Dorsey (Geo. A.)

(1). Wormian bones ×××××

(2). The long bones of Kwakiutl & Salish indians.

[From the American Anthropologist for June, 1897]

also p. 174

WORMIAN BONES IN ARTIFICIALLY DEFORMED KWAKIUTL CRANIA

GEORGE A. DORSEY

After a somewhat careful examination of the available medical literature, and especially of the standard textbooks of anatomy, such as Quain, Testut, and the chapter on the skull by Spee in the forthcoming anatomy of von Bardeleben, I fail to find any special mention or reference to any paper on the occurrence of wormian bones in the coronal suture, or in the sutures of crania which have been artificially deformed. It seems that the subject is well worthy of more extended investigation, and I believe that in the collection of Kwakiutl skulls under consideration we have proof, in the unusual frequency of wormian bones in the coronal suture, that artificial pressure on the head of the child has a tendency to lead to anomalous conditions in the suture which is most intimately effected. That artificial pressure exerts an influence on the degree of serration of sutures as well as a disturbance in the normal time of closure of such sutures can, it seems to me, be reasonably demonstrated by a study of Peruvian crania, where within close limits we find the two extreme types of artificial deformation.

The Kwakiutl skulls in the Field Columbian Museum number about 60. Of these 35 are of adults, with sutures open or partially so, and hence suitable for examination, and percentages to be made hereafter will be based on the latter number. These skulls have all been artificially deformed by bandages which encircled the head in the region of the coronal suture and passed backward and downward over asterion. All the skulls, more-

presented by the author

over, show to a greater or less extent the effect of pressure on the frontal bone.

The series may be roughly divided into two groups: those which show the force of the bandage in the form of a broad, deep groove at or just behind the coronal suture, and those which do not show a groove. In the first group I have recorded 9 cases and in the second one case of one or more wormian bones in the coronal suture, thus making 10 in all. I copy from my notes

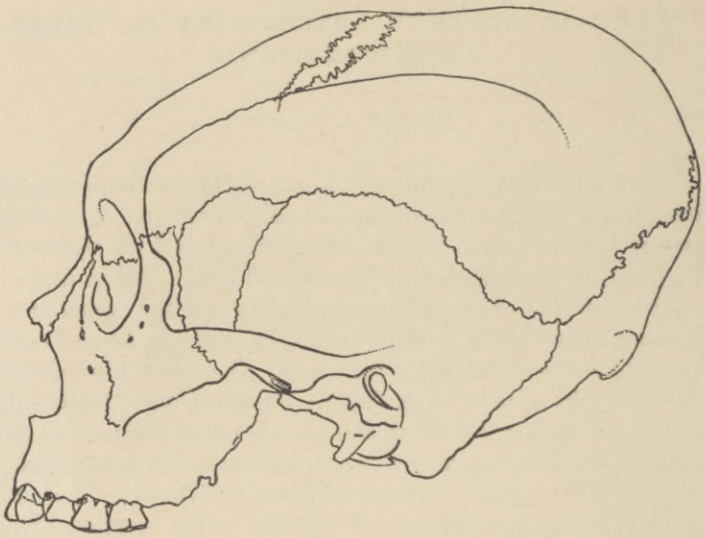

Fig. 1.

the essential points in regard to these 10 skulls, beginning with the single skull in the second group first.

No. 40521.[1]—Skull of male; only moderately elongated; no trace of groove; coronal suture obliterated on each side below stephanion; epipteric bone at right and left pterion, and four wormian bones in left coronal suture just above stephanion.

No. 40696.—Skull of female; slightly elongated; coronal groove not present except at sides; coronal suture almost entirely effaced, but three small wormian bones in the left and two in the right coronal can just barely be seen.

[1] Of the Field Museum Catalogue.

No. 40568.—Skull of female; slightly elongated; coronal groove faintly indicated; large wormian bone in left coronal suture.

No. 40523.—Skull of female; sutures almost entirely obliterated; slight coronal groove; two medium-sized wormian bones in left and one in right coronal suture.

No. 40500.—Skull of female; moderately elongated; well developed coronal depression; large epipteric at left pterion; three small wormian bones in both right and left coronal suture.

No. 40693.—Skull of male; excessively elongated; deep, broad groove just posterior to coronal suture; three wormian bones in both right and left coronal suture, one measuring 7 x 20 mm.

