78	5	101.04	
78	109.19	85	110.25	74	109.03	27	109.28	C	35	107.45	13	107.96	43	107.68	5	109.90	
89	111.82	92	112.24	85	111.89	34	113.07	P_1	35	110.78	18	110.73	44	109.75	4	116.44	
88	116.01	91	116.14	84	115.05	30	114.86	P_2	32	116.02	13	117.29	43	115.54	4	114.06	
83	95.88	90	95.25	77	95.07	27	96.47	M_1	29	96.23	15	96.04	35	96.56	5	95.76	
81	97.36	91	96.35	85	96.92	27	98.51	M_2	27	98.67	14	95.83	33	96.45	4	99.79	
79	95.44	90	94.09	82	94.08	28	95.68	M_3	24	97.33	15	94.17	31	93.34	3	96.80	

TABLE 141

ANALYSIS OF VARIANCE FOR TOOTH MEASUREMENTS FOR BANTU MALES ONLY

Tooth Crown Area		Tribal Group	Significant Deviation from Mean of Combined Groups at 5 per cent Level
MAXILLA	C	Miscellaneous	Significantly Higher
	P^1	Sotho Miscellaneous	Significantly Lower Significantly Higher
	M^1	Natal Nguni Cape Nguni	Significantly Lower Significantly Higher
	M^2	Natal Nguni Cape Nguni	Significantly Lower Significantly Higher
MANDIBLE	I_2	Cape Nguni	Significantly Higher
	P_1	Miscellaneous	Significantly Higher
	M_1	Natal Nguni Cape Nguni Miscellaneous	Significantly Lower Significantly Higher Significantly Higher
	M_2	Cape Nguni	Significantly Higher

TABLE 142

SIGNIFICANT DIFFERENCES AT THE 5 PER CENT LEVEL OF PROBABILITY OF VARIOUS TOOTH MEASUREMENTS AMONG SOUTH AFRICAN BANTU TRIBAL GROUPS - MALES ONLY

Tribal Group	Tooth Affected	Tooth Dimension which is significantly different		
		Area	B-L Diam.	M-D Diam.
Natal Nguni	M^1	Lower	Lower	Lower
	M^2	Lower	Lower	Lower
	M_1	Lower	Lower	Lower
Cape Nguni	M^1	Higher	Higher	Higher
	M^2	Higher	Higher	Higher
	I_2	Lower	-	Lower
	M_1	Higher	Higher	Higher
	M_2	Higher	Higher	Higher
Sotho	P^1	Higher	-	-
Miscellaneous	P^1	Higher	-	-
	C	Higher	-	Higher
	M_1	Higher	Higher	Higher

C. COMPARATIVE TOOTH DIMENSIONS AND INDICES OF THE BANTU COMPARED WITH THOSE OF OTHER POPULATIONS

For purposes of interracial comparisons, only those published studies were selected which furnished sufficient statistical data for statistical purposes. The original publications on the Japanese by Yamada (1932), the Chinese by Hosaka (1936) and the Tristanites by Thomsen (1955) were unobtainable in South Africa and their figures are cited at second hand from Moorrees (1957). The other population groups used for purposes of comparison were the Javanese (Mijsberg 1931), Pecos Indians (Nelson 1938), Swedes (Seipel 1946), Norwegian Lapps (Selmer-Olsen 1949), American Whites (Moorrees 1957), Aleuts (Moorrees 1957), Australian Aboriginals (Barrett et al 1963-4) and Bushmen (Van Reenen 1966). Additional calculations were made on the Chinese, Pecos Indians and East Greenland Eskimos for comparative purposes. A further Bantu group, that of Shaw 1931, although unsexed and containing insufficient statistical data, was nevertheless included for purposes of comparison.

The mesiodistal (M-D) and buccolingual (B-L) crown diameters, as well as the crown areas, of the maxillary and mandibular teeth in the various population groups are listed in Tables 143, 144, 145, 146, 147 & 148.

Maxillary Central Incisors

Males. The maxillary central incisor teeth of the Bantu are elongated mesiodistally. The range of population means for this dimension is 8.18 - 9.35 mm. The Bantu mean of 8.82 is just over midway in this range. Shaw's figure of 8.9 mm for the mean M-D diameter of the combined sexes is slightly larger than the means for either sex in the present study.

Females. As in males, the female Bantu central incisor teeth are relatively elongated mesiodistally, the population means ranging from 8.02 - 9.0 mm. Again, the Bantu female mean of 8.60 mm is just above the midway (8.51 mm) in this range.

Maxillary Lateral Incisor

Males. Only the Australian Aboriginals (7.65 mm) and Aleuts (7.29 mm) have I^2s which are larger mesiodistally than those of the Bantu. The Bantu mean M-D diameter of 7.14 mm is approximately midway in the range of population means which extend from 6.74 - 7.65 mm. Mongoloids, such as the Japanese (7.1 mm), Javanese (7.0 mm), Chinese (6.98 mm), Aleuts (7.29 mm)and Pecos Indians (7.06 mm), have means which are close to that of the Bantu. Shaw's mean dimension for this tooth in the Bantu is 7.20 mm for the combined sexes, this approximating the male mean in the present study.

Females. The females possess relatively large M-D crown dimensions. As in males, this mean (6.85 mm) is exceeded

by those of only the Aleuts (7.08 mm) and Australian Aboriginals (7.34 mm), and it falls approximately midway in the population rang (6.36 - 7.34 mm). As in males, too, Mongoloids such as Japanese (6.7 mm), Javanese (6.7 mm), Aleuts (7.08 mm) and Pecos Indians (7.06 mm), have means which are close to that of the Bantu.

Maxillary Canine

Males. The mean M-D diameter of the Bantu maxillary canine (7.91 mm) is midway in the range of population means (7.52 - 8.31 mm). Bushmen (7.52 mm), Norwegian Lapps (7.74 mm) and Japanese (7.80 mm) possess smaller mean canine dimensions, while Tristanites (7.93 mm) and American Whites (7.95 mm) have virtually the same M-D values.

The mean B-L dimensions of this tooth in male Bantu (8.72 mm) is likewise midway between the two extreme values (8.07 - 9.38 mm) in the range of population means. Shaw's figure for the combined Bantu sexes is 8.2 mm, which is considerably less than that of the males in the present study and close to the female mean of 8.10 mm.

Females. The mean M-D dimension of the maxillary canine in females (7.50 mm) is just below the midpoint of the range of population means (7.10 - 7.95 mm). As in males, the only smaller M-D dimensions are those of Bushmen (7.10 mm), Japanese (7.4 mm) and Norwegian Lapps (7.47 mm). Shaw's figure of 7.6 mm for the combined sexes is closer to the female mean, rather than to the male mean in the present study.

The mean B-L diameter of this tooth in the Bantu (8.10 mm) is also just below the midpoint of the range of population means (7.67 - 8.87 mm).

Maxillary First Premolar

Males. The M-D crown dimension of this tooth in the Bantu (7.27 mm) is just over the midpoint of the range of population means, viz. 6.75 - 7.69 mm, and approximates Shaw's figure of 7.2 mm for the Bantu combined sexes. Populations with larger mean dimensions are Australian Aboriginals (7.69 mm) and almost all the Mongoloids, i.e. Japanese (7.30 mm), Javanese (7.50 mm) and East Greenland Eskimos (7.65 mm). The Chinese mean of 7.21 mm approximates that of the Bantu.

The mean B-L crown diameter of this tooth in the Bantu (9.61 mm) is approximately midway in the range of population means (8.88 - 10.38 mm).

Females. The range of population means for the M-D crown diameter of this tooth is 6.73 - 7.53 mm. The Bantu female mean (7.15 mm) lies approximately midway in this range. As in males, only Australian Aboriginals (7.53 mm) and most of the Mongoloids, viz. Japanese (7.2 mm), East Greenland Eskimos (7.26 mm) and Javanese (7.3 mm), have larger mean M-D crown dimensions.

The mean B-L diameter of this tooth in the Bantu (9.36 mm) is in the upper half of the distribution of population means (8.13 - 10.10 mm). Shaw's figure of 9.0 mm in the Bantu is less than either the male or female value

in the present study.

Maxillary Second Premolar

Males. The mean M-D crown dimension of this tooth in the Bantu is 6.80 mm and is close to the midpoint of the modern human range of available population means (6.30 - 7.19 mm). Shaw recorded a figure of 7.0 mm for the Bantu combined sexes, which is slightly larger than the male mean in the present study.

The mean B-L diameter of this tooth in the Bantu is 9.61 mm and is in the upper half of the population means (8.72 - 10.29 mm). Its mean B-L diameter is exceeded only by the means of Javanese (9.7 mm), Tristanites (9.96 mm) and Australian Aboriginals (10.29 mm). Shaw's mean of 9.1 mm for this dimension is 0.5 mm less than the mean for males in the present study, and is also smaller than the female mean of 9.36 mm.

Females. The mean M-D dimension of this tooth in the Bantu (6.71 mm) is slightly above the midpoint (6.67 mm) of the range of population means (6.32 - 7.01 mm).

The mean B-L diameter of this tooth in the Bantu (9.36 mm) is also just over the midpoint (9.22 mm) of the range of population means (8.39 - 10.05 mm). Tristanites (9.83 mm) and Australian Aboriginals (10.05 mm) are the only populations whose second premolar mean B-L diameters exceed that of the Bantu.

Maxillary First Molar

Males. The mean M-D dimension of the upper first molars of the Bantu is 10.64 mm. This figure is slightly below

the midpoint of the population means which range from 10.02 - 11.34 mm, and is about 0.3 mm larger than the figure of 10.3 mm cited by Shaw for the combined Bantu sexes.

The mean B-L dimension of this tooth in the Bantu (11.63 mm) is likewise slightly below the midpoint of the range of available population means (10.96 - 12.63 mm). The mean recorded by Shaw (11.0 mm) for the combined sexes in the Bantu is less than either the male or female mean in the present study.

Females. The mean M-D crown diameter of this tooth in Bantu females (10.43 mm) is slightly above the midpoint of the range of population means (9.93 - 10.92 mm).

The mean B-L diameter of this tooth (11.32 mm) is below the midpoint of the range of population means (10.74 - 12.21 mm). The mean B-L diameter of this tooth in the Bantu is exceeded by those of East Greenland Eskimos (11.44 mm), Tristanites (11.77 mm) and Australian Aboriginals (12.21 mm).

Maxillary Second Molar

Males. Only American Whites (10.35 mm), Swedes (10.47 mm) and Australian Aboriginals (10.70 mm) have M^2's which are larger than those of the Bantu. The Bantu mean M-D diameter for this tooth (10.32 mm) lies in the upper half of the population range (9.34 - 10.70 mm). Shaw's mean for this dimension (10.0 mm) for the combined-sex Bantu series is less than either the male or female mean of the

present study.

The mean B-L dimension of M^2 in the Bantu (11.93 mm) is slightly above the midpoint of the range of population means (10.96 - 12.83 mm). The means of only Tristanites (12.33 mm) and Australian Aboriginals (12.83 mm) are larger than that of the Bantu. The mean figure recorded by Shaw for the combined Bantu sexes (11.5 mm) is less than either the male or female means in the present study.

Females. The mean M-D crown diameter of this tooth i the Bantu (10.03 mm) is in the upper half of the range of available population means (8.93 - 10.31 mm). Australian Aboriginals (10.31 mm) have a larger mean B-L dimension, whereas Swedes (10.05 mm) and East Greenland Eskimos (10.08 mm) have similar B-L values.

The mean B-L dimension of this tooth in the Bantu (11.53 mm) is above the midpoint of the range of population means (10.26 - 12.42 mm). As in males, the mean dimensions of [illegible] Tristanites (11.97 mm) and Australian Aboriginals (12[illegible] mm) exceed that of the Bantu.

Maxilla. Third Molar

Males. The mean M-D crown diameter of this tooth in Bantu males (9.24 mm) is in the upper half of the range of population means (8.03 - 9.87 mm). Shaw recorded a mean of 9.5 mm for the combined sexes in the Bantu; this is larger than either the male or female means in the present study.

The mean B-L diameters of this tooth in only Tristanites (11.82 mm) and Australian Aboriginals (12.09 mm)

exceed that of the Bantu (11.64 mm). The Bantu mean lies in the upper half of the range of population means (9.93 - 12.09 mm).

Females. In female Bantu, the mean crown diameter of this tooth (8.79 mm) is in the lesser half of the range of population means (8.11 - 9.76 mm). Only Swedes (8.33 mm), Japanese (8.30 mm), Bushmen (8.11 mm) and Norwegian Lapps (7.85 mm) have mean crown dimensions which are smaller than that of the Bantu.

The mean B-L dimension of this tooth in Bantu females (10.84 mm) is above the midpoint of the range of population means (9.41 - 12.12 mm). Only the B-L means of Tristanites (12.12 mm) and Australian Aboriginals (11.93 mm) are larger than that of the Bantu. Shaw recorded a mean value of 11.0 mm for the combined Bantu sexes, which is less than the male mean, but greater than the female mean in the present study.

Mandibular Central Incisor

Males The mean M-D crown diameter of the mandibular central incisor of Bantu males (5.33 mm) is a shade over the midpoint of the range of population means (4.74 - 5.87 mm). The only incisors smaller than those of the Bantu are those of Aleuts (5.23 mm) and Bushmen (4.74 mm). Norwegian Lapps (5.36 mm) have incisors of similar mean M-D dimensions.

Females. As in males, the mean M-D crown diameter of the I_1 in Bantu females (5.30 mm) is a shade over the midpoint of the range of population means (4.71 - 5.68 mm). Shaw's

mean (5.9 mm) for this tooth in the combined sexes of the Bantu unaccountably is approximately 0.6 mm larger than either male or female mean of the present study.

Mandibular Lateral Incisor

Males. The M-D crown diameter of this tooth in the Bantu (6.06 mm) is slightly above the midpoint of the range of population means (5.46 - 6.60 mm), and approximates Shaw's mean of 6.0 mm for both Bantu sexes.

Females. As in males the mean M-D crown dimension of the I_2 in the Bantu (5.99 mm) is just over the midpoint of the range of population means (5.34 - 6.36 mm).

Mandibular Canines

Males. Bantu males possess relatively large mandibular canines. The mean M-D diameter of this tooth in the Bantu is 7.33 mm which is near the top of a very small range of population means, 6.82 - 7.49 mm. Only in Australian Aboriginals is the mean M-D dimension of this tooth (7.49 mm) larger than that of the Bantu.

The mean B-L diameter of the lower canine (8.05 mm) is a little below the midpoint of the range of population means (7.41 - 8.97 mm). Only Tristanites (mean 8.97 mm) and Australian Aboriginals (mean 8.39 mm) possess broader teeth. The mean M-D and B-L diameters of the combined sexes in the Bantu, as determined by Shaw (1931), were 7.3 mm and 8.0 mm respectively, which is similar to the respective male means in the present study.

Females. The mean M-D crown diameter of $\bar{C}$ in Bantu females (6.89 mm), as in males, is large and likewise lies in the upper half of the relatively small range of population means (6.39 - 7.01 mm). Only East Greenland Eskimos (6.93 mm) and Australian Aboriginals (7.01 mm) have canines with larger mean M-D crown dimensions.

The mean B-L dimension of $\bar{C}$ in Bantu females (7.43 mm) is in the lower half of the range of means of available populations (6.97 - 8.03 mm). This mean dimension is exceeded in Tristanites (8.45 mm), Australian Aboriginals (8.03 mm) and Aleuts (7.58 mm).

