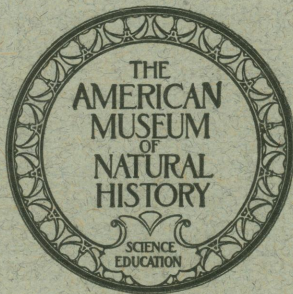


ANTHROPOLOGICAL PAPERS
OF
THE AMERICAN MUSEUM
OF NATURAL HISTORY

VOL. XXIII, PART IV

A FEW ANDAMANESE SKULLS WITH COMPARATIVE
NOTES ON NEGRITO CRANIOMETRY

BY
LOUIS R. SULLIVAN



NEW YORK
PUBLISHED BY ORDER OF THE TRUSTEES
1921

AMERICAN MUSEUM OF NATURAL HISTORY

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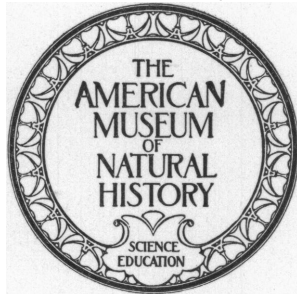
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of the *Journal of the American Medical Association* (JAMA) and the *New England Journal of Medicine* (NEJM) are the most widely cited journals in the field of medicine.

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INTRODUCTION.

In the ethnological collections of the American Museum of Natural History are three skulls, without mandibles, and four separate mandibles from the Andaman Islands. They are all decorated with strips of a coarse cloth to which are attached numerous shells. Two of the skulls are colored with a red pigment, presumably an iron oxide, and striped with white pigment. The third skull is not colored, but is rather highly polished, perhaps through much handling. All of these specimens are said to have been worn by relatives in honor of the dead. Although a few Andamanese skulls have been published, it seems that they are still sufficiently rare to warrant the description of this small collection and the addition of comparative notes from the data at present available.

September, 1919.

LOUIS R. SULLIVAN.

DESCRIPTION OF THE MATERIAL.

The observer is immediately struck with the marked similarity of the three skulls in general contour, especially in the contours of the norma verticalis and norma occipitalis. Two of the specimens are male and one is female. They are all small in general proportions, yet the faces are proportionately much smaller than the brain cases, giving the skulls, especially the female specimen, an infantile appearance.

Norma verticalis. The contour in this view is strongly rhomboidal. The frontal region is narrow while the parietal region is relatively broad and the parietal eminences are very prominent.

Norma lateralis. The glabella is smooth and the supraorbital eminences are practically absent. Only in the males do we find a very faint trace of them. In all three specimens the frontal rises vertically for three or four centimeters and then slopes rather abruptly toward the bregma. In the region of the pterion the spheno-parietal suture is very short and in one instance (70.0-1126f) we have small bilateral epipteries in this region. A short spheno-parietal articulation with a tendency to the formation of epipteric bones or to be replaced by a fronto-temporal articulation seems to be characteristic of Andamanese crania. In seven skulls Turner¹ found one having bilateral epipteries and another with an epipteric on the right side and a fronto-temporal articulation on the left side. Flower² also called attention to this feature.

Norma facialis. The nasal bones are small and flat. The nasal aperture is ovoid or ovoid-triangular. The lower border of the pyriform aperture is infantile in one case, the female, while in the other two it is intermediate between the infantile form and the prenasal fossae. The canine fossae are shallow in the female and of medium depth in the two males. No metopic sutures are present. In the other specimens described, however, metopism seems to be fairly common. In forty-eight specimens examined (but not all measured) by Flower, six were metopic. This is a frequency of about 12.5 percent. In seven specimens Turner found one metopic and in a like number Gupte³ found one metopic. Metopism seems to be characteristic in from 12 to 14 percent of the cases.

Norma basilaris. The alveolar arch is diverging. The posterior nasal spine is short and wide. The glenoid fossae are deep in one and of medium depth in two others. The mastoid processes are very small in

¹Turner, 1901.

²Flower, 1880.

³Gupte, 1909.

every case. The foramina are normal. The molar teeth are present in two cases and are of average size, but rather large for the size of the skulls. m^1 and m^2 are quadritubercular. m^3 is tritubercular secondarily in one case, while in the other it is distorted. It is quadritubercular but the hypocone has rotated mesially thus greatly increasing the lateral diameter of the tooth.

The Mandibles. The mandibles are all small. Two appear to be male and two female. The gonion are slightly everted. The symphysis is low. The chin is median in every case and poorly developed, being best described by the term neutral. The molars all have five cusps.

In Table I the detailed measurements are given, in Table II the indices and angles, and in Table III the measurements of the mandibles.