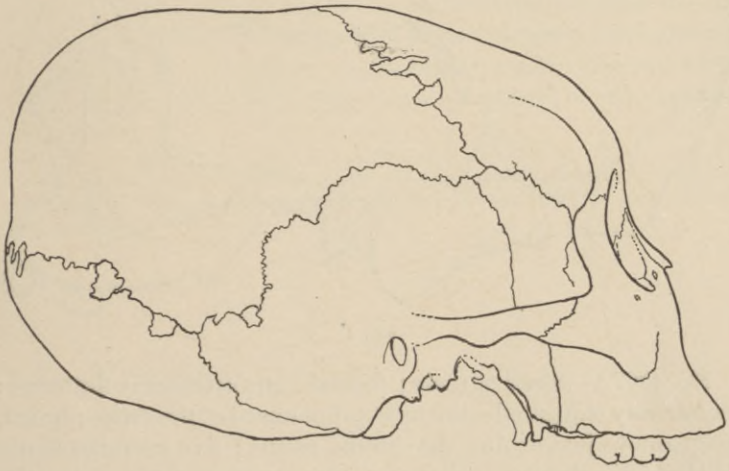

FIG. 2.

No. 40786.—Skull of female; greatly elongated; deep groove just behind coronal suture; sutures almost entirely obliterated; traces of one wormian bone in the right and three in the left coronal suture.

No. 40669.—Skull of male; excessively elongated; well defined, broad, deep groove just at and behind coronal suture; suture effaced below stephanion on both sides. In the left coronal suture there is an irregular, long, narrow wormian bone which measures 12 x 50 mm.; on the right side there are three wormian bones, one immediately after the other, and measuring together 40 x 10 mm. There is thus on each side almost a double coronal suture. (See figure 1.)

No. 40509.—Skull of young female; basilar synchondrosis partially open; much depressed about frontal region and very greatly elongated; broad groove behind coronal suture; three good-sized wormian bones in the right and two in the left coronal suture. (See figure 2.)

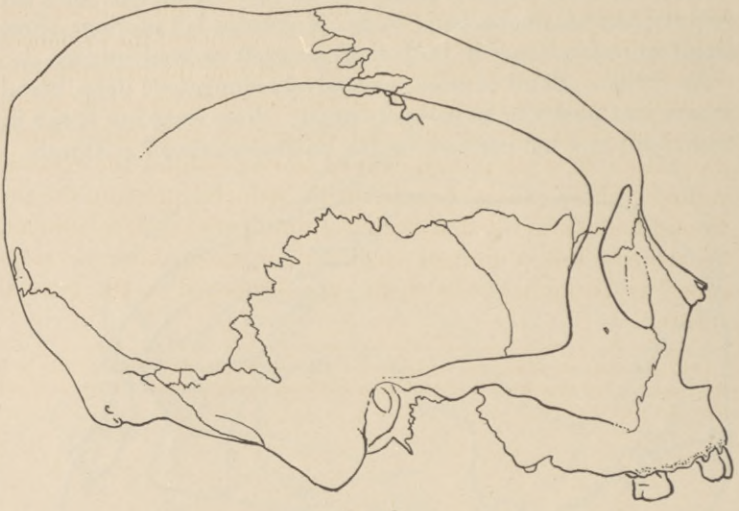

Fig. 3.

No. 40672.—Skull of male; frontal bone artificially flattened; excessively elongated—the most pronounced of the series; broad, deep groove just behind the coronal suture; five wormian bones in the right, three of which are of large size, and two in the left coronal suture, one of which measures 12 x 21 mm. (See figure 3.)

The frequency of occurrence for each sex and for the right and left side may be seen in the following table:

	Males.		*Females.*	
	Right.	Left.	Right.	Left.
Frequency of wormian bones in the coronal suture	3	4	5	6

It is thus seen that the percentage of frequency is slightly more in the females than in males, and on the left side than on the right. Both these conclusions are opposed to those reached by M. Chambellan,[1] who has made a special study of the frequency, etc., of wormian bones.

In regard to the percentage of frequency for the whole series and the causes which lead to its unusual size, one in three and five-tenths, I can only explain it by the presence of the evidences of bandaging in early life and by the fact that the percentage of frequency becomes the greater as we ascend the scale of length of the cranium due to artificial elongation, and just in direct proportion to a deep, well-defined groove behind the coronal suture. These causes, together with artificial pressure on the frontal bone, prevented a normal fronto-parietal development. To remedy this abnormal condition, wormian bones—"stop-gaps," as Humphry calls them—are developed in the coronal suture.

1 "Étude anatomique et anthropologique sur les os Wormiens," Thèse, Paris, 1883. My knowledge of this paper is second hand and from several sources. I regret that I have not seen it.

THE LONG BONES OF KWAKIUTL AND SALISH INDIANS

GEORGE A. DORSEY

The measurements and indices in this paper have been taken after the manner described by Sir William Turner in the *Challenger* Report,[1] to which work reference is made for more detailed information in regard to the subject.