Mandibular First Premolar

Males. The range of population means of M-D crown dimensions for P_1 is relatively small (6.69 - 7.49 mm). The mean in the Bantu is 7.38 mm, which is well above the midpoint of the range. Only Australian Aboriginals have mandibular first premolars with larger mean M-D crown diameters (7.49 mm). According to Shaw, the mean M-D dimension of this tooth is 7.1 mm for the combined sexes, which is slightly smaller than either male or female mean in the present study.

The mean B-L diameter of P_1 in the Bantu (8.28 mm) is just above the midpoint of the range of population means (7.39 - 8.83 mm). Tristanites (8.81 mm) and Australian Aboriginals (8.83 mm) have greater means. The male (8.28 mm) and female (7.96 mm) dimensions of P_1 in the present study approximate Shaw's figure of 8.2 mm for the combined Bantu sexes.

Females. As in males the range of population means of M-D crown diameters for P_1 is relatively small (6.76 - 7.36 mm). The mean M-D dimension of this tooth in the Bantu is 7.22 mm, which is well above the midpoint of the range of population means. The mean M-D dimension of P_1 is exceeded only by that of Australian Aboriginals (7.36 mm).

As in males, the mean B-L diameter of P_1 in the Bantu (7.96 mm) is just above the midpoint of the range of available population means (7.13 - 8.69 mm). Also, as in males, this mean dimension in the Bantu is exceeded by the mean B-L crown dimensions of only Tristanites (8.69 mm) and Australian Aboriginals (8.69 mm).

Mandibular Second Premolar

Males. The mean M-D crown dimension of this tooth in the Bantu (7.44 mm) is well within the upper half of the relatively small range of population means (6.74 - 7.56 mm). The only mean M-D crown dimension larger than that of the Bantu is that of Australian Aboriginals (7.56 mm), while Swedes (7.41 mm) have similar means.

The mean B-L diameter of P_2 in the Bantu (8.58 mm) is slightly above the midpoint of the range of population means (7.75 - 9.21 mm). The means of Tristanites (9.21 mm) and Australian Aboriginals (9.15 mm) are greater than that of the Bantu, whereas those of Javanese (8.5 mm) and East Greenland Eskimos (8.58 mm) are virtually the same.

Females. The range of population means of M-D dimension for this premolar is small, viz. 6.59 - 7.31 mm. The mean

M-D crown diameter of this tooth in Bantu females is fairly large (7.28 mm) and falls well within the upper half of the range of population means. This mean dimension in the Bantu is exceeded by the mean of only Australian Aboriginals (7.31 mm).

As in males, the mean B-L diameter of this tooth in the Bantu (8.39 mm) is just over the midpoint of the range of population means (7.51 - 9.16 mm). Shaw's recorded mean M-D and B-L dimensions for this tooth in the combined Bantu sexes (7.2 mm and 8.1 mm respectively) are less than the respective male or female means in the present study.

Mandibular First Molars

Males. The mean M-D crown diameter of the mandibular first molar in Bantu males is 11.39 mm, which is just below the midpoint of the range of means of the available populations (10.85 - 12.04 mm). Shaw cited a M-D mean of 11.0 mm for the combined Bantu sexes; this is less than either the male or female mean in the present study.

The mean B-L dimension of M_1 in the Bantu (10.86 mm) is below the midway of the range of population means (10.40 - 11.85 mm). The mean B-L diameter for the combined Bantu sexes (10.5 mm) recorded by Shaw is less than either the male (10.86 mm) or female (10.65 mm) means in the present study.

Females. As in males, the mean M-D crown diameter of this tooth in Bantu females (11.10 mm) is slightly below

the midpoint of the range of population means (10.64 - 11.62 mm).

Also as in males, the mean B-L crown dimension in Bantu females (10.65 mm) is slightly below the midway of the range of population means (10.05 - 11.44 mm).

Mandibular Second Molar

Males. The range of population means for the M-D crown dimension of this tooth is small (10.62 - 11.45 mm). The Bantu mean (11.08 mm) is just above the midpoint of this range. Shaw's mean for the combined sexes in the Bantu (11.0 mm) is similar to that of males in the present study, but slightly larger than the female mean of 10.75 mm.

The mean B-L crown diameter for M_2 in Bantu males is 10.74 mm, which is a little below the midpoint of the range of population means (10.07 - 11.60 mm). Here again, the male and female means (10.74 mm and 10.46 mm respectively) in the present study are larger than that cited by Shaw for both Bantu sexes, i.e. 10.3 mm.

Females. The mean M-D crown dimension for M_2 in Bantu females (10.75 mm), as in males, is slightly above the midpoint of the range of population means (10.06 - 11.29 mm). Australian Aboriginals (11.07 mm), Aleuts (11.16 mm) and East Greenland Eskimos (11.29 mm) have larger means than that of the Bantu, whereas Swedes (10.70 mm) have a similar mean value.

The Bantu mean B-L crown diameter of this tooth in females (10.46 mm) is midway in the range of means of

the various available populations (9.62 - 11.29 mm).

Mandibular Third Molars

Males. The mean M-D dimension for mandibular third molars in Bantu males (11.20 mm) lies well within the upper half of the range of population means (9.90 - 11.61 mm). Australian Aboriginals (11.61 mm), East Greenland Eskimos (11.42 mm) and Swedes (11.32 mm) have teeth whose mean M-D dimension exceed that of the Bantu. Shaw's mean for the combined Bantu sexes is 11.1 mm and is approximately midway between the male (11.20 mm) and female (10.86 mm) means of the present study.

The mean B-L dimension of this tooth in Bantu males (10.59 mm) is slightly above the midpoint of the range of population means (9.52 - 11.53 mm). Only the means of Tristanites (11.53 mm), Australian Aboriginals (11.41 mm) and East Greenland Eskimos (10.94 mm) exceed that of the Bantu. The combined Bantu sample of Shaw had a smaller mean (10.4 mm) than the male mean (10.59 mm) but larger than that of the female (10.27 mm) of the present study.

Females. As in males, the mean M-D crown dimension for this tooth in Bantu females (10.86 mm) is in the upper half of the range of population means (9.57 - 11.32 mm). The means of Australian Aboriginals (11.32 mm), Aleuts (11.30 mm) and East Greenland Eskimos (11.12 mm) are larger than those of the Bantu.

Likewise, as in males, the mean B-L dimension of this tooth in Bantu females (10.27 mm) is a little above

the midpoint of the range of population means (9.20 - 11.16 mm).

CROWN AREA

Unfortunately the available comparative data on crown area of the various teeth is limited to only three population groups, namely Aleuts, East Greenland Eskimos and Tristanites. The data for these groups is compared with those of the Bantu in Tables 147 & 148.

The mean crown areas of the maxillary first and second premolars, and maxillary third molars, in Bantu males [illegible] the largest of the available series. The largest mean crown areas of all the remaining maxillary and mandibular teeth in Bantu males and females, are fairly evenly distributed between East Greenland Eskimos and Tristanites. Because of the few populations, this information in itself is of limited value.

TOOTH SHAPE

The crown indices of permanent maxillary and mandibular teeth in a small number of human populations are summarized in Tables 149 & 150. It should be pointed out that the terms 'broad' or 'narrow' are relative descriptive terms and refer to high or low dental indices, and not to absolute measurements.

The trend in the maxillary teeth of Bantu males is towards mesiodistally short and buccolingually broad teeth. The mean indices for the teeth in Bantu are exceeded by those of the Tristanites in every instance,

in other words, the teeth of the Tristanites are relatively broader than the corresponding teeth of the Bantu. The Norwegian Lapps (117.4 per cent) have relatively broader second maxillary molars than those of Bantu (116.05 per cent), whereas the mean index for Norwegian Lapp male maxillary first molars is the same as that of Bantu, i.e. 109.5 per cent.

Bantu females possess relatively broad maxillary canines (108.1 per cent), second premolars (139.3 per cent) and third molars (123.45 per cent). The indices in each instance are exceeded only by those of the Tristanites ($\underline{C}$ = 116.0 per cent, P^2 = 149.5 per cent and M^3 = 136.1 per cent). In fact, the mean crown indices of the maxillary teeth of the Tristanite males and females show that they possess the broadest teeth of all the available population groups.

In the mandibular arch, the second and third molar teeth of both sexes in the Bantu possess the highest indices (M_2 = 116.1 per cent in males, 114.5 per cent in females; M_3 = 126.4 per cent in males, 123.5 per cent in females). In general, the broadest teeth are again those of the Tristanites.

In Bantu males, the mandibular first premolars (112.1 per cent) and first molars (95.5 per cent) are likewise relatively broad and are exceeded in breadth by those of only the Tristanites, whose crown indices are 126.5 per cent and 99.3 per cent respectively. The mean crown indices

of the mandibular canines (109.5 per cent) and second premolars (115.7 per cent) in Bantu males are close to the midpoint among the populations.

In females, as in males, the mandibular molars of the Bantu are relatively broad. The second and third mandibular molars, with mean crown indices of 114.5 per cent and 123.3 per cent respectively, are the broadest among the population groups. The mean crown shape index of the first molar (96.3 per cent) is exceeded only by that of the Tristanites (100.1 per cent). The crown indices of the remaining mandibular teeth in the Bantu, i.e. canines, first and second premolars are 107.8 per cent, 110.6 per cent and 115.9 per cent respectively; these indices are close to the midpoint when compared with the other racial groups.

COMPARISON OF PRESENT RESULTS WITH THOSE OF SHAW (193-)

The findings in the present study cannot be accurately compared with those of Shaw since the latter investigator's figures were for the combined sexes. However, a rough comparison between the two studies can possibly be made. It will be recalled that of the 132 Bantu skulls examined by Shaw, only 20 were of the female sex. Since his combined sample was weighted heavily in favour of males, for purposes of comparison, Shaw's values should thus approximate more closely to male values obtained in the present study.

Most of the mean M-D crown diameters recorded by

Shaw for the combined sexes are lower than those of males in the present study (Table 151). The differences in the corresponding mean dimensions of I^1, I^2, P^1, P^2 and M^3 in the upper jaw, and I_1, I_2, $\bar{C}$, P_1, P_2, M_2 and M_3 in the lower jaw are small and less than 0.3 mm. The differences in corresponding M-D crown diameter means of $\underline{C}$, M^1, M^2 and M_1 are in the vicinity of 0.3 mm. The M-D mean for I_1 recorded by Shaw unaccountably is 0.57 mm larger than that of the present study.

All the mean B-L crown diameters cited by Shaw are less than the corresponding means in the present study. In the upper jaw, the differences in means range from 0.43 mm to 0.64 mm. In the lower jaw the differences in B-L means of $\bar{C}$, P_1 and M_3 are minimal, whereas those of P_2, M_1 and M_2 are in the vicinity of 0.4 mm.

Shaw measured the M-D diameters of the crowns of incisors and canines, wnether extracted or in position in the jaws, across the cutting edge. The M-I diameters of all premolars and molars he measured along the median anteroposterior axes of the crown, from articulation (or contact) to articulation if the teeth were still in position in the jaws, or from the middle of the upper border of the articular facet anteriorly to a similar point of a similar facet posteriorly in teeth that had been extracted from the jaws. The B-L diameters, Shaw obtained by measuring at right angles to the M-D diameters as well as to the vertical (Shaw c.f. page 11). The measuring techniques in the present study, recorded at the

beginning of the chapter on odontometry, are slightly different from those of Shaw.

It would seem that Shaw's technique of measuring his M-D crown diameters would tend to bias his results towards being smaller. This however does not account [redacted] certain teeth (P^2, M^3 and I_1) being biased in the opposite direction. Since the differences in means are generally small (except for I_1) the most likely explanation is that these differences are because of sampling error. The writer cannot however account for the relatively larger I_1 mean discrepancy.

The B-L crown diameter means recorded by Shaw are consistently smaller (generally by approximately the same amount) than the corresponding means in the present study. This observation suggests that technical differences are involved. This possibility, combined with the fact that Shaw's measurements were all made to the nearest 0.5 mm perhaps accounts for the differences in results.

SUMMARY

In an effort to glean a clearer overall picture of the size of the Bantu teeth relative to other populations, the ranges of M-D and B-L crown diameters were represented diagrammatically (Fig. 54). The arrows in the illustration indicate the positions of the mean dimensions of the Bantu teeth relative to the range of means of the available population series.

In addition to the diagram a simplified chart was drawn up (Table 152). In this table the population with

Fig. 54. Diagrammatic representation of the M-D and B-L mean crown diameters of the teeth of South African Bantu-speaking Negroids compared with those of other populations. The arrows in the illustration indicate the positions of the mean dimensions of the Bantu teeth relative to the range of means of the available population series

the largest mean dimension is listed in the "order of largest dimension" column under number 1. The second and third largest dimensions are listed under columns 2 and 3 respectively. The dimensions of the Bantu teeth are frequently of medium size, in which case they are simply tabulated in the "medium sized" column. The figure 4 in parentheses behind the word Bantu, viz. Bantu (4) denotes that the Bantu mean for the specific dimension is the fourth largest of the population means

The diagram illustrates clearly that in the main, the Bantu teeth are close to the midpoint in the range of population means for living populations of man. In most instances the arrows in the diagram point close to the midway mark between the two extremes, which are generally represented by Australian Aboriginals and Bushmen.

In the maxilla, the mean M-D crown diameters of M^2 in both males and females tend towards being large.

In the mandible, $\bar{C}$, P_1 and P_2 of both sexes tend to possess larger M-D crown dimensions. These characteristics are clearly illustrated by the arrows in the diagram (representing the Bantu means for $\bar{C}$, P_1 and P_2) pointing nearer the upper extremity of the respective parameters.

The B-L crown dimensions of the Bantu teeth are all medium-sized with the exception of M^3 in males and females. These teeth in the Bantu are relatively broad. This is borne out in Table 15 in which the Bantu M^3's are rated third largest in the population series. The appearance

of the parameter illustrating the range of means for this tooth in females is deceptive, since the mean for Tristanite females is unusually large (12.12 mm), consequently the range of means for this tooth in females is extended even beyond that of males. On the other hand, the arrow representing the Bantu male mean for this tooth is located well above the upper half of the M^3 parameter.

The crown areas of the Bantu could unfortunately be compared with those of only three population groups, namely, East Greenland Eskimos, Tristanites and Aleuts, all of which possess relatively large teeth, particularly the former two groups. The Australian Aboriginals, whose crown areas are not included in the comparative table of areas, no doubt possess the largest teeth. This judgement is based on the mean M-D and B-L crown diameters which in most instances are the largest for living human populations.

The population table of crown indices is of limited value in that the Bantu could be compared with only four population groups, namely, Norwegian Lapps, Tristanites, Aleuts and East Greenland Eskimos.

The trend in the maxillary teeth of Bantu males and females is towards mesiodistally short and buccolingually broad teeth. The maxillary teeth of Tristanites, however, are all relatively broader than those of Bantu. The second and third mandibular molar teeth of Bantu males and females are relatively the broadest of all available population groups. The relative dimensions of the remaining mandibular teeth, although broad, are exceeded

in relative breadth by those of Tristanites.

The mean M-D and B-L crown dimensions recorded by Shaw (1931), except in isolated instances, do not differ markedly from those in the present study. Technical differences and sampling errors probably account for the differences in results.

TABLE 143

MESIODISTAL CROWN DIAMETERS OF PERMANENT MAXILLARY TEETH OF LIVING HUMAN POPULATIONS (mm)

X The data for males and females were combined in the original publications; I have separated them into male and female sets of data.

* Combined males and females.