TABLE I
MEASUREMENTS OF ANDAMANESE SKULLS

Catalogue Number	70.0-733	70.0-734	70.0-1126
Sex	Male	Male	Female
Cranial Capacity (with millet)	1280	1280	1170
Greatest Length (Glabella-Opisthocranion)	162	166	161
Greatest Breadth	133	139	128
Basion-bregmatic Height	136	137	126
Ear Height (Verticale to horizontal plane)	114	114	106
Minimum Frontal Breadth	86	94	84
Basion-Nasion Length	90	99	92
Basion-Prosthion Length	92	96	94
Bizygomatic Diameter	120	125	113
Upper Face Height (Nasion to Prosthion)	61	68	59
Nasal Height	44	52	43
Nasal Breadth	23	23	22
	L R	L R	L R
Orbital Width (from Maxillo-frontale)	35-35	40-40	38-37
Orbital Height	31-31	33-33	32-33
Maxillo-Alveolar Length	51	56	49
Maxillo-Alveolar Breadth	60	64	59
Palate Length	41	45	40
Palate Breadth	35	40	34
Foramen Magnum Length	33	29	29
Foramen Magnum Breadth	31	27	24
Horizontal Circumference	466	477	455
Median Sagittal Arc	356	359	339
Transverse Bregmatic Arc	304	309	291

TABLE II
INDICES AND ANGLES

Catalogue Number	70.0-733	70.0-734	70.0-1126
Sex	Male	Male	Female
Indices:			
Length-Breadth	82.1	83.7	79.5
Length-Height	84.0	82.5	78.3
Breadth-Height	102.3	98.6	98.4
Length Ear-Height	70.4	68.7	65.8
Transverse Fronto-Parietal	64.7	67.6	65.6
Alveolar Projection	102.2	97.0	102.2
Transverse Cranio Facial	90.2	89.9	88.3
Upper Facial	50.8	54.4	52.2
Nasal	52.3	44.2	51.2
	L R	L R	L R
Orbital	88.6-88.6	82.5-82.5	84.2-89.2
Maxillo-Alveolar	117.6	114.3	120.4
Palatal	85.4	88.9	85.0
Foramen Magnum	93.9	93.1	82.8
Angles formed with Ear-Eye Horizontal:			
Profile Angle	75°	82°	77°
Nasal Angle	78°	83°	80°
Alveolar Angle	63°	75°	66°
Glabella-Bregmatic Angle	52°	50°	44°
Nasion-Bregmatic Angle	56°	52°	50°

TABLE III
MEASUREMENTS OF MANDIBLES

Catalogue Number	70.0-736	70.0-1127	70.0-735	70.0-737
Sex	Male	Male	Female	Female
Bigonial Breadth	94	94	85	89
Minimum Breadth of Ramus	29	30	27	27
Height of Symphysis	28	30	30	..
Height between m_1 and m_2	25	26	23	20

COMPARISON WITH OTHER STUDIES.

Obviously one cannot with any degree of confidence describe a racial type from the study of three skulls and four mandibles. Yet it is safe to say that one could do this with greater accuracy for the Andamanese than for most groups of mankind. On first seeing these skulls I was at once struck with their fundamental similarity. A survey of the literature on the Andamanese has substantiated the fact that the skull of the Andamanese offers more distinctive points to the eye than do the skulls of most groups. It was very easy to establish that these skulls were genuine inasmuch as they agree in nearly every detail with those described and figured by other writers. Nor have I found any skulls of other groups which might be confused with the skull of an Andamanese.

The earliest descriptions of Andamanese skulls of which I find any record are those described by Owen, Busk, and Davis. Owen¹ describes a single skull. He published two plates (1861) giving four views of this skull, but no measurements. Busk² describes two Andamanese skulls and gives measurements. But the measurements taken are antiquated and not comparable with those now in use. Fortunately Professor Flower³ later re-measured these same two skulls. J. Barnard Davis in his *Thesaurus Cranium* describes four skulls and two mandibles. Unfortunately, again, Davis's measurements are for the most part not comparable with those taken by modern workers. They are also recorded in inches. Cranial capacity is given in terms of weight. Quatrefages and Hamy⁴ describe and measure two Andamanese skulls, one male and one female. Some of their measurements are comparable with those used today. We are indebted to Professor Flower⁵ for the greatest contribution to this subject. He has published two papers on the Andamanese. In the first he describes and measures twelve male and twelve female skulls. In his second paper he describes a few more but does not give individual measurements. In his catalogue he records the measurements of all the Andamanese skulls in the Royal College of Surgeons, England. In 1901 Sir William Turner⁶ described and measured seven Andamanese skulls. Gupte⁷ later described seven specimens from the

¹Owen, 1861 and 1863.

²Busk, 1866.

³Flower, 1880.

⁴Quatrefages and Hamy, 1882.

⁵Flower, 1880, 1884, and 1879 (1907).

⁶Turner, 1901.

⁷Gupte, 1909.

Indian Museum, Calcutta. Doubtless a search through the German catalogues might reveal a few others. But without much doubt the foregoing are the more important contributions to the subject. A majority of the skulls are known to have come from the neighborhood of the English settlement at Port Blair.

On account of the earlier unstandardized methods of measuring skulls much data are not available for comparison. As previously stated the work of Davis and Busk has been excluded for this reason. A majority of the measurements of the later workers are comparable. Very unfortunately Professor Flower has taken the ophryon as a measuring point for the length of the skull and height of the face. Cranial capacity has been measured by the use of millet and mustard seed by all except Turner who used No. 8 shot. The orbital width has been taken from the dacryon by a majority of the workers. Flower appears to have used the lacrimale. I prefer the maxillo-frontale. The following measurements are probably comparable throughout:—

1. Maximum breadth of the skull.
2. Minimum frontal breadth.
3. Basion-bregmatic height.
4. Nasion-basion length.
5. Nasion-prosthion length.
6. Bizygomatic breadth.
7. Nasal height.
8. Nasal breadth.
9. Nasal index.
10. Cranio-facial index.
11. Alveolar index.