The material examined comprises the following: 19 skeletons of the Kwakiutl race of Vancouver island, B. C., including those of 9 males and 10 females, and 15 skeletons of the Salish race, 13 of them being of the Vancouver Songish and 2 of the Sanitch tribes. Of the entire number, 10 are of males and 10 are of females. There are thus in all 34 skeletons, there being 19 of males and 15 of females. It will be noted that I have made no comment on the length of any of the bones measured, but have confined attention to the indices which have been determined from the measurements. At another time I shall consider the lengths of the bones of these and other skeletons from the Northwest with a view of determining their stature.

BONES OF THE UPPER LIMB

I have made no observations on the ulna, and only the bones of the right side have been measured. In each bone I have determined, by means of an osteometric board, the maximum length; this for the humerus is from the most projecting part of the head to the most projecting point on the surface of the trochlea; for the radius it includes the styloid process. While measuring the humerus the occurrence of perforation of the olecranon fossa was noted. This occurred five times in 32 bones, or about 15 percent. Wyman puts it at 31 percent for the Ohio mounds, and it has been determined by Hamy[2] and Sauvages[3] to occur in about 5 per cent of European humeri. Perforation of the olecranon fossa may be due, as Flower contends, to impoverishment or insufficient nourishment, but cer-

1 *Challenger* Report, vol. xvi, "Report on the Bones of the Human Skeleton," pp 89–114.

2 Peabody Museum Report, 1871.

3 Topinard, Éléments d'Anthropologie Générale, p. 1016.

tainly there is no evidence present in the other bones of these Northwest Coast peoples which supports this view. It may also be noted that in three of the perforated humeri their length exceeded the average. In no humerus was there any indication of a supra-condyloid foramen or spine.

Radio-humeral Index.—Table I presents a comparative view, both sexually and racially, of the measurements of the humerus and radius, together with the radio-humeral or antebrachial index, which is obtained from the formula:

$$\frac{\text{Maximum length of radius} \times 100}{\text{Maximum length of humerus.}}$$

Table I

	Kwakiutl.			*Salish.*		
	Humerus.	Radius.	Radio-humeral index.	Humerus.	Radius.	Radio-humeral index.
Males.....	342	274	74.2	308	241	78.2
	297	235	79.1	312	237	75.9
	295	222	74.9	324	240	74.0
	302	234	77.4	352	269	76.4
	307	237	73.9	302	235	77.8
	310	237	76.4	287	237	82.5
	324	240	74.9	313	231	73.8
	.....	.....	.....	348	252	72.7
	306	244	79.7	304	219	72.0
	.....	.....	.....	304	239	78.6
Mean...	310	239	77.0	315	240	76.1
Females...	304	218	71.7	287	205	71.4
	272	208	76.4	307	226	73.6
	263	205	78.7	291	211	72.5
	300	215	71.6	297	232	78.8
	290	214	73.7	.....	.....	.....
	284	231	81.3	.....	.....	.....
	292	213	73.1	.....	.....	.....
	285	214	75.0	.....	.....	.....
	291	218	74.9	.....	.....	.....
	303	227	74.8	.....	.....	.....
Mean...	288	216	75.0	295	219	75.1
Mean for both sexes.....			76.0	Mean for both sexes.		74.2

On examining the indices there appears to be no appreciable difference between the two races, but a slight difference between the two sexes. This, together with the distribution of the indices, may be seen in the following table:

Table II

Turner's classification.	*Kwakiutl.*				*Salish.*			*Kwakiutl + Salish.*			Total.
	Index.	♂	♀	♂+♀	♂	♀	♂+♀	♂	♀	♂+♀	
Brachykerkic...	71	...	2	2	...	1	1	...	3	3	19
	72	...	...	.....	2	2	4	2	2	4	
	73	1	1	2	1	3	4	2	4	6	
	74	3	2	5	1	...	1	4	2	6	
Mesatikerkic....	75	...	1	1	1	...	1	1	1	2	12
	76	1	1	2	1	...	1	2	1	3	
	77	...	...	.....	1	...	1	2	...	2	
	78	...	1	1	2	...	2	2	1	3	
	79	2	...	2	...	...	.....	2	...	2	
Dolichokerkic..	80	...	...	.....	...	...	.....	...	...	.....	2
	81	...	1	.....	...	...	.....	...	1	1	
	82	...	...	.....	...	...	.....	1	...	1	

It will be noticed that I have divided this table according to the classification proposed by Professor Turner. The average index, 75.5, falls into the mesatikerkic group, but as a matter of fact the majority of the indices fall within the limits of the brachykerkic group, *i. e.*, a majority show a relatively long foramen. In this respect these skeletons agree with Europeans, Lapps, Eskimos, and Samoyeds. It is greatly to be regretted there are no measurements available of other American races, but, except for a few single observations, the field seems never to have been touched.