CENTRAL INCISOR

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	144	8.82	± 0.06	47	8.60	± 0.09
Bantu* (Shaw)	66	8.9	?			
Bushmen	82	8.18	? xx	64	8.02	? xx
Australian Aboriginals	130	9.35	± 0.05	111	9.0	± 0.06
Pecos Indians*	105	8.67	± 0.02			
Aleuts	97	8.45	± 0.05	65	8.07	± 0.05
Chinese	267	8.68	± 0.03	-	-	-
Japanese	132	8.5	± 0.03	45	8.2	± 0.04
Javanese X	129	8.6	± 0.06	35	8.2	± 0.12
Tristanites	152	8.78	± 0.05	131	8.60	± 0.05
Norwegian Lapps	73	8.37	± 0.05	85	8.34	± 0.05
Swedes X	483	8.84	± 0.03	490	8.62	± 0.02
American Whites	87	8.78	± 0.05	87	8.40	± 0.06

LATERAL INCISOR

Bantu (Present Study	195	7.14	± 0.05	71	6.85	± 0.08
Bantu* (Shaw)	66	7.2				
Bushmen	81	6.56	? xx	64	6.36	? xx
Australian Aboriginals	115	7.65	± 0.06	104	7.34	± 0.06
Pecos Indians*	84	7.06	± 0.03			
Aleuts	88	7.29	± 0.05	59	7.08	± 0.05
Chinese	219	6.98	± 0.03	-	-	± -
Japanese	127	7.1	± 0.03	40	6.7	± 0.08
Javanese X	131	7.0	± 0.06	38	6.7	± 0.10
Tristanites	146	6.74	± 0.05	131	6.68	± 0.07
Norwegian Lapps	95	6.84	± 0.06	105	6.70	± 0.05
Swedes X	469	6.81	± 0.03	476	6.64	± 0.03
American Whites	84	6.64	± 0.07	86	6.47	± 0.07

xx Study pending

TABLE 143 (Continued)

CANINE

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	270	7.91	± 0.03	93	7.50	± 0.04
Bantu* (Shaw)	66	7.6	?			
Bushmen	80	7.52	?xx	64	7.10	?
Australian Aboriginals	80	8.31	± 0.06	84	7.95	± 0.05
Pecos Indians*	84	7.06	± 0.03			
East Gr.Eskimos X	9	8.09	± 0.06	7	7.59	?
Aleuts	81	8.03	± 0.04	57	7.67	± 0.05
Chinese	210	8.06	± 0.03	-	-	-
Japanese	142	7.8	± 0.03	52	7.4	± 0.04
Javanese X	136	8.0	± 0.05	42	7.7	± 0.08
Tristanites	132	7.93	± 0.04	112	7.74	± 0.04
Norwegian Lapps	194	7.74	± 0.03	177	7.47	± 0.03
Swedes X	463	8.10	± 0.02	473	7.73	± 0.02
American Whites	87	7.95	± 0.05	85	7.53	± 0.04
FIRST PREMOLAR						
Bantu (Present Study)	295	7.27	± 0.03	94	7.15	± 0.04
Bantu* (Shaw)	62	7.2	?			
Bushmen	81	6.82	?xx	63	6.73	?xx
Australian Aboriginals	98	7.69	± 0.05	86	7.53	± 0.05
Pecos Indians*	82	7.43	± 0.03			
East Gr. Eskimos X	10	7.65	0.18	5	7.26	?
Aleuts	77	7.15	± 0.04	37	6.96	± 0.05
Chinese	209	7.21	0.03	-	-	-
Japanese	140	7.3	± 0.03	46	7.2	± 0.05
Javanese	133	7.5	± 0.05	39	7.3	± 0.07
Tristanites	132	6.96	± 0.04	112	7.02	± 0.07
Norwegian Lapps	221	6.75	± 0.03	205	6.55	± 0.03
Swedes X	135	7.18	± 0.03	124	7.04	± 0.04
American Whites	87	7.01	± 0.04	84	6.85	± 0.05

TABLE 143 (Continued)

SECOND PREMOLAR

POPULATION GROUP	MALE			FEMALE		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	294	6.8	± 0.02	93	6.71	± 0.04
Bantu* (Shaw)	87	7.0	?			
Bushmen	81	6.30	?xx	64	6.32	?xx
Australian Aboriginals	96	7.19	± 0.04	83	7.01	± 0.05
Pecos Indians*	88	7.01	± 0.04			
East Gr. Eskimos X	11	6.93	± 0.11	6	6.57	± 0.04
Aleuts	62	6.65	± 0.06	37	6.61	± 0.07
Chinese	143	6.86	0.03	-	-	-
Japanese	140	6.8	± 0.03	40	6.8	± 0.04
Javanese X	129	7.0	± 0.05	40	6.9	± 0.06
Tristanites	128	6.64	± 0.04	102	6.59	± 0.03
Norwegian Lapps	237	6.45	± 0.03	208	6.32	± 0.03
Swedes X	125	6.5	± 0.04	115	6.85	± 0.04
American Whites	86	6.82	± 0.04	81	6.62	± 0.05
FIRST MOLAR						
Bantu (Present Study)	292	10.64	± 0.03	92	10.43	± 0.05
Bantu* (Shaw)	91	10.3				
Bushmen	117	10.78	?xx	128	10.45	?xx
Australian Aboriginals	115	11.34	± 0.05	109	10.92	± 0.05
Pecos Indians*	67	10.7	± 0.04			
East Gr. Eskimos X	27	10.84	± 0.10	30	10.53	± 0.10
Aleuts	53	10.37	± 0.10	36	10.05	± 0.07
Chinese	88	10.02	± 0.06	-	-	-
Japanese	151	10.2	± 0.03	60	10.0	± 0.05
Javanese X	129	10.8	± 0.06	41	10.5	± 0.09
Tristanites	145	10.69	± 0.05	122	10.45	± 0.04
Norwegian Lapps	256	10.23	± 0.04	223	9.93	± 0.03
Swedes X	164	10.69	± 0.04	135	10.47	± 0.05
American Whites	83	10.81	± 0.06	85	10.52	± 0.06

TABLE 143 (Continued)

SECOND MOLAR

POPULATION GROUP	MALE			FEMALE		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study	303	10.32	± 0.04	99	10.03	± 0.06
Bantu* (Shaw)	91	10.0	?			
Bushmen	114	10.22	?xx	121	9.98	?xx
Australian Aboriginals	82	10.70	± 0.08	79	10.31	± 0.07
Pecos Indians*	79	9.94	± 0.04			
East Gr. Eskimos X	38	10.23	± 0.08	17	10.08	± 0.15
Aleuts	51	10.00	± 0.10	41	9.84	± 0.09
Chinese	70	9.36	0.06	-	-	-
Japanese	142	9.8	± 0.03	56	9.4	± 0.06
Javanese X	125	10.0	± 0.06	39	9.6	± 0.11
Tristanites	109	10.03	± 0.08	96	9.78	± 0.07
Norwegian Lapps	267	9.34	± 0.04	225	8.93	± 0.04
Swedes X	151	10.47	± 0.05	176	10.05	± 0.04
American Whites	65	10.35	± 0.08	50	9.81	± 0.07
THIRD MOLAR						
Bantu (Present Study)	265	9.24	± 0.05	81	8.7	± 0.11
Bantu* (Shaw)	80	9.5	?			
Bushmen	60	8.68	?xx	54	8.11	?
Australian Aboriginals	36	9.87	± 0.14	35	9.76	± 0.13
Pecos Indians*	84	9.36	± 0.04			
East Gr. Eskimos X	26	9.65	± 0.18	9	9.46	± 0.25
Aleuts	27	9.16	± 0.17	15	8.99	± 0.13
Chinese	50	8.60	± 0.10	-	-	-
Japanese	76	8.8	± 0.08	26	8.3	± 0.10
Javanese X	96	9.2	± 0.10	31	9.1	± 0.14
Tristanites	63	8.89	± 0.10	56	8.87	± 0.10
Norwegian Lapps	196	8.03	± 0.05	154	7.85	± 0.06
Swedes X	33	9.48	± 0.17	7	8.33	± ?

TABLE 144

MESIODISTAL CROWN DIAMETERS OF PERMANENT MANDIBULAR TEETH IN LIVING HUMAN POPULATIONS (mm)

X The data for males and females were combined in the original publications; I have separated them into male and female sets of data.

* Combined males and females

CENTRAL INCISOR

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	181	5.33	± 0.03	61	5.30	± 0.05
Bantu* (Shaw)	62	5.9				
Bushmen	82	4.74	?xx	63	4.71	?xx
Australian Aboriginals	136	5.87	± 0.03	117	5.68	± 0.04
Pecos Indians*	84	5.52	± 0.02			
Aleuts	98	5.23	± 0.04	73	5.08	± 0.05
Chinese	216	5.56	± 0.03	-	-	-
Japanese	129	5.4	± 0.03	44	5.2	± 0.04
Javanese X	128	5.5	± 0.04	37	5.4	± 0.08
Tristanites	154	5.54	± 0.04	132	5.49	± 0.04
Norwegian Lapps	76	5.36	± 0.03	83	5.22	± 0.03
Swedes X	507	5.51	± 0.02	491	5.42	± 0.02
American Whites	85	5.42	± 0.03	87	5.25	± 0.04
LATERAL INCISOR						
Bantu (Present Study)	223	6.06	± 0.03	83	5.99	± 0.05
Bantu* (Shaw)	62	6.0	?			
Bushmen	80	5.46	?xx	64	5.34	?xx
Australian Aboriginals	130	6.60	± 0.04	112	6.36	± 0.04
Pecos Indians*	74	6.14	± 0.02			
Aleuts	100	6.09	± 0.03	72	5.90	± 0.04
Chinese	187	6.15	± 0.03	-	-	-
Japanese	136	6.0	± 0.03	51	5.9	± 0.04
Javanese X	133	6.2	± 0.05	39	6.1	± 0.09
Tristanites	152	6.08	± 0.05	135	6.08	± 0.04
Norwegian Lapps	123	5.98	± 0.04	124	5.85	± 0.04
Swedes X	507	6.13	± 0.02	493	5.94	± 0.02
American Whites	85	5.95	± 0.04	87	5.78	± 0.04

xx Study pending

TABLE 144 (Continued)

CANINE

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study	264	7.33	± 0.03	96	6.89	± 0.04
Bantu* (Shaw)	62	7.3	?			
Bushmen	81	6.83	?xx	64	6.39	?xx
Australian Aboriginals	98	7.49	± 0.05	95	7.01	± 0.04
Pecos Indians*	94	7.27	0.03			
East Gr. Eskimos X	4	7.28	± ?	3	6.93	?
Aleuts	91	7.20	± 0.04	74	6.71	± 0.04
Chinese	209	7.31	0.03	-	-	-
Japanese	146	7.0	± 0.02	48	6.6	± 0.04
Javanese X	139	7.2	± 0.04	42	6.8	± 0.08
Tristanites	136	7.15	± 0.04	120	6.87	± 0.04
Norwegian Lapps	219	6.82	± 0.03	186	6.50	± 0.03
Swedes X	503	7.12	± 0.02	493	6.69	± 0.02
American Whites	84	6.96	± 0.04	87	6.47	± 0.04
FIRST PREMOLAR						
Bantu (Present Study)	300	7.38	± 0.03	101	7.22	± 0.04
Bantu* (Shaw)	62	7.1	?			
Bushmen	62	6.69	?xx	63	6.76	?xx
Australian Aboriginals	95	7.49	± 0.06	85	7.36	± 0.04
Pecos Indians*	105	7.15	± 0.03			
East Gr. Eskimos X	7	7.15	?	5	7.04	?
Aleuts	94	7.01	± 0.06	64	6.85	± 0.04
Chinese	232	7.18	0.03	-	-	-
Japanese	143	7.1	± 0.05	49	7.0	± 0.03
Javanese X	133	7.3	± 0.05	42	7.1	± 0.07
Tristanites	135	7.07	± 0.06	120	7.10	± 0.05
Norwegian Lapps	226	6.72	± 0.03	191	6.59	± 0.03
Swedes X	160	7.27	± 0.03	146	7.16	± 0.03
American Whites	85	7.07	± 0.04	87	6.87	± 0.04

TABLE 144 (Continued)

SECOND PREMOLAR

POPULATION GROUP	MALE			FEMALE		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	293	7.44	± 0.03	92	7.28	± 0.05
Bantu* (Shaw)	62	7..				
Bushmen	82	6.88	?xx	63	6.70	?xx
Australian Aboriginals	89	7.56	± 0.05	82	7.31	± 0.05
Pecos Indians*	91	7.42	± 0.03			
East Gr. Eskimos X	11	7.14	± 0.14	8	6.99	± 0.09
Aleuts	81	7.17	± 0.05	56	7.02	± 0.07
Chinese	160	7.29	± 0.02	-	-	-
Japanese	138	7.1	± 0.03	47	7.1	± 0.04
Javanese X	131	7.3	± 0.05	42	7.1	± 0.08
Tristanites	121	7.21	± 0.05	107	7.13	± 0.04
Norwegian Lapps	232	6.74	± 0.03	191	6.59	± 0.03
Swedes X	103	7.41	± 0.04	117	7.21	± 0.04
American Whites	82	7.29	± 0.06	83	7.02	± 0.04
	FIRST	MOLAR				
Bantu (Present Study)	277	11.39	± 0.04	84	11.10	± 0.07
Bantu* (Shaw)	83	11.0	?			
Bushmen	118	10.85	?xx	130	10.74	?xx
Australian Aboriginals	119	12.04	± 0.06	101	11.62	0.06
Pecos Indians*	67	11.96	± 0.05			
East Gr. Eskimos X	18	12.02	± 0.11	11	11.47	± 0.18
Aleuts	47	11.56	± 0.08	20	11.20	± 0.11
Chinese	95	11.33	± 0.06	-	-	-
Japanese	7	11.2	± 0.03	52	10.9	± 0.05
Javanese X	114	11.5	± 0.06	36	11.2	± 0.09
Tristanites	143	11.22	± 0.05	112	11.01	± 0.05
Norwegian Lapps	228	10.95	± 0.04	192	10.64	± 0.04
Swedes X	5	11.24	± 0.05	123	10.98	± 0.06
American Whites	7	11.13	± 0.05	84	10.74	± 0.06

TABLE 144 (Continued)

SECOND MOLAR

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	284	11.08	± 0.04	78	10.75	± 0.07
Bantu* (Shaw)	83	11.0				
Bushmen	118	10.62	?xx	126	10.47	?xx
Australian Aboriginals	82	11.45	± 0.08	80	11.07	± 0.07
Pecos Indians*	62	11.41	± 0.04			
East Gr. Eskimos X	22	11.52	± 0.12	12	11.29	± 0.17
Aleuts	43	11.19	± 0.14	36	11.16	± 0.10
Chinese	82	10.73	0.08	-	-	-
Japanese	141	11.0	± 0.04	45	10.6	± 0.08
Javanese X	132	10.9	± 0.06	38	10.4	± 0.12
Tristanites	108	10.77	± 0.07	92	10.51	± 0.07
Norwegian Lapps	254	10.51	± 0.04	203	10.06	± 0.04
Swedes X	241	11.15	± 0.04	275	10.70	± 0.04
American Whites	53	10.76	± 0.10	53	10.34	± 0.08
	THIRD MOLAR					
Bantu (Present Study)	278	11.20	± 0.05	73	10.86	± 0.10
Bantu* (Shaw)	66	11.1				
Bushmen	91	10.04	?xx	74	9.8	?xx
Australian Aboriginals	33	11.61	± 0.16	33	11.32	0.12
Pecos Indians*	62	11.33	± 0.06			
East Gr. Eskimos X	22	11.42	± 0.16	[illegible]	11.12	?
Aleuts	15	11.13	± 0.20	20	11.30	± 0.13
Chinese	26	10.60	± 0.25	-	-	-
Japanese	88	10.2	± 0.06	26	9.5	± 0.10
Javanese X	98	10.9	± 0.08	28	10.7	± 0.13
Tristanites	45	10.78	± 0.14	43	10.40	± 0.13
Norwegian Lapps	172	9.90	± 0.07	152	9.57	± 0.06
Swedes X	52	11.32	± 0.12	11	10.30	± ?