The horizontal circumference cannot be used, nor with any degree of surety the median sagittal and transverse arcs.

Cranial Capacity. In his earlier paper (1880) Flower measured cranial capacity by means of mustard seed. In 1884 he substituted lead shot. His results are as follows:—

	13 Males	13 Females
Mustard seed	1244 cc.	1128 cc.
Lead shot	1281 cc.	1148 cc.

Since Flower did not give the individual measurements with shot I have taken his earlier observations with mustard seed and combined them with those of Gupte and our present series taken with millet.

	18 Males	14 Females	*37 Both Sexes
Average	1268.9	1127.8	1198.9
σ	± 104.6	± 59.9	± 104.9
e	± 24.6	± 16.0	± 17.2
$\sqrt{}$	8.24%	5.31%	8.75%
Minimum	1070	1020	1020
Maximum	1520	1250	1520

(*Includes five not sexed.)

The modes are 1280 and 1100 for the males and females respectively. The one extreme case of 1520 cc., for a male skull perhaps raises the averages unduly. In the comparative tables of Martin only the Vedda (Sarasin) and the Papuan (Sergi and Moschen) groups have a lower cranial capacity. The averages given are Vedda 1250 and 1139 and Papuans 1236 and 1125. The number of cases in both of these instances is small.

Length, Breadth, and Cranial Index. As previously stated the fact that Flower has measured the length from the ophryon has dissected our series into two small groups so that the real value of the cranial index is uncertain. Ordinarily it would seem that the length from the ophryon would be less than that from the glabella. In the case of the Andamanese this is probably not true. Comparative measurements are given below:—

	Glabella Length (Turner, Gupts, etc.)	Ophryon Length (Flower)	Difference
10 ♂	164.9	13 ♂ 168.0	3.1
6 ♀	160.7	12 ♀ 160.7	0.0
3?	163.4	4? 162.0	-1.4
19 Total	163.3	29 Total 164.2	0.9

Were the series larger we might add to or subtract from Flower's measurement an average correction. But in the present instance such a procedure does not seem advisable. While Flower's measurements seem to exceed those of other workers in all the groups except the unsexed skulls we can be by no means certain that Flower was not dealing with a series of larger skulls. The fact that his average cranial capacity is slightly larger and also that his measurements of head breadth are in excess of those of the other series seems to indicate that the skulls with which he was dealing are actually somewhat larger.