Apart from the distribution of the indices, it is interesting to note the wide range of variation as shown in Table II. In the table given by Topinard[1] the highest average index is 79, while

[1] Éléments d'Anthropologie Générale, p. 1043.

the lowest is 72. He gives, however, a single Eskimo with an index of 69.8. A few of the results incorporated in Turner's report also fall below 71, and a very few are higher than 82, but they are rare exceptions.

I am inclined to believe that the people under consideration should be put into the brachykerkic division, notwithstanding the fact that the mean index just falls within the next group, for it is quite possible that one or two of the higher indices, especially the two which fall within the dolichokerkic group, are due to intermixture with the Indians of the east or south. There is some very good evidence which points to the conclusion that the greater part of the aborigines of North America are mesatikerkic, while we should expect those of the Northwest coast to agree rather closely with the Eskimo and northern Asiatic peoples.

BONES OF THE LOWER LIMB

I have made no measurements of the femur or tibia to determine the amount of flattening, but I noted the presence of a well-defined third trochanter in three instances and an imperfectly developed third trochanter in four others. The bones of the males are especially well marked with muscular ridges, and in many of the femora the pilastered form was strongly indicated. With the tibiæ there is a well-marked tendency to the platycnemic form, but this is never as pronounced as it is in some of the Ohio mound tibia.

Tibio-femoral Index.—The tibio-femoral index is determined by the formula $\frac{\text{length of tibia} \times 100}{\text{length of femur}}$. Both bones are measured by means of an osteometric board. The femur is measured in its natural or oblique position, and the tibia is measured from the condylar to the astragaloid surface—*i. e.*, the spine and malleolus are excluded. The measurements and indices are seen in Table III.

There appears to be no appreciable difference in the two races, but there is still a slight amount of variation in the two sexes, so that we may say that in the females the leg is shorter in proportion to the thigh than it is in the males, and in this, as in the radio-humeral index, the woman is further removed from the Australians, Negroes, *et al.* than are the men. To show the dis-

tribution I have arranged a table similar to Table II, but have not differentiated the sexes or races (Table IV).

Professor Turner has proposed to make 83 the dividing line between dolichoknemic, or long legs, and brachyknemic, or short

Table III

	Kwakiutl.			*Salish.*		
	Oblique-length femur.	Condylar-astragaloid tibia.	Tibio-femoral index.	Oblique-length femur.	Condylar-astragaloid tibia.	Tibio-femoral index.
Males....	481	386	80.2	392	317	80.8
	400	332	83.0	403	325	80.6
	395	311	78.7	424	341	80.4
	406	332	81.7	475	373	78.5
	414	324	78.2	410	324	79.0
	401	320	79.8	404	.....	.....
	410	337	82.1	417	317	73.6
	449	359	79.5	462	355	76.8
	424	338	79.9	399	320	80.2
	.....	.....	.....	421	338	80.2
Mean..	441	337	80 0	420	334	79.2
Females.	403	328	81.2	395	311	78.7
	397	314	78.0	402	310	77.1
	390	307	78.7	429	331	77.1
	397	314	80.0	391	316	80.8
	403	322	79.9	383	311	81.2
	403	317	78.6	.....	.....	.....
	400	301	75.2	.....	.....	.....
	388	302	77.8	.....	.....	.....
	407	.....	.....	.....	.....	.....
	412	341	82.7	.....	.....	.....
Mean..	400	314	78.5	400	315	78.7
Mean, both sexes			79.2	Mean, both sexes...		79.1

legs. In the first division he places the Australians, Tasmanians, Negroes, and Americans; in the second group are the Europeans, Lapps, Eskimos, Samoyeds, *et al.* Reference to the table shows that out of 34 indices for the Northwest coast no single one falls within the dolichoknemic group, and in this respect, in

common with what we have seen in regard to the radio-humeral index, these people show close affinity to the Eskimo and north Asiatic people.

Table IV

Index.	Frequency of occurrence.
73	1
74	..
75	1
76	1
77	3
78	7
79	5
80	8
81	3
82	2
83	1
Mean...	79.1

Attention may also be called to the extremely low indices in Table IV. The lowest tibio-femoral index recorded by Topinard is 78, omitting the dwarf Bébé, while Turner presents only one index, that of a male Lapp, from his entire series, which reaches the lowest of my series.