TABLE 145

BUCCOLINGUAL CROWN DIAMETERS OF PERMANENT MAXILLARY TEETH IN LIVING HUMAN POPULATION (mm)

X The data for males and females were combined in the original publications; I have separated them into male and female sets of data.

* Combined males and females.

CANINE

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	270	8.72	± 0.04	93	8.10	± 0.06
Bantu* (Shaw)	66	8.2	?			
Bushmen	82	8.07	?xx	64	7.68	?xx
Australian Aboriginals	41	9.12	± 0.09	36	8.67	± 0.06
Pecos Indians*	86	8.36	± 0.04			
East Gr. Eskimos	13	8.59	± 0.05	8	8.40	?
Aleuts	65	8.47	± 0.05	44	8.15	± 0.06
Chinese	210	8.31	0.03	-	-	-
Japanese	142	8.4	± 0.04	52	7.9	± 0.04
Javanese X	136	8.5	± 0.05	43	7.8	± 0.07
Tristanites	82	9.38	± 0.06	47	8.87	± 0.08
Norwegian Lapps	197	8.18	± 0.04	167	7.67	± 0.04
FIRST PREMOLAR						
Bantu (Present Study)	294	9.61	± 0.65	93	9.36	± 0.06
Bantu* (Shaw)	62	9.0	?			
Bushmen	81	8.88	?xx	63	9.01	?xx
Australian Aboriginals	85	10.38	± 0.07	81	10.10	± 0.06
Pecos Indians*	82	9.89	± 0.04			
East Gr. Eskimos	14	9.65	± 0.10	6	8.13	?
Aleuts	81	9.31	± 0.07	29	9.18	± 0.04
Chinese	209	9.39	0.03	-	-	-
Japanese	140	9.5	± 0.03	46	9.3	± 0.06
Javanese X	132	9.8	± 0.05	39	9.4	± 0.09
Tristanites	75	9.81	± 0.06	49	9.64	± 0.09
Norwegian Lapps	203	8.9	± 0.04	189	8.64	± 0.04

xx Study pending

TABLE 145 (Continued)

SECOND PREMOLAR

POPULATION GROUP						
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	294	9.61	± 0.05	93	9.36	± 0.06
Bantu* (Shaw)	87	9.1	?			
Bushmen	80	8.85	?xx	64	8.86	?xx
Australian Aboriginals	85	10.29	± 0.06	81	10.05	± 0.07
Pecos Indians*	88	9.18	± 0.03			
East Gr. Eskimos	15	9.54	± 0.14	6	8.39	?
Aleuts	69	9.13	± 0.07	30	9.03	± 0.13
Chinese	143	9.17	0.03	-	-	-
Japanese	140	9.4	± 0.03	46	9.2	± 0.04
Javanese X	129	9.7	± 0.06	49	9.2	± 0.09
Tristanites	65	9.96	± 0.08	41	9.83	± 0.07
Norwegian Lapps	208	8.72	± 0.04	199	8.47	± 0.04
FIRST MOLAR						
Bantu (Present Study)	292	11.63	± 0.04	92	11.32	± 0.06
Bantu* (Shaw)	91	11.0	?			
Bushmen	117	10.96	?xx	129	10.91	?xx
Australian Aboriginals	85	12.63	± 0.06	81	12.21	± 0.06
Pecos Indians*	67	11.54	± 0.03			
East Gr. Eskimos	30	11.80	± 0.06	30	11.44	± 0.12
Aleuts	45	11.34	± 0.09	20	11.21	± 0.10
Chinese	88	11.19	± 0.05	-	-	-
Japanese	151	11.4	± 0.03	60	11.0	± 0.04
Javanese X	130	11.8	± 0.05	41	11.2	± 0.08
Tristanites	104	12.14	± 0.06	70	11.77	± 0.06
Norwegian Lapps	231	11.24	± 0.04	208	10.74	± 0.04

TABLE 145 (Continued)

SECOND MOLAR

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	303	11.93	± 0.04	99	11.53	± 0.07
Bantu* (Shaw)	91	11.5	?			
Bushmen	118	10.96	?xx	124	10.88	?xx
Australian Aboriginals	41	12.83	± 0.11	36	12.42	± 0.11
Pecos Indians*	79	11.24	± 0.05			
East Gr. Eskimos	38	11.56	± 0.10	17	11.49	± 0.17
Aleuts	42	11.36	± 0.13	27	11.28	± 0.12
Chinese	70	11.0	± 0.05	-	-	-
Japanese	142	11.6	± 0.03	56	10.9	± 0.04
Javanese X	125	11.7	± 0.06	39	10.9	± 0.12
Tristanites	84	12.33	± 0.09	47	11.97	± 0.09
Norwegian Lapps	258	10.96	± 0.04	198	10.26	± 0.05
THIRD MOLAR						
Bantu (Present Study)	265	11.64	± 0.05	81	10.84	± 0.13
Bantu* (Shaw)	80	11.0	?			
Bushmen	78	10.53	?xx	65	10.21	?xx
Australian Aboriginals	32	12.09	± 0.15	30	11.93	± 0.15
Pecos Indians*	84	10.57	± 0.04			
East Gr. Eskimos	26	11.37	± 0.15	9	10.42	± 0.29
Aleuts	22	10.76	± 0.25	9	10.70	± 0.09
Chinese	50	10.33	± 0.09	-	-	-
Japanese	76	10.8	± 0.07	26	10.0	± 0.11
Javanese X	96	11.2	± 0.11	31	10.7	± 0.12
Tristanites	29	11.82	± 0.21	23	12.12	± 0.20
Norwegian Lapps	187	9.93	± 0.06	152	9.41	± 0.08

TABLE 146

BUCCOLINGUAL CROWN DIAMETERS OF PERMANENT MANDIBULAR TEETH IN LIVING HUMAN POPULATIONS (mm)

X The data for males and females were combined in the original publications; I have separated them into male and female sets of data.

* Combined males and females ** Study pending

CANINE

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	264	8.05	±0.03	96	7.43	±0.05
Bantu* (Shaw)	62	8.0	?			
Bushmen	81	7.41	?**	64	6.97	?**
Australian Aboriginals	41	8.39	±0.08	36	8.03	±0.07
Pecos Indians*	94	7.71	±0.04			
East Gr.Eskimos	11	7.86	±0.14	3	7.13	?
Aleuts	74	7.93	±0.07	57	7.58	±0.06
Chinese	209	7.89	±0.03	-	-	-
Japanese	146	7.7	±0.03	48	7.3	±0.04
Javanese[X]	139	7.9	±0.04	42	7.2	±0.07
Tristanites	54	8.97	±0.09	43	8.45	±0.10
Norwegian Lapps	211	7.55	±0.03	190	6.95	±0.03
	FIRST PREMOLAR					
Bantu (Present Study)	300	8.28	±0.03	101	7.96	±0.05
Bantu* (Shaw)	62	8.2	?			
Bushmen	81	7.63	?	63	7.49	?
Australian Aboriginals	85	8.83	±0.06	81	8.69	±0.06
PPecos Indians*	105	7.91	±0.04			
East Gr.Eskimos	8	7.90	±0.21	7	7.42	?
Aleuts	86	7.82	±0.06	49	7.58	±0.06
Chinese	232	8.07	±0.03	-	-	-
Japanese	143	7.9	±0.03	49	7.8	±0.04
Javanese[X]	132	8.2	±0.06	42	7.7	±0.06
Tristanites	64	8.81	±0.06	61	8.69	±0.07
Norwegian Lapps	226	7.39	±0.03	197	7.13	±0.03

xx Study pending

TABLE 146 (Continued)

SECOND PREMOLAR

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	293	8.58	± 0.03	92	8.39	±0.05
Bantu* (Shaw)	62	8.1	?			
Bushmen	82	7.99	?**	63	7.80	?**
Australian Aboriginals	85	9.15	±0.07	81	8.94	±0.06
Pecos Indians*	91	8.42	±0.04			
East Gr.Eskimos	14	8.58	±0.10	10	7.68	±0.18
Aleuts	79	8.40	±0.07	42	8.14	±0.09
Chinese	160	8.13	±0.03	-	-	-
Japanese	138	8.4	±0.03	47	8.1	±0.05
Javanese[X]	131	8.5	±0.05	42	8.2	±0.08
Trastanites	83	9.21	±0.05	55	9.16	±0.07
Norwegian Lappe	217	7.75	±0.03	203	7.51	±0.03
	FIRST MOLAR					
Bantu (Present Study)	277	10.86	±0.03	84	10.65	±0.06
Bantu* (Shaw)	73	10.5	?			
Bushmen	118	10.52	?**	128	10.37	?**
Australian Aboriginals	83	11.85	±0.07	80	11.44	±0.06
Pecos Indians*	67	10.74	±0.04			
East Gr.Eskimos	19	11.63	±0.15	14	10.90	±0.13
Aleuts	49	10.56	±0.08	16	10.29	±0.11
Chinese	95	10.67	±0.03	-	-	-
Japanese	137	10.8	±0.03	52	10.7	±0.04
Javanese[X]	117	11.0	±0.06	35	10.7	±0.10
Tristanites	110	11.22	±0.05	100	11.08	±0.07
Norwegian Lapps	246	10.40	±0.04	207	10.05	±0.04

TABLE 146 (Continued)

SECOND MOLAR

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
Bantu (Present Study)	284	10.74	±0.03	78	10.46	±0.06
Bantu* (Shaw)	72	10.3	?			
Bushmen	118	10.43	?**	125	10.25	?**
Australian Aboriginals	41	11.60	±0.10	36	11.29	±0.07
Pecos Indians*	62	10.47	±0.04			
East Gr.Eskimos	22	11.01	±0.15	13	10.59	±0.17
Aleuts	45	10.58	±0.10	37	10.29	±0.10
Chinese	82	10.37	0.04	-	-	-
Japanese	141	10.5	±0.03	45	10.2	±0.06
Javanese[X]	133	10.5	±0.06	38	10.2	±0.10
Tristanites	80	11.16	±0.07	72	10.94	±0.07
Norwegian Lapps	259	10.07	±0.04	218	9.62	±0.04
	THIRD MOLAR					
Bantu (Present Study)	278	10.59	±0.04	73	10.27	±0.08
Bantu* (Shaw)	65	10.4	?			
Bushmen	95	10.17	?**	72	9.76	?**
Australian Aboriginals	29	11.41	±0.13	30	11.16	±0.10
Pecos Indians*	62	10.10	±0.05			
East Gr.Eskimos	22	10.94	±0.16	5	10.26	?
Aleuts	13	10.15	±0.15	17	10.42	±0.12
Chinese	26	10.35	±0.13	-	-	-
Japanese	88	10.0	±0.05	26	9.5	±0.12
Javanese[X]	99	10.4	±0.07	29	10.2	±0.11
Tristanites	14	11.53	±0.16	13	11.05	±0.17
Norwegian Lapps	168	9.52	±0.06	152	9.20	±0.06

TABLE 147

CROWN AREAS OF PERMANENT MAXILLARY TEETH IN VARIOUS POPULATION GROUPS (mm^2)

*Combined males and females

POPULATION GROUPS	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
C						
Bantu (Present Study)	65	69.0	± 0.5	93	60.8	± 0.5
Tristanites	80	74.5	± 0.8	47	68.7	± 0.9
East Gr.Eskimos*	16	65.8	?	-	-	-
Aleuts	65	68.1	± 0.9	44	62.9	± 0.9
P^1						
Bantu (Present Study)	295	70.4	± 0.5	94	65.9	± 0.6
Tristanites	73	68.6	± 0.8	47	67.4	± 1.1
East Gr.Eskimos*	15	68.7	?	-	-	-
Aleuts	79	66.9	± 0.8	27	63.7	± 1.0
P_2^2						
Bantu (Present Study)	293	65.9	± 0.5	93	62.0	± 0.7
Tristanites	64	65.7	± 0.9	41	64.9	± 1.0
East Gr.Eskimos*	17	61.5	?	-	-	-
Aleuts	65	61.0	± 0.9	25	60.0	± 1.9
M_1^1						
Bantu (Present Study)	292	123.5	± 0.7	92	117.0	± 1.2
Tristanites	94	129.5	± 1.0	66	123.4	± 1.2
East Gr.Eskimos*	57	124.6	?	-	-	-
Aleuts	43	116.4	± 2.3	18	115.6	± 1.2
M_2^2						
Bantu (Present Study)	303	123.8	± 0.6	78	115.3	± 1.4
Tristanites	76	125.1	± 1.1	43	116.5	± 1.9
East Gr.Eskimos*	55	117.7	?	-	-	-
Aleuts	41	112.7	± 2.3	26	110.9	± 2.3
M_3^3						
Bantu (Present Study)	265	107.3	± 0.8	81	96.2	± 1.9
Tristanites	29	105.2	± 3.3	22	106.9	± 2.8
East Gr.Eskimos*	35	107.3	?	-	-	-
Aleuts	21	100.3	± 3.9	9	94.8	± 1.8

TABLE 148

CROWN AREAS OF PERMANENT MANDIBULAR TEETH IN VARIOUS POPULATION GROUPS (mm^2)

*Combined males and females

POPULATION GROUPS	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
C						
Bantu (Present Study)	264	58.9	± 0.4	96	50.0	± 0.6
Tristanites	51	64.0	± 1.1	45	57.2	± 1.1
East Gr.Eskimos*	7	52.5	?	-	-	-
Aleuts	72	57.2	± 0.7	57	51.2	± 0.7
P_1						
Bantu (Present Study)	300	61.3	± 0.4	101	57.3	± 0.5
Tristanites	64	61.4	± 0.8	58	62.7	± 0.8
East Gr.Eskimos*	12	54.7	?	-	-	-
Aleuts	81	55.4	± 0.8	45	52.1	± 0.8
P_2						
Bantu (Present Study)	293	63.8	± 0.4	92	61.1	± 0.7
Tristanites	81	66.2	± 0.7	58	67.7	± 1.5
East Gr.Eskimos*	19	57.9	?	-	-	-
Aleuts	71	60.6	± 0.9	41	57.4	± 1.1
M_1						
Bantu (Present Study)	277	124.0	± 0.7	84	117.8	± 1.3
Tristanites	105	126.1	± 1.0	91	123.8	± 1.2
East Gr.Eskimos*	29	134.3	- ?	-	-	-
Aleuts	47	122.4	± 1.4	16	114.6	± 2.4
M_2						
Bantu (Present Study)	284	119.4	± 0.8	78	112.3	± 1.2
Tristanites	79	119.6	± 1.6	71	115.0	± 1.4
East Gr.Eskimos*	34	124.5	?	-	-	-
Aleuts	44	120.1	± 2.4	36	115.3	± 2.5
M_3						
Bantu (Present Study)	279	118.5	± 1.0	73	111.6	± 1.8
Tristanites	12	124.6	± 3.3	15	119.9	± 3.3
East Gr.Eskimos*	27	123.1	?	-	-	-
Aleuts	13	111.5	± 4.5	16	119.4	± 3.1

TABLE 149

CROWN INDICES OF PERMANENT MAXILLARY TEETH IN DIFFERENT POPULATION GROUPS (B-L/M-D X 100)