TABLE IV MEASUREMENTS AND INDICES OF ANDAMANESE SKULLS (Calculated from the Data of Flower, Turner, Gupte, Quatrefages, and Sullivan)								
Measurement	No.	Sex	Average	$\sigma \pm$	e $\pm$	V in %	Minimum	Maximum
Cranial Capacity (millet)	18	M	1269	104.60	24.60	8.24	1070	1520
“ “ “	14	F	1128	59.90	16.00	5.31	1020	1250
“ “ “	37	MF	1199	104.90	17.20	8.75	1020	1520
Greatest Length	10	M	164.9	.....	.....	.....	.....	.....
“ “	6	F	160.7	.....	.....	.....	.....	.....
“ “	19	MF	163.3	.....	.....	.....	.....	.....
Greatest Breadth	23	M	136.1	4.09	.85	3.00	128	145
“ “	18	F	131.8	2.82	.66	2.14	126	137
“ “	48	MF	134.4	4.24	.61	3.15	126	145
Cranial Length-Breadth Index	10	M	83.4	.....	.....	.....	.....	.....
“ “ “	6	F	81.0	.....	.....	.....	.....	.....
“ “ “	19	MF	82.5	.....	.....	.....	.....	.....
Basion-Bregmatic Height	23	M	130.2	4.92	1.03	3.77	120	140
“ “	18	F	124.2	3.18	.75	2.56	118	131
“ “	47	MF	127.3	5.03	.73	3.95	118	140
Cranial Breadth-Height Index	23	M	95.7	4.06	.84	4.24	87	102
“ “ “	18	F	94.2	2.13	.50	2.26	90	98
“ “ “	46	MF	94.9	3.55	.52	3.74	87	102
Minimum Frontal Breadth	21	M	92.2	4.28	.93	4.64	85	102
“ “ “	17	F	89.2	2.69	.65	3.01	84	94
“ “ “	42	MF	90.7	4.00	.61	4.41	84	102
Transverse Fronto-Parietal Index	21	M	68.1	3.34	.72	4.90	63	75
“ “ “	17	F	67.8	2.40	.56	3.54	64	74
“ “ “	42	MF	67.8	3.05	.47	4.49	62	75
Bizygomatic Diameter	22	M	124.6	5.30	1.13	4.25	112	136
“ “	17	F	117.7	2.81	.68	2.38	113	123
“ “	40	MF	121.8	5.70	.90	4.67	112	136
Transverse Cranio-Facial Index	22	M	91.6	4.59	.98	5.01	80	103
“ “ “	17	F	89.0	2.38	.58	2.67	87	95
“ “ “	40	MF	90.7	4.10	.64	4.52	80	103
Basion-Nasion Length	22	M	93.4	4.27	.91	4.57	83	101
“ “	17	F	90.8	2.55	.61	2.81	86	95
“ “	45	MF	92.3	3.72	.55	4.03	83	101
Basion-Prosthion Length	22	M	93.4	5.14	1.12	5.50	82	102
“ “	17	F	92.5	3.86	.93	4.17	86	97
“ “	45	MF	93.0	4.45	.66	4.78	82	102
Index of Alveolar Projection	22	M	100.3	2.79	.59	2.78	97	107
“ “ “	17	F	101.8	3.45	.83	3.38	96	108
“ “ “	45	MF	100.9	3.39	.50	3.36	96	109
Total Anatomical Face Height	4	M	99.2	.....	.....	.....	.....	.....
“ “ “ “	3	F	92.0	.....	.....	.....	.....	.....
“ “ “ “	8	MF	94.6	.....	.....	.....	.....	.....
Upper Anatomical Face Height	9	M	61.0	.....	.....	.....	.....	.....
“ “ “ “	5	F	56.6	.....	.....	.....	.....	.....
“ “ “ “	17	MF	58.9	.....	.....	.....	.....	.....
Nasal Height	23	M	45.8	2.93	.61	6.39	40	52
“ “	18	F	43.2	1.34	.32	3.10	41	46
“ “	48	MF	44.8	3.07	.44	6.85	40	54
“ Width	23	M	23.3	1.54	.32	6.61	20	26
“ “	18	F	22.5	1.17	.27	5.20	21	25
“ “	48	MF	22.9	1.56	.22	6.81	18	26
“ Index	23	M	51.0	3.03	.63	5.94	44	58
“ “	18	F	52.0	1.55	.36	2.98	49	58
“ “	48	MF	51.2	2.89	.41	5.64	44	58
Orbital Width (from Dacryon)	20	M	36.7	1.34	.30	3.65	35	40
“ “ “ “	16	F	35.7	1.26	.31	3.53	34	39
“ “ “ “	43	MF	36.2	1.62	.24	4.47	33	40
“ Height	21	M	32.7	1.31	.28	4.00	30	35
“ “	17	F	31.8	1.14	.27	3.58	30	34
“ “	43	MF	32.3	1.34	.20	4.14	30	35
“ Index	21	M	89.0	4.48	.98	5.03	79	95
“ “	17	F	89.1	4.00	.97	4.48	81	97
“ “	43	MF	89.3	4.33	.64	4.84	79	97
Maxillo-Alveolar Length	9	M	49.3	.....	.....	.....	.....	.....
“ “	5	F	50.6	.....	.....	.....	.....	.....
“ “	16	MF	49.6	.....	.....	.....	.....	.....
“ Breadth	9	M	59.1	.....	.....	.....	.....	.....
“ “	5	F	57.4	.....	.....	.....	.....	.....
“ “	16	MF	58.8	.....	.....	.....	.....	.....
Maxillo-Alveolar Index			9 Male	5 Female	16 Total			
Average			120.7	113.2	119.2			
Foramen Magnum Length			21 Male	19 Female	40 Total			
Average			32.9	31.4	32.1			
Foramen Magnum Breadth			14 Male	13 Female	27 Total			
Average			28.0	26.7	27.4			
Foramen Magnum Index			14 Male	13 Female	27 Total			
Average			84.4	85.1	84.7			
Bigonial Breadth (Mandible)			10 Male	15 Female	25 Total			
Average			91.9	83.9	87.1			
Symphysal Height (Mandible)			11 Male	14 Female	25 Total			
Average			26.3	26.3	26.3			

TABLE V

MEASUREMENTS AND INDICES OF PHILIPPINE NEGRITO SKULLS

(Calculated from the Measurements by Koeze)