UPPER AND LOWER EXTREMITIES COMPARED

Intermembral Index.—The intermembral index is the relation of the length of the humerus and the radius to the length of the femur and tibia, the latter being 100. The formula is $\frac{\text{humerus} + \text{radius} \times 100}{\text{femur} + \text{tibia}}$.

For the determination of this index, however, the maximum length of both femur and tibia (excluding spine) are taken, in order that the sum of their lengths may be comparable with that of the humerus and radius. In the following table the sum of the humerus and radius is given, as determined from the measurements in Table I, along with the maximum lengths of the femur and tibia, together with their sum, and the intermembral index.

Table V

	Femur.	Tibia.	F. + T. total.	H. + R. total.	Intermembral index.
	Kwakiutl.				
	mm.				
Males	486	397	883	616	69.7
	403	342	745	532	71.4
	397	318	715	517	72.3
	411	343	754	536	71.0
	418	330	748	534	71.4
	405	330	735	547	74.4
	405	349	764	564	73.6
	456	370	816	.....	.....
	427	349	776	550	70.8
Mean	424	347	770	549	71.4
Females	407	337	774	522	70.1
	400	323	723	480	66.4
	394	311	707	468	66.4
	402	328	728	515	70.7
	408	333	741	504	68.0
	398	329	721	515	70.8
	403	307	710	505	71.1
	392	313	705	499	70.8
	410	.....	.....	509	.....
	419	352	771	530	68.7
Mean	403	325	728	504	69.2
	Salish.				
Males	397	327	724	549	75.8
	406	334	740	549	74.1
	427	354	781	564	72.2
	477	383	860	621	72.2
	414	330	744	537	72.1
	407	.....	.....	524	.....
	420	328	748	544	72.7
	465	365	830	600	72.2
	401	329	730	523	71.6
	424	349	773	543	70.2
Mean	423	344	770	555	72.0
Females	497	323	720	492	68.3
	408	321	729	533	73.1
	432	338	770	502	65.1
	398	328	724	.....	.....
	385	322	707	529	70.4
Mean	404	322	730	514	70.4

Arranging this to show variation in sex and the distribution of the indices, we have the following:

Table VI

Intermembral index.	♂	♀	♂ + ♀
65	..	1	1
66	..	2	2
67	..	..	..
68	..	2	2
69	1	..	1
70	2	4	6
71	4	1	5
72	6	..	6
73	2	1	3
74	3	..	3
75	..	1	1
Mean...	71.6	69.8	70.7

The average index, 70.7, for the Northwest coast races is higher than that given by Broca[1] or Flower[2] for Europeans, and is only exceeded by that given by Turner for the Eskimos and Lapps—73.4 and 72.8 respectively. The index given by Turner for the Australians is 68.7; for the Oahuans, 67.4; for the Maoris, 69.3. The highest intermembral index that I can find on record is that given by Turner of a female Lapp with an index of 74.9. He also records an index of 74.8 for a female Eskimo. In my table there are three instances where the index is 74 and two where it is 75. It is probable that this index of 75.8 (a Salish male) has never been exceeded.

Femoro-humeral Index.—This is determined by the formula $\frac{\text{length of humerus} \times 100}{\text{length of femur}}$. In both bones the maximum length is taken; these are given for the humerus in Table I and for the femur in Table V. In Table VII the femoro-humeral indices for both sexes of the two races combined are shown.

According to the combined results of Broca and Flower, the femoro-humeral index in Europeans is 72.5. This is not ex-

[1] Bull. de la Soc. d'Anthrop., ser. 2, t. ii, p. 641, Nov. 21, 1867.
[2] Quoted from Turner.

ceeded by the average of any races measured by Turner except the Eskimos and Lapps, which have the indices of 77.7 and 75.4 respectively. In my results there are seven indices which equal or exceed the index in the Lapps and one which surpasses the mean of the two Eskimos.

Table VII

Humero-femoral index.	♂	♀	♂ + ♀
66	..	1	1
67	..	1	1
68	..	1	1
69	..	..	..
70	2	2	4
71	2	1	3
72	..	4	4
73	5	..	5
74	3	2	5
75	1	1	2
76	2	..	2
77	1	1	2
78	1	..	1
Mean...	73.6	72.0	72.8

Summary.—The Kwakiutl and Salish Indians of British Columbia have a radio-humeral index of 75.5, a tibio-humeral index of 79.1, an intermembral index of 70.7, and a femoro-humeral index of 72.8. These indices approach very closely, and indeed often equal, those which have been determined for the Eskimos, the Samoyeds, and the Lapps.