* - Combined males and females

POPULATION GROUP	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
C						
Bantu (Present Study	270	110.5	± 0.4	93	108.1	±0.7
Pecos Indians*	86	104.0	± 0.4	-	-	-
East Gr.Eskimos*	16	106.2	± ?	-	-	-
Aleuts	65	105.6	± 0.8	44	105.9	±0.7
Tristanites	82	118.8	± 0.9	46	116.0	±1.6
Norwegian Lapps	160	105.6	± 0.4	153	102.6	±0.4
P^1						
Bantu (Present Study)	295	133.3	± 0.4	94	130.6	±0.7
Pecos Indians*	82	133.1	± 0.5	-	-	-
East Gr.Eskimos*	15	122.9	± ?	-	-	-
Aleuts	79	130.4	± 0.6	27	133.4	±1.4
Tristanites	75	140.7	± 1.2	47	139.3	±1.4
Norwegian Lapps	186	131.5	± 0.4	180	132.1	±0.4
P^2						
Bantu (Present Study)	293	140.7	± 0.5	93	139.3	±0.9
Pecos Indians*	88	130.4	± 0.5	-	-	-
East Gr.Eskimos*	17	130.8	,?	-	-	-
Aleuts	65	136.4	±1.0	25	137.8	±2.2
Tristanites	65	151.6	± 1.5	42	149.5	±1.3
Norwegian Lapps	195	135.4	± 0.5	184	133.9	±0.5
M^1						
Bantu (Present Study)	292	109.5	± 0.3	92	109.9	± 0.9
Pecos Indians*	67	107.6	± 0.4	-	-	-
East Gr.Eskimos*	57	108.8	± ?	-	-	-
Aleuts	42	109.3	± 0.6	18	110.2	±1.3
Tristanites	99	114.3	± 0.6	18	113.9	±0.8
Norwegian Lapps	217	109.5	± 0.3	191	108.4	±0.4

TABLE 149 (continued)

* Combined males and females

POPULATION GROUPS	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
M^2						
Bantu (Present Study)	303	116.1	± 0.4	99	114.5	± 0.7
Pecos Indians*	79	111.7	± 0.4	-	-	-
East Gr.Eskimos*	55	113.4	± ?	-	-	-
Aleuts	41	114.6	± 1.1	26	115.0	± 1.0
Tristanites	77	125.8	± 1.1	43	124.3	± 1.2
Norwegian Lapps	253	117.4	± 0.4	194	115.2	± 0.5
M^3						
BBantu (Present Study)	265	126.4	± 0.6	81	123.45	± 1.1
Pecos Indians*	82	113.1	± 0.5	-	-	-
East Gr.Eskimos*	35	117.2	± ?	-	-	-
Aleuts	21	114.9	± 1.7	5	121.3	± 3.4
Tristanites	29	134.1	± 1.9	22	136.1	± 3.0
Norwegian Lapps	184	124.3	± 0.8	150	119.8	± 0.9

TABLE 150

CROWN INDICES OF PERMANENT MANDIBULAR TEETH IN DIFFERENT POPULATION GROUPS ($^{B-L}/_{M-D} \times 100$)

*Combined males and females

POPULATION GROUPS	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
C						
Bantu (Present Study)	264	109.5	± 0.4	96	107.8	± 0.7
Pecos Indians*	94	106.3	± 0.4	-	-	-
East Gr. Eskimos*	7	103.2	± ?	-	-	-
Aleuts	72	110.1	± 1.0	57	112.4	± 0.7
Tristanites	51	125.7	± 1.4	43	123.0	± 1.0
Norwegian Lapps	181	110.4	± 0.5	156	107.3	± 0.5
P_1						
Bantu (Present Study)	300	112.1	± 0.4	101	110.6	± 0.6
Pecos Indians*	105	110.5	± 0.4	-	-	-
East Gr. Eskimos*	12	108.6	± ?	-	-	-
Aleuts	82	111.3	± 0.9	45	111.4	± 0.9
Tristanites	63	126.5	± 0.8	59	122.3	± 1.2
Norwegian Lapps	203	110.1	± 0.4	177	108.7	± 0.5
P_2						
Bantu (Present Study)	293	115.7	± 0.4	92	115.9	± 0.8
Pecos Indians*	91	113.7	± 0.4	-	-	-
East Gr. Eskimos*	19	115.7	± ?	-	-	-
Aleuts	72	117.3	± 0.8	41	116.6	± 0.7
Tristanites	82	127.8	± 0.8	55	128.1	± 1.1
Norwegian Lapps	198	115.2	± 0.5	181	114.0	± 0.5
M_1						
Bantu (Present Study)	277	95.5	± 0.2	84	96.3	± 0.5
Pecos Indians*	67	90.5	± 0.3	-	-	-
East Gr. Eskimos*	29	96.0	± ?	-	-	-
Aleuts	47	91.5	± 0.6	16	92.4	± 1.2
Tristanites	113	99.3	± 0.5	90	100.1	± 0.6
Norwegian Lapps	215	94.7	± 0.3	185	94.5	± 0.3

TABLE 150 (continued)

POPULATION GROUPS	MALES			FEMALES		
	No.	Mean	S.E.	No.	Mean	S.E.
M_2						
Bantu (Present Study)	303	116.1	± 0.4	99	114.5	± 0.7
Pecos Indians*	62	91.6	± 0.3	-	-	-
East Gr. Eskimos*	34	96.0	± ?	-	-	-
Aleuts	44	93.7	± 0.8	36	91.9	± 0.4
Tristanites	78	103.9	± 0.8	71	104.4	± 0.7
Norwegian Lapps	245	95.8	± 0.3	195	95.8	± 0.3
M_3						
Bantu (Present Study)	265	126.4	± 0.6	83	123.5	± 1.1
Pecos Indians*	62	90.7	± 0.4	-	-	-
East Gr. Eskimos*	27	95.2	± ?	-	-	-
Aleuts	13	92.8	± 1.6	16	91.6	± 1.2
Tristanites	12	104.8	± 2.9	15	103.1	± 1.5
Norwegian Lapps	158	96.3	± 0.5	146	96.3	± 0.5

TABLE 151

COMPARISON OF MEAN M-D AND B-L CROWN DIAMETERS OF SHAW (1931) AND THOSE OF MALES IN THE PRESENT STUDY

	M-D CROWN DIAMETER			B-L CROWN DIAMETER		
Tooth	Shaw	Present study	Difference between means	Shaw	Present study	Difference between means
I^1	8.9	8.82	+ 0.08			
I^2	7.2	7.14	+ 0.06			
$\underline{C}$	7.6	7.91	- 0.31	8.2	8.72	- 0.52
P^1	7.2	7.27	- 0.07	9.0	9.61	- 0.61
P^2	7.0	6.80	+ 0.20	9.1	9.61	- 0.51
M^1	10.3	10.64	- 0.34	11.0	11.63	- 0.63
M^2	10.0	10.32	- 0.32	11.5	11.93	- 0.43
M^3	9.5	9.24	+ 0.26	11.0	11.64	- 0.64
I_1	5.9	5.33	+ 0.57			
I_2	6.0	6.06	- 0.06			
$\underline{C}$	7.3	7.33	- 0.03	8.0	8.05	- 0.05
P_1	7.1	7.38	- 0.28	8.2	8.28	- 0.08
P_2	7.2	7.44	- 0.24	8.1	8.58	- 0.48
M_1	11.0	11.39	- 0.39	10.5	10.86	- 0.36
M_2	11.0	11.08	- 0.08	10.3	10.74	- 0.44
M_3	11.1	11.20	- 0.19	10.4	10.59	- 0.19

TABLE 152

TABLE TO ILLUSTRATE TOOTH DIMENSIONS OF THE BANTU NEGROIDS RELATIVE TO OTHER LIVING HUMAN POPULATIONS

MESIODISTAL DIAMETER

TOOTH	MALES				FEMALES			
	Order of largest dimension				Order of largest dimension			
	1	2	3	Medium-sized	1	2	3	Medium-sized
I^1	Austr.Ab.	Swedes	Bantu		Austr.Ab.	Swedes	Bantu	
I^2	Austr.Ab.	Aleut	Bantu		Austr.Ab.	Aleut	Bantu	
C	Austr.Ab.	Swedes	East Gr.Esk.	Bantu	Austr.Ab.	Trist	Swedes	Bantu
P^1	Austr.Ab.	East Gr.Esk.	Bantu		Austr.Ab.	Javanese	East Gr. Esk.	Bantu
P^2	Austr.Ab.	East Gr.Esk.	Swedes	Bantu	Austr.Ab.	Swedes	Japanese	Bantu
M^1	Austr.Ab.	East Gr.Esk.	Am.White	Bantu	Austr.Ab.	East Gr. Esk.	Am.White	Bantu
M^2	Austr.Ab.	Swedes	Am.White	Bantu(4)	Austr.Ab.	East Gr. Esk.	Swedes	Bantu(4
M^3	Austr.Ab.	East Gr.Esk.	Swedes	Bantu	Austr.Ab.	East Gr. Esk.	Javanese	Bantu
I_1	Austr.Ab.	Chinese	Pecos Ind.	Bantu	Austr.Ab.	Trist.	Swedes	Bantu
I_2	Austr.Ab.	Chinese	Pecos Ind.	Bantu	Austr.Ab.	Javanese	Trist.	Bantu
C	Austr.Ab.	Bantu	Chinese		Austr.Ab.	Bantu	Trist.	
P_1	Austr.Ab.	Bantu	Javanese		Austr.Ab.	Bantu	Swedes	
P_2	Austr.Ab.	Bantu	Pecos Ind.		Austr.Ab.	Bantu	Swedes	
M_1	Austr.Ab.	East Gr.Esk.	Pecos Ind.	Bantu	Austr.Ab.	East Gr. Esk.	Javanese	Bantu
M_2	East Gr.Esk.	Austr.Ab.	Pecos Ind.	Bantu	East Gr.Esk.	Aleut	Austr.Ab.	Bantu
M_3	Austr.Ab.	East Gr.Esk.	Swedes	Bantu	Austr.Ab.	Aleut	East Gr. Esk.	Bantu

BUCCOLINGUAL DIMENSION

TOOTH	MALES				FEMALES			
	Order of largest dimension				Order of largest dimension			
	1	2	3	Medium-sized	1	2	3	Medium-sized
C	Trist.	Austr.Ab.	Bantu		Trist.	Austr.Ab.	Eskimo	Bantu
P^1	Austr.Ab.	Pecos Ind.	Trist.	Bantu	Austr.Ab.	Trist.	Javanese	Bantu
P^2	Austr.Ab.	Trist.	Javanese	Bantu(4)	Austr.Ab.	Trist.	Bantu	
M^1	Austr.Ab.	Trist.	Esk/Jav.	Bantu	Austr.Ab.	Trist.	East Gr.Esk.	Bantu(4)
M^2	Austr.Ab.	Trist.	Bantu		Austr.Ab.	Trist.	Bantu	
M^3	Austr.Ab.	Trist.	Bantu		Trist.	Austr.Ab.	Bantu	
$\bar{C}$	Trist.	Austr.Ab.	Bantu		Trist.	Austr.Ab.	Aleut	Bantu(4)
P_1	Austr.Ab.	Trist.	Bantu		Austr.Ab.	Trist.	Bantu	
P_2	Trist.	Austr.Ab.	Bantu/Esk.		Trist.	Austr.Ab.	Bantu	
M_1	Austr.Ab.	East Gr.Esk.	Trist.	Bantu	Austr.Ab.	Trist.	East Gr.Esk.	Bantu
M_2	Austr.Ab.	Trist.	East Gr.Esk.	Bantu(4)	Austr.Ab.	Trist.	East Gr.Esk.	Bantu(4)
M_3	Trist.	Austr.Ab.	East Gr.Esk.	Bantu(4)	Austr.Ab.	Trist.	Bantu	
			CROWN AREA					
C	Trist.	Bantu	Aleut		Trist.	East.Gr.Esk.	Aleut	Bantu
P^1	Bantu	East Gr.Esk.	Trist.		East Gr.Esk.	Trist.	Bantu	
P^2	Bantu	Trist.	East Gr.Esk.		Trist.	Bantu	East Gr.Esk.	
M^1	Trist.	East Gr.Esk.	Bantu		East Gr.Esk.	Trist.	Bantu	
M^2	Trist.	Bantu	East Gr.Esk.		East Gr.Esk.	Trist.	Bantu	
M^3	Bantu	East Gr.Esk.	Trist.		East Gr.Esk.	Trist.	Bantu	
$\bar{C}$	Trist.	Bantu	Aleut		Trist.	East Gr.Esk.	Aleut	Bantu
P_1	Trist.	Bantu	Aleut		Trist.	Bantu	East Cr.Esk.	
P_2	Trist.	Bantu	Aleut		Trist.	Bantu	East Gr.Esk.	
M_1	East Gr.Esk.	Trist.	Bantu		East Gr.Esk.	Bantu		
M_2	East Gr.Esk.	Trist.	Bantu		East Gr.Esk.	Aleut	Trist.	Bantu
M_3	Trist.	East Gr.Esk.	Bantu		East Gr.Esk.	Trist.	Bantu	

CHAPTER 8

VARIABILITY IN PALATAL, DENTAL ARCH AND TOOTH MEASUREMENTS

In this chapter the metrical and indicial variability of the bony palate, maxillo-alveolar dental arch and individual tooth dimensions will be discussed. Further, the various palatal, dental arch and tooth measures of male and female Bantu series are classified in descending order of variability. Following Pearson and Davin (1924), coefficients of variation are used here for absolute measures and standard deviations for angles and indices. The coefficients of variation have been divided into the following grades:- high variation, over 6 percent, moderately high variation 4.5 to 6, moderately low variation 3.5 to 4.5, and low variation less than 3.5 per cent.

The variability in the South African Bantu Negroid will be discussed under the following headings:-

A. Variability in palatal and dental arch measurements.

B. Variability in teeth.

A. VARIABILITY IN PALATAL AND DENTAL ARCH MEASUREMENTS

i. Variations of absolute measurements

(a) Sex variability

Table 153 gives the coefficients of variation of absolute palatal and dental arch measurements in the South African Bantu Negroid series by sex. The underlined female values

xceed the corresponding male values. The table shows that in only five instances are the male coefficients of variation larger than those of females, whereas for the remaining thirteen characters the position is reversed. The absolute differences between the corresponding values of the coefficients of variation are in most cases small. The sex differences in C.V. are greater than unity in only two measures, viz. the odontometric mandibular arch length (C.V. males 7.8 per cent, females 12.2. per cent) and palatal breadth (C.V. males 8.0 per cent, females 6.8 per cent).

Generally there is an overall similarity of individual values which is reflected by the approximately similar mean coefficients of variation (males 6.13 per cent, females 6.50 per cent) for palatal and dental arch measurements. There is no appreciable sexual differentiation of these measures in the Bantu. De Villiers (1964), too, in her study of Bantu cranial nd mandibular characters found very little sexual ifference in variability.

Variability of individual measures

The various palatal and dental arch dimensions are graded in Table 154 according to the method suggested by Pearson and Davin (1924). Almost all the absolute measurements in the Bantu fall into the categories of moderately high and high variability. Since all measures of palatal and dental arch lengths and breadths are closely related, it is not

unexpected that nearly all should fall into the same categories of variability.

The bizygomatic diameter, however, falls into the category of moderately low variation. This agrees with a similar observation by de Villiers (1964).

(ii) Variation of Angles and Indices

(a) Sex variability

Tables 155 and 155A list the standard deviations of palatal maxillo-alveolar indices and angles respectively in the Bantu by sex. As in the previous table, underlined female values exceed the corresponding male values.