Measurement	No.	Sex	Average	$\sigma \pm$	$e \pm$	V in %	Minimum	Maximum
Cranial Capacity	34	M	1409	116.80	20.00	8.28	1140	1650
" "	18	F	1219	105.00	25.40	8.61	940	1420
" "	52	MF	1343	144.70	20.00	10.70	940	1650
Greatest Length	39	M	172.3	5.30	.85	3.07	160	183
" "	20	F	162.3	6.18	1.38	3.80	149	173
" "	59	MF	168.9	7.34	.95	4.34	149	183
" Breadth	38	M	143.7	4.03	.65	2.80	132	151
" "	20	F	135.9	4.99	1.11	3.67	119	143
" "	58	MF	141.0	5.80	.76	4.11	119	151
Cranial Length-Breadth Index	38	M	84.3	.....	.....	.....	.....	.....
" " "	20	F	83.9	.....	.....	.....	.....	.....
" " "	58	MF	84.0	.....	.....	.....	.....	.....
Basion-Bregmatic Height	37	M	136.3	5.81	.95	4.26	127	152
" "	20	F	131.7	4.84	1.08	3.67	125	143
" "	57	MF	134.6	5.92	.78	4.39	125	152
Cranial Breadth-Height Index	37	M	95.3	3.39	.56	3.55	88	103
" " "	20	F	97.6	3.71	.83	3.80	89	105
" " "	57	MF	96.1	3.68	.48	3.83	88	105
Minimum Frontal Breadth	39	M	92.3	5.08	.83	5.50	83	102
" " "	21	F	89.5	3.88	.81	4.34	83	100
" " "	60	MF	91.2	4.84	.62	5.30	83	102
Bizygomatic Diameter	35	M	131.3	5.38	.91	4.09	120	145
" "	15	F	123.0	5.42	1.40	4.40	113	134
" "	50	MF	128.8	6.60	.93	5.12	113	145
Basion-Nasion Length	37	M	99.5	3.77	.62	3.78	92	106
" "	20	F	93.7	4.82	1.08	5.14	84	103
" "	57	MF	97.8	5.04	.66	5.15	84	106
Basion-Prosthion Length	35	M	95.4	5.58	.94	5.84	78	105
" "	14	F	90.7	5.82	1.55	6.41	79	100
" "	49	MF	94.0	6.03	.86	6.41	78	105
Index of Alveolar Projection	33	M	96.3	3.65	.63	3.79	89	105
" " "	14	F	98.1	4.36	1.12	4.44	89	104
" " "	47	MF	96.9	3.97	.57	4.09	89	105
Upper Anatomical Face Height	35	M	68.7	.....	.....	.....	.....	.....
" " " "	16	F	62.9	.....	.....	.....	.....	.....
" " " "	51	MF	66.9	.....	.....	.....	.....	.....
Nasal Height	36	M	50.9	2.83	.47	5.56	44	58
" "	17	F	47.9	2.59	.62	5.41	41	51
" "	53	MF	49.9	3.08	.42	6.19	41	58
" Width	37	M	27.2	2.37	.38	8.71	24	37
" "	19	F	25.4	1.86	.42	7.32	22	28
" "	56	MF	26.6	2.25	.30	8.42	22	37
" Index	36	M	53.3	4.30	.70	8.06	45	64
" "	17	F	53.8	3.74	.91	6.84	48	61
" "	53	MF	53.5	4.14	.56	7.73	45	64
Orbital Width (maxillo-frontale)	39	M	42.2	1.92	.30	4.55	38	45
" " "	20	F	40.4	2.30	.51	5.69	36	46
" " "	59	MF	41.6	2.23	.29	5.36	36	46
" Height	39	M	35.3	1.67	.26	4.73	32	40
" "	20	F	34.3	1.86	.41	5.42	31	38
" "	59	MF	34.9	1.80	.23	5.15	31	40
" Index	39	M	83.2	4.53	.72	5.44	74	95
" "	20	F	84.6	4.23	.92	5.00	77	93
" "	59	MF	83.8	4.53	.59	5.40	74	95
Foramen Magnum Length	37	M	35.1	.....	.....	.....	.....	.....
" " "	19	F	34.4	.....	.....	.....	.....	.....
" " "	56	MF	34.8	.....	.....	.....	.....	.....
" " Breadth	37	M	30.1	.....	.....	.....	.....	.....
" " "	18	F	29.5	.....	.....	.....	.....	.....
" " "	55	MF	29.9	.....	.....	.....	.....	.....
" " Index	37	M	85.8	.....	.....	.....	.....	.....
" " "	18	F	90.6	.....	.....	.....	.....	.....
" " "	55	MF	87.5	.....	.....	.....	.....	.....

Comparison of Breadth of Cranium in the Same Groups.

Other Series		Flower's Series		Difference
10 ♂	135.2	13 ♂	135.4	0.2
6 ♀	131.3	12 ♀	132.8	1.5
3?	135.3	4?	135.0	-0.3
19 Total	134.0	29 Total	134.3	0.3

But it seems safe to conclude that the measurement of length from the optryon in the case of the Andamanese who have a poorly developed glabella and a vertical forehead has affected the cranial index in such a manner as to decrease it slightly and to make the Andamanese appear slightly more long-headed than in the case where the glabella is used as the measuring point. The averages for the cranial index are:—

Other Series		Flower's Series		Difference
10 ♂	83.4	13 ♂	80.7	-2.7
6 ♀	81.0	12 ♀	82.5	1.5
3?	83.6	4?	83.3	-0.3
19 Total	82.5	29 Total	81.8	-0.7

It is probable that 82.5 is more nearly the correct average for the group than 81.8. Yet the use of the two methods has made it impossible to make any statement as to the relationship of the cranial index in the sexes. The range of the index in both methods is from 77.0 to 89.0 in the males and from 79.0 to 87.0 in the females. As a group the Andamanese are decidedly brachycranial.

Nothing need be said of the other measurements since they are undoubtedly comparable, with the exception of those already noted. In Table IV I have listed the averages, variabilities, errors of the averages, coefficients of variation, and minimum and maximum measurements calculated from the data of Flower, Turner, Gupte, Quatrefages, and my own series. To these I have added in Table V the corresponding values for the series of Philippine Negrito published but not averaged by Koeze¹ and in Table VI the averages of a small series of Semang Negrito skulls compiled by Schlaginhaufen.² This last series is rather small but, so far as I have been able to determine, constitutes the bulk of the data on this group.

¹Koeze, 1901-1904.²Schlaginhaufen, 1907.