In all but two characters in table 155 do the standard deviations of males exceed those of females. The mean standard deviations of the palatal and Izard's indices of females (S.D. 7.21 per cent and 2.44 per cent respectively) are higher than the corresponding indices in males, viz. S.D. 7.01 per cent and 2.22 per cent respectively. In no instance is the sex difference greater than unity. The overall similarity of individual values is reflected by equal mean standard deviations (mean S.D. for males and females being 4.65 per cent).

In table 155A the standard deviations of the profile angles in the males exceed those of females, the sex difference in no instance being greater than unity. The mean standard deviations of the males (S.D. 3.30 per cent) and females (S.D. 3.17 per cent) is an indication of an overall similarity of individual values.

(b) Variability of individual angles and indices

The mean standard deviations of palatal and maxillo-alveolar indices in Bantu males and females are all in the vicinity of 7 (Table 156). An S.D.

greater than 6 is regarded as connoting high variability. The variability of an index depends essentially on the variability of its components (Pearson and Davin, op.cit., p.346). This observation applies in general to the variability exhibited by the indices in the present Bantu series. For most indices formed by the ratio of characters, one or both of which are taken from the low or moderately low category of variability, fall into the lower category of index variability. On the other hand, indices formed by the ratio of characters taken from the category of high and moderate variability fall into a higher category of index variability. Since all the palatal and dental arch lengths and breadths are located in the high or moderately high category of variation, it is not unexpected that their indices should fall into the high variation category.

Izard's mean index (S.D. males 2.22 per cent, females 2.44 per cent) and Berger's mean index (S.D. males 2.36 per cent, females 1.97 per cent) showed low variances. Also the mean standard deviations of the various profile angles (facial: males 3.21 per cent, females 2.89 per cent; nasal: males 3.01 per cent, females 3.00 per cent; alveolar: males 3.69 per cent, females 3.63 per cent) evince moderately low and low degrees of variation. This low degres of variation in facial profile angles suggests a consistent facial profile

pattern which in the Bantu is generally prognathous.

B. VARIABILITY IN TEETH

M-D and B-L crown diameters

(a) Sex variability

The coefficients of variation of mean M-D and B-L crown diameters of the teeth in the South African Bantu Negroid are listed in Table 157. The underlined female dimensions are those which exceed the corresponding male values. In the M-D tooth dimensions, the male coefficients of variation are larger than those of females in 11 out of 16 comparisons. The coefficients of variation are larger than those of females in 11 out of 16 comparisons. The coefficients of variation of the M-D diameters of I^2, P^2, M^3, M_1 and M_3 in females are larger than the corresponding male coefficients. The absolute differences between the corresponding male and female values of coefficient of variation, with the exception of M^3, I_1 and P_1, are small and below unity. The M^3 evinces the greatest sex difference in M-D diameter, i.e. C.V. males 7.88 per cent, C.V. females 10.91 per cent.

The small differences in the means of the coefficients of variation of the M-D crown dimensions of the maxillary and mandibular teeth (maxilla: males 6.70 per cent, females 6.90 per cent; mandible: males 6.87 per cent, females 6.22 per cent) are a reflection of the overall similarity of the individual measures.

As regards B-L crown dimensions, the coefficients of variation in Bantu males are higher than those of females in only five teeth, namely, I^2, P^2, $\bar{C}$, P_1 and P_2. The sex differences between corresponding male and female values are generally small and below unity; only P^2 and M^3 show C.V.'s with sex differences which are greater than unity. The C.V. of M^3 evinces the greatest sex difference (C.V. males 6.72 per cent, females 10.46 per cent), whereas that of P^2 is less (C.V. males 8.04 per cent, females 6.16 per cent).

The overall similarity of individual male-female coefficient is reflected by the small differences in the mean coefficients of variation of these teeth (maxilla: males 6.41 per cent, females 6.92 per cent; mandible: males 6.06 per cent, females 6.13 per cent).

(b) Variability of individual measures

All the absolute M-D and B-L crown diameters of Bantu teeth fall into the categories of high or moderately high variability (Table 158).

The maxillary teeth with the lowest degree of variation of M-D crown dimensions are M^1 (C.V. males 4.96 per cent, females 4.89 per cent) and C (C.V. males 5.46 per cent, females 5.11 per cent).

The mean B-L crown diameters of P^1 and M^1 in the maxilla are the least variable with male and female coefficients of variation of 4.60 per cent and 5.61 per cent in P^1, and 5.08 per cent and 5.28 per cent

for M^1 respectively.

The mandibular teeth with the smallest degree of variation in M-D crown dimension is P_1 in females (C.V. 4.92 per cent).

In the mandibular arch, the least variable B-L crown dimension is that of M_1 (C.V. 4.91 and 4.96 per cent in males and females respectively).

Maxillary teeth with the highest variability of M-D crown diameters are I^2 (C.V. males 9.50 per cent, females 9.72 per cent) and M^3 (C.V. males 7.88 per cent, females 10.91 per cent).

In the lower jaw, the M-D crown dimensions of M_3 in males (C.V. 7.78 per cent) and females (C.V. 8.00 per cent) and I_1 in males (C.V. 7.97 per cent) show the highest coefficients of variation.

Maxillary teeth with the highest degree of variability of B-L crown dimensions are I^2 in both sexes (C.V. males 8.04 per cent, females 7.99 per cent), P^2 in males (C.V. 8.04 per cent) and M^3 in females (C.V. 10.46 per cent), the latter (as with M-D dimensions) evincing the highest degree of variability.

Mandibular teeth with the highest coefficients of variation in B-L crown diameter are I_1 and M_2 in females with C.V. of 7.43 per cent and 7.00 per cent respectively and $\bar{C}$ in males (C.V. 6.88 per cent).

Crown Area

(a) Sex variability

The table of coefficients of variation of crown areas (Table 159) shows that the female values (underlined) are higher than the corresponding male values in 8 of the 16 teeth, although I^2 should be regarded as equal. The position is reversed in the remaining half of the teeth. The absolute differences between the corresponding male and female values are of a fairly high order; in no fewer than 11 teeth are the sex differences greater than unity. This sex difference is highest in M^3 (C.V. males 12.91 per cent, females 17.90 per cent). The difference in the mean co-

is highest in M^3 (C.V. males 12.91 per cent, females lar 17.90 per cent). The differ, viz: maxilla: males 11.53 per cent, females 11.29 per cent, mandible: males 11.62 per cent, females 11.87 per cent.

(b) Variability of Individual measures

The crown areas of all the teeth in the Bantu fall into the category of high variability, i.e. ≥ 6. The female $\underline{C}$ (C.V. 7.24 per cent), female P^1 (C.V. 8.48 per cent) and female M^1 (C.V. 8.61 per cent) exhibit the smallest degree of variation of crown area.

The M^3 in females evinces the largest coefficient of variation (17.90 per cent). This is not surprising if we recall that the same tooth in Bantu females possesses the highest degree of variation in its M-D

and B-L crown dimensions. The coefficients of variation of I^2 in males (14.95 per cent) and females (14.97 per cent) and I_1, I_2 and M_3 in females with coefficients of variation of 15.79 per cent, 14.90 per cent and 14.12 per cent respectively are likewise large.

Crown Shape Indices

(a) Sex Variability

Table 160 lists the standard deviations of crown indices in teeth of both sexes. In the upper jaw, all the mean standard deviations of female Bantu (underlined), with the exception of I^1, are larger than the corresponding male values. In the lower jaw, only the standard deviations of $\bar{C}$, M_1 and M_3 in females are larger than the corresponding male values. The absolute differences between the corresponding male and female values, with the exception of M^1, are small and below unity. The sex difference in M^1 is larger (S.D. males = 5.39 per cent, females = 8.44 per cent). The overall similarity of individual values is reflected in the small differences in the mean standard deviations of these teeth (S.D. maxillary teeth in males 7.62 per cent, in females 7.59 per cent; S.D. mandibular teeth in males 6.27 per cent, in females 6.17 per cent).

(b) Variability of individual measures

The mean crown shape indices of most of the teeth in the Bantu fall into the category of high variability, i.e. >6 (Table 161). The I^2 and M^3 of both sexes

and P^2 and M^1 in females (S.D. I^2 males = 7.95 per cent, females = 8.22 per cent; S.D. M^3 males = 9.42 per cent, females 9.71 per cent; S.D. P^2 and M^1 in females = 8.56 per cent and 8.44 per cent respectively) evince the greatest degree of variation in crown shape in the upper jaw. The M^3 in both sexes is the most highly variable, then I^2 and P^2 in both sexes and M^1 in females.

In the lower jaw I_1 (S.D. males = 8.68 per cent, females = 8.05 per cent) and I_2 (S.D. males = 8.15 per cent, females = 7.75 per cent) are the most variable in crown shape followed by P_2. The M^1 in males (S.D. 5.39 per cent), I^1 in females (S.D. 5.72 per cent) and M_3 in both sexes (S.D. males = 4.56 per cent, females = 4.65 per cent) fall into the category of moderately high variability, whereas M_1 (S.D. males = 3.93 per cent, females = 4.42 per cent) and M_2 (S.D. males = 4.41 per cent, females = 4.15 per cent) evince the smallest degree of variation, with S.D.'s between 3.5 per cent and 4.5 per cent.

SUMMARY

In general the sex differences in absolute and relative palatal and dental arch lengths and breadths are small. The individual variability of these absolute dimensions is rated moderately high or high. The degrees of variation of the profile, nasal and alveolar facial angles are low.

The absolute differences in variation of M-D crown dimension between corresponding Bantu male and female teeth

are generally small. The greatest sex difference in these dimensions is observed in M^3.

The degree of variation in B-L crown dimension between the sexes is likewise small and in most instances is below unity. The greatest sex differences are noted in M^3 and P^2.

The M-D and B-L crown diameter of all Bantu teeth fall into the category of moderately high or high variability.

In the upper jaw the mean M-D crown diameters of I^2 and M^3 in both sexes are the most variable, whereas in the lower jaw the most variable M-D crown dimensions are noted in M_3 of both sexes and I_1 in males.

The teeth with the lowest variation of M-D crown dimension in the upper jaw are $\underline{C}$ and M^1 in both sexes, whereas in the lower jaw P_1 in females and M_1 in males evince the lowest degree of variation.

The B-L crown diameters of I^2 in both sexes, and M^2 and M^3 in females, exhibit the greatest degree of variability in the upper jaw, whereas in the lower jaw the most variable teeth are those of I_1 and M_2 in females and $\bar{C}$ in males

Teeth with the least degree of B-L crown diameter variation in the upper jaw are P^1 and M^1 in males and females, and M_1 in the lower jaw of both sexes.

The sex differences in crown area of corresponding teeth in Bantu are fairly high, the differences in eleven instances being greater than unity.

The crown areas of all the teeth fall into the category of high variability, i.e. ≥ 6.

In the upper jaw, the most variable crown areas in teeth are those of I^2 and M^3, whereas the least variable are those of M^1 in both sexes, M^2 in males, and $\underline{C}$ and P^1 in females.

In the lower jaw, I_1 and M_3 in both sexes and I_2 in females evince the greatest degree of variation in crown area, whereas M_1 in both sexes, and P_1 and M_2 in females, are the least variable.

The sex differences in degree of variation in the corresponding mean values of crown shape indices of all the teeth in the Bantu with the exception of M^1, are of a low order and below unity.

In the upper jaw I^2 and M^3 in both sexes and P^2 and M^1 in females exhibit the greatest degree of variation in crown shape, whereas in the lower jaw, the shape variability is greatest in I_1 and I_2 in both sexes.

Teeth with the least degree of crown shape variability are those of I^1 in both sexes, and P^1 and M^1 in males in the upper jaw. The least variable crown shapes in the lower jaws of both sexes are M_1, M_2 and M_3.

TABLE 152

COEFFICIENTS OF VARIATION OF PALATAL AND MAXILLO-ALVEOLAR MEASUREMENTS IN SOUTH AFRICAN BANTU NEGROIDS (%)

Character		Male	Female
Palatal length		6.5	6.6
Palatal breadth		8.0	6.8
Palatal height		12.7	12.9
Maxillo-alveolar length	Biometric method	5.3	5.8
" " breadth	Biometric method	4.8	5.4
Maxillary arch length	Anthropometric method	6.1	5.8
" " breadth	Anthropometric method	4.7	5.0
Mandibular arch length	Anthropometric method	5.4	5.3
" " breadth	Anthropometric method	4.6	5.0
Maxillary arch length	Odontometric method	5.8	6.2
" " breadth	Odontometric method	5.6	6.2
Mandibular arch length	Odontometric method	7.8	12.2
" " breadth	Odontometric method	5.5	6.6
Bicuspid width (Maxilla)		5.3	5.6
" " (Mandible)		7.7	6.1
Bizygomatic diameter		4.1	3.9
Maxillary arch breadth (Izard)		4.8	5.4
" " " (Berger)		5.6	6.2
	Mean	6.13	6.50

Footnote: The underlined females values exceed the corresponding male values.

TABLE 154

CLASSIFICATION OF VARIABILITIES OF PALATAL AND MAXILLO-ALVEOLAR MEASUREMENTS IN SOUTH AFRICAN BANTU NEGROIDS

Character		C.V.	
		High > 6	
		Males	Females
Palatal length		6.5	6.5
" breadth		8.0	6.8
" height		12.7	12.9
Maxillary arch length (Anthropometric method)		6.1	
" " length	Odontometric method		6.2
" " breadth	Odontometric method		6.2
Mandibular arch length	Odontometric method	7.8	12.2
" " breadth	Odontometric method		6.6
Bicuspid width (Mandible)		7.7	6.1
Maxillary arch breadth (Berger)			6.2
		Moderately high 4.5 to 6	
Maxillo-alveolar length	Biometric method	5.8	5.8
" " breadth	Biometric method	4.8	5.4
Maxillary arch length	Anthropometric method		5.8
" " breadth	Anthropometric method	4.7	5.0
Mandibular arch length	Anthropometric method	5.4	5.3
" " breadth	Anthropometric method	4.6	5.8
Maxillary arch length	Odontometric method	5.8	
" " breadth	Odontometric method	5.6	
Mandibular arch breadth	Odontometric method	5.5	
Bicuspid width (maxilla)		5.3	5.6
Maxillary arch breadth (Izard)		4.8	5.4
" " " (Berger)		5.6	
		Moderately low 3.5 to 4.5	
Bizygomatic diameter		4.1	3.9

TABLE 155

STANDARD DEVIATIONS OF PALATAL ARCH AND MAXILLO-ALVEOLAR INDICES IN SOUTH AFRICAN BANTU NEGROIDS.

Character	Males	Females
Palatal index	7.01	7.21
Maxillo-alveolar index	7.02	6.98
Izard's index	2.22	2.44
Berger's index	2.36	1.97
Mean	4.65	4.65

Footnote: The underlined female values exceed the corresponding male values.

TABLE 155A

STANDARD DEVIATIONS OF PALATAL ARCH AND MAXILLO-ALVEOLAR ANGLES IN SOUTH AFRICAN BANTU NEGROIDS.

Character	Males	Females
Facial profile angle	3.21	2.80
Nasal profile angle	3.01	3.00
Alveolar profile angle	3.69	3.63
Mean	3.30	3.17

TABLE 155

STANDARD DEVIATIONS OF PALATAL ARCH AND MAXILLO-ALVEOLAR ANGLES AND INDICES IN SOUTH AFRICAN BANTU NEGROIDS

Character	Males	Females
Palatal index	7.01	7.21
Maxillo-alveolar index	7.02	6.98
Izard's index	2.22	2.44
Berger's index	2.36	1.97
Facial profile angle	3.21	2.89
Nasal profile angle	3.01	3.00
Alveolar profile angle	3.69	3.63
Mean	4.07	4.02

Footnote: The underlined female values exceed the corresponding male values.

TABLE 156

CLASSIFICATION OF VARIABILITIES OF PALATAL AND MAXILLO-ALVEOLAR ANGLES AND INDICES IN THE SOUTH AFRICAN BANTU NEGROIDS

Character	S. D.	
	High >6	
	Males	Females
Palatal index	7.01	7.21
Maxillo-alveolar index	7.02	6.98

	Moderately low 3.5 to 4.5	
	Males	Females
Alveolar profile angle	3.69	3.63

	Low ≤3.5	
	Males	Females
Izard's index	2.22	2.44
Berger's index	2.36	1.97
Facial profile angle	3.21	2.89
Alveolar profile angle	3.01	3.00

TABLE 157

COEFFICIENTS OF VARIATION (%) OF MEAN M-D AND B-L CROWN DIAMETERS OF TEETH IN SOUTH AFRICAN BANTU NEGROIDS

Tooth	M-D Diameter (mm)		B-L Diameter (mm)	
	Males	Females	Males	Females
I^1	7.43	6.77	6.22	<u>7.06</u>
I^2	9.50	<u>9.72</u>	8.04	7.99
$\underline{C}$	5.46	5.11	6.80	<u>7.02</u>
P^1	5.86	5.54	4.60	<u>5.61</u>
P^2	5.62	<u>6.08</u>	8.04	6.16
M^1	4.96	4.89	5.08	<u>5.28</u>
M^2	6.85	6.18	5.80	<u>5.84</u>
M^3	7.88	<u>10.91</u>	6.72	<u>10.46</u>
Mean	6.70	6.90	6.41	6.92
I_1	7.97	6.59	6.71	<u>7.43</u>
I_2	7.71	7.01	5.95	<u>6.63</u>
$\underline{C}$	6.14	5.54	6.88	6.52
P_1	6.18	4.92	6.14	5.97
P_2	7.19	6.56	6.04	5.26
M_1	5.24	<u>5.74</u>	4.91	<u>4.96</u>
M_2	6.71	5.36	5.16	<u>5.29</u>
M_3	7.78	<u>8.00</u>	6.72	<u>7.00</u>
Mean	6.87	6.22	6.06	6.13

<u>Footnote</u>: The underlined female values exceed the corresponding male values.

TABLE 158

CLASSIFICATION OF VARIABILITY OF M-D AND B-L CROWN DIAMETERS IN SOUTH AFRICAN BANTU NEGROIDS

Tooth	M-D Diameter (mm)		Tooth	B-L Diameter (mm)	
	C.V. High > 6			C.V. High > 6	
	Males	Females		Males	Females
I^1	7.43	6.77	I^1	6.22	7.06
I^2	9.50	9.72	I^2	8.04	7.99
P^2		6.08	C	6.80	7.02
M^2	6.85	6.18	P^2	8.04	6.16
M^3	7.88	10.91	M^3	6.72	10.46
I_1	7.97	6.59	I_1	6.71	7.43
I_2	7.71	7.01	I_2		6.63
C	6.14		C	6.88	6.52
P_1	6.18		P_1	6.14	
P_2	7.19	6.56	P_2	6.04	
M_2	6.71			6.72	7.00
M_3	7.78	8.00			
	Moderately high 4.5 to 6			Moderately high 4.5 to 6	
C	5.46	5.11	P^1	4.60	5.61
P^1	5.86	5.54	M^1	5.08	5.28
P^2	5.62		M^2	5.80	5.84
M^1	4.96	4.89			
C		5.54	I_2	5.95	
P_1		4.92	P_1		5.97
M_1	5.24	5.74	P_2		5.26
M_2		5.36	M_1	4.91	4.96
			M_2	5.16	5.29

TABLE 159.

COEFFICIENTS OF VARIATION OF CROWN AREAS OF TEETH IN SOUTH AFRICAN BANTU NEGROIDS (%)

Tooth	AREA		
		Males	Females
I^1		11.92	12.46
I^2		14.95	14.97
$\underline{C}$		10.95	7.24
P^1		11.00	8.48
P^2		11.74	9.72
M^1		9.83	8.61
M^2		8.90	10.90
M^3		12.91	17.90
	Mean	11.53	11.29
I_1		12.54	15.79
I_2		10.83	14.90
$\bar{C}$		11.68	10.75
P_1		11.84	9.43
P_2		11.76	10.44
M_1		9.32	9.76
M_2		11.09	9.78
M_3		13.87	14.12
	Mean	11.62	11.87

Footnote: The underlined female values exceed the corresponding male values.

TABLE 160

STANDARD DEVIATIONS FOR CROWN INDICES IN TENTH OF SOUTH AFRICAN BANTU NEGROIDS

Tooth	S.D.	
	Males	Females
I^1	6.13	5.72
I^2	7.95	8.22
$\underline{C}$	6.77	6.89
P^1	6.17	6.63
P^2	7.82	8.56
M^1	5.39	8.44
M^2	6.47	6.53
M^3	9.42	9.76
Mean	7.02	7.59
I_1	8.68	8.05
I_2	8.15	7.75
$\bar{C}$	6.36	6.81
P_1	6.56	6.22
P_2	7.53	7.29
M_1	3.93	4.42
M_2	4.41	4.15
M_3	4.56	4.65
Mean	6.27	6.17

Footnote: The underlined female values exceed the corresponding male values.

TABLE 161

CLASSIFICATION OF VARIABILITY OF CROWN SHAPE INDICES OF TEETH IN SOUTH AFRICAN BANTU NEGROIDS

Tooth	S.D.	
	High ≥6	
	Males	Females
I^1	6.13	
I^2	7.95	8.22
$\underline{C}$	6.77	6.89
P^1	6.17	6.63
P^2	7.82	8.56
M^1		8.44
M^2	6.47	6.53
M^3	9.42	9.71
I_1	8.68	8.05
I_2	8.15	7.75
$\bar{C}$	6.36	6.81
P_1	6.56	6.22
P_2	7.53	7.29
	Moderately high 4.5 to 6	
M^1	5.39	
I^1		5.72
M_3	4.56	4.65
	Moderately low 3.5 to 4.5	
M_1	3.93	4.42
M_2	4.41	4.15

CHAPTER 9
SEXUAL DIMORPHISM OF THE JAWS AND TEETH IN THE SOUTH AFRICAN BANTU NEGROIDS

In this chapter, the sex differences in various features of Bantu jaws and teeth are discussed in the same sequence as in the chapters describing those features.

Occlusion of the teeth

No notable sex differences are observed in the incidence of various types of occlusion in the Bantu. The figures from the British Dental Association Reports (Brash, McKeag and Scott 1956) include some information suggestive of differential sex incidence, but there is certainly not sufficient evidence, either in those Reports or in the present study, to provide a clear answer to the question whether there are any significant sex differences in irregularity and malocclusion as a whole.

Spacing and mid-diastemata

The incidence of generalized spacing of teeth is slightly higher in Bantu males than in females. Likewise the incidence of maxillary, as well as that of mandibular midline diastemata, is only slightly higher in males. The male maxillary and mandibular dental arches are generally larger than those of females and consequently more readily able to accommodate all the teeth, frequently with room to spare. The lack of available data makes it impossible at this stage to establish whether this is a general sex difference.

Crowding

The percentage incidence of crowded teeth in the maxillae and mandibles of the Bantu is remarkably similar in to the two sexes. The available information regarding the incidence of crowding is limited, but from the B.D.A. reports, according to Brash, McKeag and Scott (1956), it would appear that there are no differences in the degree of crowding between sexes in various populations.

Occlusal and interproximal attrition

The calculated indices of occlusal attrition in Bantu reveal that the degree of attrition in males is greater than that of females. This observation is in accord with the general tendency by which males of most populations tend to wear their teeth more rapidly and to a greater degree than females. There are, however, exceptions to this phenomenon as pointed out by Heithersay (1959,1960) and Davies and Pedersen (1955), in which, owing to social and dietary habits, females of certain population groups exhibit more attrition than males.

The amount of interproximal attrition in the Bantu is consistently slightly less in females than in males of various age groups. The pattern of age changes in the degree of interproximal attrition generally coincides with that in the amount of occlusal attrition.

Overbite

About half the Bantu males exhibit an edge-to-edge incisor bite, whereas only 16 per cent of females

evince this incisor relationship, the incidence thus being approximately three times greater in males. The overlap seen most frequently in females is that of a quarter of a tooth overbite (42.1 per cent of the sample).

Dental arch shape

The modal arch form in the maxillae of males is the hyperbolic type of arch, whereas in females it is the parabolic arch type.

Sutures of the horizontal palate

Horizontal palatal sutures are continuous in a higher percentage of Bantu males (54.2 per cent) than in females (37.7 per cent). Asymmetrical patterns are more frequent in females.

These findings are not very different from those of Shaw (1931) for his combined sample of male and female Bantu. In his study on Australian Aboriginals, Campbell (1925) noted that palatal sutures meet in the midline in 23.5 per cent of crania, about half the incidences recorded in the present Bantu study.

Measures of size and shape of the palate

Bantu males have mean palatal lengths and breadths which are significantly larger than those of females. De Villiers (1964) in her study on Bantu crania noted similar sex differences for these dimensions. In fact, male palatal dimensions are larger than those of females in virtually all populations studied.

The mean palatal index for Bantu males is higher (indicating a relatively broader palate) than that of females, the sexual difference, however, not being significant. This too is in accord with the observations of de Villiers's study. Palatal indices in males and females of various populations generally do not differ greatly from each other, the Bantu not being an exception to the rule.

There is no appreciable sexual differentiation in the degree of variability of absolute and relative palatal and dental arch measures and indices in the Bantu.

The mean palatal index for males falls at the low end of the brachystaphyline category, whereas the mean female palatal index is located at the upper end of the mesostaphyline category. The present study differs from that of de Villiers (1964) in which the modal index category for all her Bantu groups is leptostaphyline.

The palatal depths in Bantu males are significantly greater than in females. This agrees with the findings of de Villiers, although she used a different method of determining palatal height in the Bantu. In his study of Bantu-speaking Negroes of the Zulu tribe, Sperber (1958) too noted this sexual dimorphism in palatal depth. As in the Bantu, the palatal depths in Medieval Swedes are greater in males than in females (Lysell 1958). In their Bushman study, Pittard et Trolliet (1932/3), and Sperber (1958) in his study of the Bantu-Bush, likewise recorded greater palatal depths in males than in females. On the

other hand, in the /?Auni‡Khomani and Lake Chrissie Bushman, the palatal depths in females are greater than in males (Sperber 1958).

Measures of size and shape of dental arches

Various methods, such as the biometric, anthropometric and odontometric, have been used to measure length and breadth of the dental arches in the Bantu. In each instance, the mean male length and breadth are significantly larger than those of females. The mean bicuspid width in males is likewise significantly larger than that of females.

These findings are not unexpected in that, according to de Villiers (1964), a metrical analysis of the characters of the maxilla, palate, bizygomatic breadth and coronoid processes showed the dimensions of the male to be significantly greater than those of the female. In virtually all populations this is the case. De Villiers, using the biometric method of measuring, recorded significant differences in lengths and breadths of the dental arches between males and females in the Bantu.

Seipel (1946), too, using an odontometric measuring technique on Swedes, noted sex differences in maxillo-alveolar dimensions.

The significantly larger mean maxillo-alveolar index in males indicates that they have relatively broader dental arches than females. De Villiers found that brachyurany was characteristic of her sample of South African Negro. The present study however

supports the views of Shaw (1931) and Galloway (1941), who found that the maxillo-alveolar indices in the Bantu were generally mesouranic.

Relationship between dental arch measurements and facial measurements

The mean bizygomatic diameter of the Bantu male is larger than that of the female. This confirms de Villiers's (1964) data on the Bantu.

The maxillary and mandibular arch breadths of Bantu males, as determined by the methods of Izard (1927) and of Berger (1938), are likewise significantly larger than those of females. This again is not unexpected in view of all the significantly larger mean palatal and maxillo-alveolar dimensions of Bantu males.

Whereas Izard's mean index for Bantu males is larger than that for females, Berger's index evinced no significant sex difference. Unfortunately neither Izard nor Berger provided comparative tables. Moorrees (1957), on the other hand, in his study of the Aleut, was the only other investigator, to the writer's knowledge, who used these measurements; unfortunately no figures were recorded separately for males and females.

Prognathism

The mean total profile angle in Bantu males and females places them in the lower (near-progmathous) part of the mesognathous category. The mean nasal and alveolar profile angles for both sexes fall into the orthognathous and mesognathous classes respectively. None of the profile angles in Bantu males differed significantly from those of females.

Few comparisons are possible in that most studies on prognathism recorded prognathism for combined sexes. Górnay (1957) found no sex difference in total facial prognathism for Uganda Negroes. De Villiers (1964) likewise determined no sex difference in facial prognathism in her study of Southern Bantu.

Shovel-shaped maxillary incisor teeth

Bantu females exhibit a greater degree of shovelling (of all grades) of maxillary central and lateral incisor teeth than males. The incidence of all grades of shovelling of central incisors is 11.3 per cent in males, and 19.4 per cent in females. The incidence of all grades of shovelling in lateral incisors of females is nearly double that of males (33.5 per cent and 61.1 per cent in males and females respectively). The maxillary central and lateral incisors in American Whites, too, evince a greater incidence of all grades of shovelling in females than in males. In American Negroes, however, it is the males that exhibit a greater incidence of shovelling than females, the sex difference in central incisors, however, being minimal (Hrdlička 1920). Dahlberg (1951) recorded little sex difference of all grades of shovelling of Pima Indian permanent incisors. From the limited data available, it would appear that sex differences in shovelling of maxillary incisor teeth in various population groups follow no particular trend or pattern.

Median ridges and lingual tubercles in maxillary incisors

The percentage incidence of marked lingual ridges in the Bantu is small (none in females, 1.6 per cent in males). In males, 41.6 per cent and in females 60.0 per cent exhibit a slight or moderate degree of ridging of their central incisors. The lateral incisors of both sexes evince a lower incidence of these ridges, viz., 30.6 per cent in males, 40.0 per cent in females. The incidence of slight or moderate ridging in central and lateral incisor teeth [redacted] is thus higher in females than in males.

A little more than, and slightly fewer than, half of the maxillary central and lateral incisors respectively in males possess smooth lingual surfaces. The incidence of smooth surfaced incisors is slightly [illegible] in females.

The incidence of lingual tubercles (all grades) in central incisor teeth in females (14.0 per cent) is approximately three times as great as that of males (4.7 per cent). In lateral incisor teeth, the incidence of all grades of tubercles is likewise higher (but to a lesser extent) in females (16.9 per cent) than in males (11.4 per cent).

In spite of vertical ridges being one of the most conspicuous points of variability in the anterior teeth of man (Lasker 1950), data on sex differences are unavailable This lack of comparative data applies

equally to lingual tubercules, despite considerable interest in this direction.

Outline shapes of maxillary incisors

In the Bantu series, square teeth are seen in about a third of the teeth in males and in approximately a quarter of the teeth in females. Ovoid teeth are seen in a little over 30 per cent of males, and a little under 30 per cent of females, the incidence of tapered teeth being the same for both sexes.

It would appear that the general tendency is for males to have the square to ovoid shaped maxillary incisors, whereas females tend towards the ovoid to tapered shapes. This broader shape tendency in males may possibly be attributed partly to the fact that these teeth in males are mesiodistally broader than those of females. To the writer's knowledge, no other authors have commented on sex differences in outline shapes of these teeth in various populations.