TABLE VI
MEASUREMENTS AND INDICES OF SEMANG NEGRITO SKULLS
(Calculated from Data Compiled by Schlaginhaufen)

Measurement	Male		Female		Male+Female	
	No.	Average	No.	Average	No.	Average
Cranial Capacity	4	1338	3	1130	7	1248
Greatest Length	7	172.7	3	165.0	10	170.4
Greatest Width	7	134.7	3	131.0	10	133.6
Cranial Length-Breadth Index	7	78.1	3	79.4	10	78.9
Basion-Bregmatic Height	3	131.3	3	132.6	6	132.0
Cranial Breadth-Height Index	5	97.6	1	100.7	6	98.1
Minimum Frontal Breadth	5	90.4	3	91.3	8	90.7
Transverse Fronto-Parietal Index	1	70.8	1	68.1	2	69.5
Bizygomatic Diameter	6	128.6	3	125.0	9	127.4
Transverse Cranio-Facial Index	5	95.4	1	96.3	6	95.6
Basion-Nasion Length	6	97.0	3	98.0	9	97.3
Basion-Prosthion Length	6	96.5	3	96.3	9	96.4
Index of Alveolar Projection	6	99.4	3	98.3	9	99.1
Orbital Width	6	39.1	3	39.0	9	39.1
Orbital Height	6	32.1	3	33.0	9	32.4
Orbital Index	6	81.8	3	84.2	9	82.6
Nasal Height	6	46.3	3	47.0	9	46.5
Nasal Width	6	24.5	3	27.0	9	25.3
Nasal Index	6	52.6	3	57.5	9	54.2

Variability of the Series. For comparative purposes the range of variability is best studied by means of the coefficient of variability (V) which expresses the range of variation in terms of percentage of the average. These have been listed in Table VII. Since there are too few cases in the Semang series, the series of Naqada crania by Fawcett¹ has been substituted for comparative purposes. The variability is important from three points of view:—

First: for a comparison of the relative variability of the different measurements and indices.

Second: for a comparison of the relative variability in the sexes.

Third: for a comparison of the relative variability of the three groups.

¹Fawcett, 1902.

Cranial capacity, nasal width, and the nasal index are the most variable in all three groups in both the male and the female crania. Only slightly less variable is the nasal height. On the other hand, greatest breadth and greatest length are the least variable throughout. In all the groups the breadth-height index also shows a small range of variation. Between these two extremes we have an intermediate group which shows considerable differences in the various groups. In the Andamanese and Philippine series the basion-prosthion length shows a large degree of variability. In the Naqada series it is less variable. Orbital height is about 50 per cent more variable in the Naqada series than in either the Andamanese or Philippine series. The other differences are more or less irregular and different in the two sexes of the same group.

The variability in the sexes of the three groups is quite different. In the Andamanese series the males are clearly the more variable. Of the sixteen measurements and indices recorded the males are the more variable in fifteen. The series of female Andamanese skulls show a remarkably small degree of variability throughout. In the Philippine series the females are the more variable in ten of the sixteen measurements recorded. In the Naqada the honors are about even in the two sexes, the males being the more variable in eight measurements and the females in seven. In all three groups the males are the more variable in the height, minimum frontal diameter, nasal width, and orbital index. In the other measurements the sexual differences are not as consistent.

The relative variability of the different groups is of considerable interest. Theoretically the more homogeneous groups racially should exhibit the lesser degree of variability. While such a theory obviously would not hold in the case of a single criterion, if a sufficiently large number of measurements are used to define and describe a series of skulls we should expect the results to follow this principle. In the case at hand we have sixteen measurements and indices to use as a criterion. According to the standards of the biometricians the Naqada series has been adjudged a fairly homogeneous group racially, much more so than we should expect to find on the average among racial groups of the present day. For this reason it will be of interest to compare the variability of the Andamanese and the Philippine Negrito with that of the Naqada series. In the Andamanese we should expect to find a low degree of variability since they probably approach more closely than most other peoples to our conception of a homogeneous racial type. Until comparatively recent times they have been more or less completely isolated.

TABLE VII
VARIABILITY
(Expressed by the Coefficient of Variability (V) in Percent)

Measurement	Male			Female			Male and Female		
	Andamanese	Philippine Negrito	Naqada	Andamanese	Philippine Negrito	Naqada	Andamanese	Philippine Negrito	Naqada
Cranial Capacity	8.24	8.28	7.72	5.31	8.61	6.92	8.75	10.70	....
Greatest Length	....	3.07	3.24	....	3.80	3.10	....	4.34	....
Greatest Breadth	3.00	2.80	3.29	2.14	3.67	3.45	3.15	4.11	....
Basion-Bregmatic Height	3.77	4.26	3.98	2.56	3.67	3.66	3.95	4.39	....
Cranial Breadth-Height Index	4.24	3.55	4.72	2.26	3.80	4.73	3.74	3.83	....
Minimum Frontal Breadth	4.64	5.50	5.29	3.01	4.34	4.47	4.41	5.30	....
Bizygomatic Diameter	4.25	4.09	4.16	2.38	4.40	4.77	4.67	5.12	....
Basion-Nasion Length	4.57	3.78	4.88	2.81	5.14	4.68	4.03	5.15	....
Basion-Prosthion Length	5.50	5.84	4.84	4.17	6.41	5.09	4.78	6.41	....
Index of Alveolar Projection	2.78	3.79	....	3.38	4.44	....	3.36	4.09	....
Nasal Height	6.39	5.56	6.13	3.10	5.41	6.81	6.85	6.19	....
Nasal Width	6.61	8.71	7.89	5.20	7.32	7.28	6.81	8.42	....
Nasal Index	5.94	8.06	8.18	2.98	6.84	9.28	5.64	7.73	....
Orbital Width	3.65	4.55	4.97	3.53	5.69	5.30	4.47	5.36	....
Orbital Height	4.00	4.73	7.06	3.58	5.42	6.58	4.14	5.15	....
Orbital Index	35.0	5.44	6.76	4.48	5.00	5.94	4.84	5.40	....