The number of cusps on the maxillary molars

All Bantu male maxillary first molars, and nearly all female maxillary first molars have four cusps. A little over 70 per cent and a little under this percentage of males and females respectively possess four-cusped second molars. The incidence of combined 4- and 3+- cusped maxillary third molars is approximately 66 per cent in males and females. The sex differences in the Bantu conform with those in other

populations (Moorrees 1957), males being less inclined than females towards a reduction in the number of cusps in the maxillary molars.

Tubercle of Carabelli

The incidence of Carabelli's tubercle in maxillary first and second molars is slightly higher, and in third molars, slightly lower in females than in males. Large, well-developed Carabelli tubercles, however, are more frequently seen in males.

Neither Shaw (1931) nor Shapiro (1949) in their studies of this tubercle in the Bantu, or for that matter, any other available studies, differentiated between the sexes.

Cusp and groove pattern of the mandibular molars

The most frequent cusp and groove pattern on the M_1's in males and females is the Y5 pattern. The incidence of this pattern is slightly higher in males than in females.

The M_2's of both sexes are mainly quadricuspid. No sex differences are evident.

The percentage incidence of the Y5 pattern in M_3's in males is 6.6 per cent, but in females the incidence is six times greater (39.6 per cent). On the other hand the incidence of the +5 cusp pattern in males (55.9 per cent) is higher than that in females (37.9 per cent).

Sex differences have been given scant attention in the literature and most studies have recorded figures for males and females combined. Hellman(1928)

contended that males tend to be more conservative in their retention of the Y5 pattern than females. In the Aleuts, Moorrees (1957) noted that sex differences were pertinent only with regard to the findings reported for second molars. Aleut females, according to Moorrees, showed a greater reduction in cusp numbers of this tooth than in males. Goldstein (1931) in his study of the Alaskan Eskimo reported a smaller sex difference for the occurrence of five cusps on this tooth (M_2).

The incidence of the tuberculum sextum, although not high in the Bantu, is slightly higher in females than in males.

Likewise the incidence of the accessory lingual tubercle is slightly higher in females.

Buccal grooves and pits

No outstanding sex differences in the percentage incidence of the various depths of buccal grooves or pits are observed in the Bantu. Here again, unfortunately, no comparative data on sex differences are available for comparison.

Paramolar cusps

Paramolar cusps are rare in the Bantu. In males, out of a total of 1564 maxillary molar teeth examined, only 8 paramolar cusps have been seen, and in females, 2 paramolar cusps have been noted out of a total of 443 maxillary molars examined. The incidence of paramolar cusps in the upper jaws of both males and females is therefore similar, viz. 0.05 per cent.

In the lower jaw in males, 22 paramolar cusps were recorded out of a total of 1566 molar teeth examined (0.14 per cent), while in females, out of 419 molars examined, 6 paramolar cusps were observed (0.14 per cent). As in the maxilla, there is no difference in the sex incidence of these cusps in the lower jaw.

Odontometric measurements

The mean M-D crown diameters of all the maxillary teeth in Bantu males, with the exception of P^2, are significantly larger than those of the corresponding teeth in females. The mean M-D diameter of P^2 in males is larger than in females but not at a significant level.

In the mandibular arch, the mean M-D dimensions of all the teeth in Bantu males, with the exception of I_1 and I_2, are significantly larger than those of females. The M-D dimensions of these incisors are larger than those of females, but at a level which is not significant. These findings are not unusual, in that males generally have greater M-D crown diameters than females in all groups where the findings have been reported separately for the sexes. Sex differences in M-D diameters in the Bantu are greater for the mandibular than for the maxillary teeth. Moorrees (1957), in his study of the Aleuts, too, noted this sex characteristic.

The mean B-L crown diameters of all the teeth (maxillary and mandibular) in Bantu males are larger than those of the corresponding teeth in females at a

significant level. This observation too is not unexpected in that male M-D dimensions are usually larger than those of females in other population groups.

From the sex ratios of various teeth, it is found that the teeth which are most strikingly sexually dimorphic in size and shape in the Bantu are the maxillary canines, the maxillary third molars, and the mandibular canines. Their mean M-D and B-L crown diameters, and consequently their crown areas, are the most sexually dimorphic. That the canines are sexually different is not unusual, in that in virtually all population groups maxillary and mandibular canines tend to exhibit the greatest degree of sexual dimorphism in their M-D and B-L crown dimensions. Different teeth exhibit different degrees of sexual dimorphism in various populations. Mean M-D and B-L crown dimensions are therefore of value in differentiating among not only population groups, but among populations belonging to the same racial subgroups. Selmer-Olsen (1949) in a study of the Lapps, and Moorrees (1957) in his Aleut study, noted in their respective investigations that interpopulation differences are more distinct for males than for females. The sex differences of individual teeth in the Bantu were not compared with those of other population groups.

All the teeth in the maxillae of Bantu males, with the exception of M^3, have larger crown shape indices than the corresponding teeth of females. The mean crown

significant level. This observation too is not unexpected in that male B-L dimensions are usually larger than those of females in other population groups.

From the sex ratios of various teeth, it is found that the teeth which are most strikingly sexually dimorphic in size and shape in the Bantu are the maxillary canines, the maxillary third molars, and the mandibular canines. Their mean M-D and B-L crown diameters, and consequently their crown areas, are the most sexually dimorphic. That the canines are sexually different is not unusual, in that in virtually all population groups maxillary and mandibular canines tend to exhibit the greatest degree of sexual dimorphism in their M-D and B-L crown dimensions. Different teeth exhibit different degrees of sexual dimorphism in various populations. Mean M-D and B-L crown dimensions are therefore of value in differentiating among not only population groups, but among populations belonging to the same racial subgroups. Selmer-Olsen (1949) in a study of the Lapps, and Moorrees (1957) in his Aleut study, noted in their respective investigations that interpopulation differences are more distinct for males than for females. The sex differences of individual teeth in the Bantu were not compared with those of other population groups.

All the teeth in the maxillae of Bantu males, with the exception of M^1, have larger crown shape indices than the corresponding teeth of females. The mean crown

indices of only four of these teeth however ($\underline{C}$, P^1, M^2 and M^3) are significantly higher in males than in females. The sex differences in crown indices for the remaining maxillary teeth are small.

In the mandibular arch, all the teeth, with the exception of P_2, M_1 and M_2, possess larger crown shape indices in Bantu males than in females. The female mean indices for these teeth (P_2=115.89 per cent, M_1=96.31 per cent and M_2=97.28 per cent) are only slightly larger than those of the corresponding teeth in males, viz: P_2=115.66 per cent, M_1=95.51 per cent and M_2=97.02 per cent). Only $\overline{C}$ and P_1 show significant sex differences, these teeth in males being relatively broader buccolingually (or shorter mesiodistally) than those of females. The sex differences in crown shape indices of the remaining mandibular teeth are small.

The crown shapes of the teeth in Bantu tend to conform with the general tendency whereby males possess relatively broader teeth (buccolingually) than females. Moorrees (1957) however, in his study of Aleuts, recorded larger crown indices for all the maxillary teeth and $\overline{C}$ and M_1 in females than in males. These sex differences in crown shape of various teeth may be useful in differentiating populations.

The variability in absolute differences for M-D crown dimensions between corresponding male and female teeth is generally small, the greatest sex differences

being that of M^3. The variation in absolute differences for B-L crown dimensions between corresponding male and female teeth is likewise small, the greatest sex difference in C. V. being those of M^3 and P^2.

The sex differences in variability of crown areas of corresponding teeth in the Bantu are of a fairly high order. In no fewer than 11 of the total of 16 means of teeth in the Bantu, are the sex differences in C.V. greater than unity.

The sex differences in the variability of crown shape indices of corresponding teeth in the Bantu are of a low order. With the exception of M^1, all the S.D.'s are below unity.

DISCUSSION

The problem of the sex of the jaws and teeth presents two aspects, firstly, the determination of the sex of any individual specimen, and secondly, the assessment of sex difference in a dental series belonging to a known population group. The first type of problem may not be solved with certainty. It may be possible to solve the second kind of problem by using the various morphological and metrical features of the jaws and teeth as a guide to the sex of the individual. Some of these features in the South African Bantu Negroids are markedly different sexually, whereas others differ to a minor extent. The following is a brief survey of these sex differences in the Bantu.

Generally there is no difference between males and females in the manner in which teeth are accommodated in the respective dental arches. The differences between the sexes in occlusion, spacing and mid-diastemata, and crowding are likewise minimal.

Bantu males tend to have palates which are significantly broader, longer and deeper than those of females. The dental arches are likewise generally broader and longer in males than in females. Also the zygomatic arch breadths in males are significantly larger than those of females. Bantu males generally show evidence of a more powerful masticatory apparatus, indicated by the much greater measurements for the total facial height, the length and breadth dimensions of the maxilla and the height dimensions of the mandible (de Villiers 1964). Further support for this view is provided by the greater degree of occlusal and interproximal attrition seen in males. The edge-to-edge incisor relationship which is three times commoner in males than in females possibly also is associated with the more powerful male masticatory apparatus and/or their chewing habits or patterns.

Although the dental arch indices do not reflect significant sex differences, morphologically the modal arch form in Bantu males is the hyperbolic type, whereas in females it is the parabolic type. Horizontal palatal sutures are continuous in a slightly higher percentage of Bantu males, whereas the asymmetrical patterns are more frequent in females.

The outline shapes of the maxillary incisor teeth in Bantu males tend towards being square to ovoid, whereas those of females tend towards the ovoid to tapered shapes. A little more than half the male central incisor teeth have smooth lingual contours, whereas a little less than half tend to be slightly or moderately ridged. In females, the lingual surfaces of 69 per cent of the central incisors are slightly or moderately ridged. Approximately two-thirds of the lateral incisor teeth in males have smooth lingual contours, whereas in females, a little over half the teeth are smooth lingually. The remaining incisor teeth in both sexes have lingual surfaces which are mainly slightly or moderately ridged, marked ridging being infrequently observed in the Bantu.

The incidence of all grades of lingual tubercles in central incisor teeth in females is approximately three times as great as that of males. The sex difference in lateral incisors is not as pronounced.

Although shovelling is not a characteristic feature of maxillary incisor teeth in the Bantu, the incidence in females is greater than that in males, particularly in the lateral incisors.

There are minimal sex differences in the morphology of the maxillary molar teeth in the Bantu. The males are less inclined than the females towards a reduction in the number of cusps in the maxillary molars. There is little sex difference in the incidence of Carabelli's tubercle in these molars, males however tending to have a higher

incidence of marked (cuspoid or lobular) tubercles than females.

The cusp and groove morphology of the mandibular first and second molars likewise evince very little sex differences. However, in lower third molars, the incidence of the Y5 pattern in females is six times greater than in males. This phenomenon appears to be contrary to the general trend whereby males are more inclined than females towards a more conservative cusp number and groove pattern (Hellman 1928). Neither the buccal grooves and pits, nor the incidence of paramolar cusps, tuberculum sextum nor accessory median lingual tubercles in lower molar teeth in the Bantu evince notable sex differences.

The most marked and significant sex difference in teeth in the South African Bantu series are of metrical features. The mean M-D crown diameters of all the teeth (with the exception of P_2, I_1 and I_2), and the mean B-L crown diameters of all the teeth in Bantu males are significantly larger than the corresponding teeth in females. The teeth of males are generally broader buccolingually than those of females. The teeth which are most strikingly sexually dimorphic in size and shape are the $\underline{C}$, M^3 and $\bar{C}$.

In sum, the morphological observations of the jaws and teeth in the South African Bantu Negroid series tend to be less sexually different than those determined metrically.

A further aspect of sexual dimorphism is an apparent sex difference in the expression of physical

type. This phenomenon according to de Villiers (1964), has been remarked upon by several authors, and her own study of the South African Bantu Negroids reveals evidence of 'Boskop' features generally being more frequently associated with males, and Bush features with females. The generally larger male and smaller female dimensions in the present study adds further support to these views.

The abovementioned morphological and metrical features commonly present themselves in typically male and female jaws and teeth, but it should be borne in mind that, in the Bantu, as in other racial groups, that for most features, the ranges of variation of males and females overlap. However, the aforementioned criteria should provide a useful guide to the identification of the probable sex in the jaws and teeth of the South African Bantu Negro.

CHAPTER 10

TRIBAL DIFFERENCES

Among the jaws and teeth of four South African Bantu-speaking Negroid groups, Natal Nguni, Cape Nguni, Sotho and Miscellaneous, certain morphological and metrical differences exist. Tribal identification from an examination of individual skulls is impossible, because of the wide range of variation of features and measurements within the groups (de Villiers 1964). Also, tribal differences, as in most population studies, are slight.

The mean dental arch dimensions and indices, and the mean palatal dimensions, of the various tribal groups reveal no significant group differences. The mean palatal indices, however, show that the Cape Nguni males possess significantly relatively broader palates than the Natal Nguni and Miscellaneous male groups. The Sotho have significantly broader palates than the Miscellaneous males. These metrical observations are borne out in part by morphological observations which in many instances are not readily amenable to measurement but are apparent to the eye. Among such observations are the dental arch contours of the maxilla which in the tribal sub-groups are mainly hyperbolic and parabolic. The Sotho males however have a preponderance of hyperbolic maxillary arches. Also, in the mandible, whereas the two Nguni and Miscellaneous groups possess a large percentage of divergent arches, the Sotho tend to have a greater proportion of broad

hyperbolic arches. The maxillary and mandibular arches in the Sotho are generally broad. The Sotho and the Miscellaneous groups tend to have alveolar profile measurements which are slightly less than those of the two Nguni groups. The relatively broader arches in the Sotho probably account in part for the lesser protrusion of the alveolar profile.

Among morphological features of the teeth, the Cape Nguni tend to have the least conservative cusp number in maxillary molars. The males of the group possess the highest incidence of quadricuspid second molars, whereas the females possess the lowest incidence of four-cusped first, second and third molars. The females of this tribe evince the highest incidence of 3 and 3½ cusped teeth in all three maxillary molars. This tendency of the Cape Nguni towards reduction of cusp pattern is reflected, too, in the lower molars. Lower first molars show no notable inter-tribal (inter-group) differences in the percentage incidence of Y5 molar patterns. The second molars in the Cape Nguni, however, show a greater tendency towards reduction of the Y5 cusp groove pattern.

Among other trival group differences in tooth morphology is the incidence of smooth lingual surfaces of maxillary central and lateral incisor teeth. Sotho males and females and Natal Nguni females have a lower incidence of smooth incisors.

The Natal Nguni possess a relatively high incidence of tuberculum sextum in the lower molars of both sexes.

When crown shapes of the tribal sub-groups are compared, no differences are noted. There are, however, differences in tooth crown sizes among the tribes. The Natal Nguni males possess characteristically smaller maxillary and mandibular first molars and maxillary second molars, based on the smaller mean mesiodistal and buccolingual crown diameters of these teeth.

In contrast, the Cape Nguni males have large maxillary and mandibular first and second molar teeth. The mean mesiodistal and buccolingual crown dimensions of these teeth of Cape Nguni are significantly larger than in other tribal groups. The mandibular lateral incisor teeth of this group tend to be smaller owing to its lesser mesiodistal crown diameter.

Sotho and Miscellaneous males possess large maxillary first premolars. The mean mesiodistal and buccolingual crown diameters tend to be slightly larger than the mean dimensions of the combined groups.

Miscellaneous males evince large maxillary canines and first molars, owing to the large mean mesiodistal crown diameter of the canine, and the large mesiodistal and buccolingual mean crown dimensions of the molar.

The females of the various tribal sub-groups evince small, but not significant differences in crown size.

Author Jacobson A C B
Name of thesis A Morphological and metrical study of the teeth, the jaws and the bony palate of several large groups of South African Bantu-Speaking Negroids 1967

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2013

LEGAL NOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed, or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page) for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.