An examination of Table VII will show that the theory is borne out by the facts. The Andamanese are considerably less variable throughout than either the Philippine Negrito or Naqada series. In the male groups the Andamanese are least variable in eight characters, intermediate in five, and most variable in only two characters. These two characters are nasal height and bizygomatic width. The rather large variability of bizygomatic width is apparently due to the inclusion of a few adolescent individuals who have rather narrow faces. Face width is known to be one of the last diameters of the head or face to reach adult proportions since it is apparently dependent somewhat on the eruption of the teeth. In a series of Indians this diameter was found to show a rather large annual increment up to the age of twenty-five years. In the female groups the Andamanese are the least variable of the three groups throughout.

COMPARATIVE VARIABILITY OF THE GROUPS.

	Male			Female			Both Sexes	
	Least Variable	Inter-mediate	Most Variable	Least Variable	Inter-mediate	Most Variable	Least Variable	Most Variable
Andamanese	8	5	2	15	0	0	14	1
Philippine	6	5	5	0	11	5	1	14
Naqada	2	6	7	1	5	9	..	..
Total Number of Characters	16	16	14	16	16	14	15	15

Perhaps less to be expected is the fact that the Philippine Negrito series is less variable than the Naqada series. In the male group the Philippine Negrito is least variable in six characters, intermediate in five, and most variable in five. In the female groups the Philippine Negritos are least variable in no characters since the Andamanese monopolize this position but they are intermediate in eleven characters and most variable in five. While the Naqada are undoubtedly a fairly homogeneous group, when we compare them with the Andamanese and the Philippine Negrito we find them least variable in only two characters in the male group, intermediate in six characters, and most variable in seven characters. In the female group they are least variable in one character, intermediate in five, and most variable in nine characters. When the sexes are combined the Andamanese are less variable than the Philippine Negrito in all characters except nasal height. These results may be summarized as follows:—

Since the Andamanese, the Philippine Negrito, and the Semang Negrito are almost universally regarded as representatives of the same racial type it will be of interest to compare the averages of the different measurements in the three groups. Unfortunately data on the Semang are scattered and sparse. The series of ten skulls described by Schlaginhaufen has been collected from five different sources. The averages cannot be taken as very significant. In the case of the Andamanese and Philippine Negrito, although the series are not as large as might be desired, some approach to an accurate comparison may be made. The averages are listed in Table VIII.

As mentioned before, the Andamanese have very small brain cases. Both the Semang and the Philippine Negrito surpass them in this respect. Consequently we should expect the gross diameters of the brain case to exceed in the Semang and the Philippine Negrito. Such is the case. Not only in the brain case but in every diameter recorded the Semang and the Philippine Negrito exceed the Andamanese. In Table IX I have compared the differences of the averages of the Andamanese and the Philippine Negrito with the variability of the averages ($\sqrt{e_1^2 + e_2^2}$). It will be noted that the differences are positive in nearly every case and that they are of sufficient magnitude to be considered real mathematical differences. This too might be expected. If the Philippine Negrito originated from the same source as the Andamanese it must have been at some fairly early date. They are now widely separated and the one group has been isolated on their island home for some time, while the other has had an entirely different experience in a different

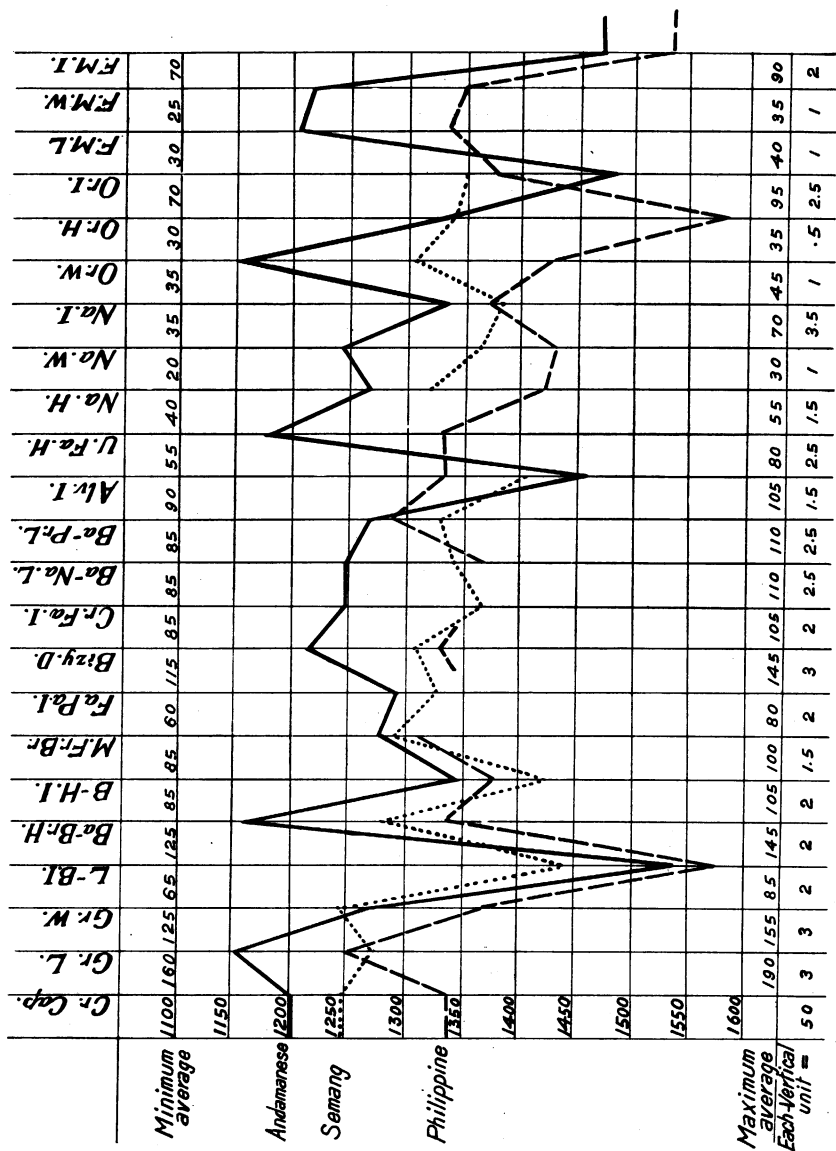


Fig. 1. Graphic comparison of the distribution of the averages of the entire series of Andamanese, Semang, and Philippine Negrito skulls in a scale representing the range of these measurements and indices in the various groups of mankind.

TABLE VIII
COMPARISON OF AVERAGES

Measurement	Male			Female			Male and Female		
	Andamanese Negrito	Philippine Negrito	Semang Negrito	Andamanese Negrito	Philippine Negrito	Semang Negrito	Andamanese Negrito	Philippine Negrito	Semang Negrito
Cranial Capacity	1269	1409	1338	1128	1219	1130	1199	1343	1248
Greatest Length	164.9	172.3	172.7	160.7	162.3	165.0	163.3	168.9	170.4
Greatest Width	136.1	143.7	134.7	131.8	135.9	131.0	134.4	141.0	133.6
Cranial Length-Breadth Index	84.3	83.4	78.1	81.0	83.9	79.4	82.5	84.0	78.9
Basion-Bregmatic Height	130.2	136.3	131.3	124.2	131.7	132.6	127.3	134.6	132.0
Cranial Breadth-Height Index	95.7	95.3	97.6	94.2	97.6	100.7	94.9	96.1	98.1
Minimum Frontal Breadth	92.2	92.3	90.4	89.2	89.5	91.3	90.7	91.2	90.7
Transverse Fronto-Parietal Index	68.1	....	70.8	67.8	....	68.1	67.8	....	69.5
Bizygomatic Diameter	124.6	131.3	128.6	117.7	123.0	125.0	121.8	128.8	127.4
Transverse Cranio-Facial Index	91.6	....	95.4	89.0	....	96.3	90.7	....	95.6
Basion-Nasion Length	93.4	99.5	97.0	90.8	93.7	98.0	92.3	97.8	97.3
Basion-Prosthion Length	93.4	95.4	96.5	92.5	90.7	96.3	93.0	94.0	96.4
Index of Alveolar Projection	100.3	96.3	99.4	101.8	98.1	98.3	100.9	96.9	99.1
Upper Anatomical Face Height	61.0	68.7	....	56.6	69.9	....	58.9	66.9	....
Nasal Height	45.8	50.9	46.3	43.2	47.9	47.0	44.8	49.9	46.5
Nasal Width	23.3	27.2	24.5	22.5	25.0	27.0	22.9	26.6	25.3
Nasal Index	51.0	53.3	52.6	52.0	53.8	57.5	51.2	53.5	54.2
Orbital Width	36.7	42.2	39.1	35.7	40.4	39.0	36.2	41.6	39.1
Orbital Height	32.7	35.3	32.1	31.8	34.3	33.0	32.3	34.9	32.4
Orbital Index	89.0	83.2	81.8	89.1	84.6	84.2	89.3	83.8	82.6
Foramen Magnum Length	32.9	35.1	....	31.4	34.4	....	32.1	34.8	....
Foramen Magnum Width	28.0	30.1	....	26.7	29.5	....	27.4	29.9	....
Foramen Magnum Index	84.4	85.8	....	85.1	90.6	....	84.7	87.5	....

environment. The Philippine Negrito and Semang have probably been in contact with a greater number of racial types, at least in recent years. Perhaps the most surprising thing is that they are not more different from the Andamanese. While the differences that exist at the present time must be considered actual mathematical differences it is interesting to note the nature of these differences. In Fig. 1 I have noted the averages for these three groups in the form of a curve the basis of which is the range of the various measurements and indices as they have been recorded in racial groups. The vertical distances are determined not by the range of these measurements in individual cases but by the range of the average of these measurements in racial groups. They have been weighted by the extent of their variabilities. If a measurement like the average of the height of the orbit shows a range of only about five millimeters in mankind, a very slight difference, one millimeter, is more significant than a difference of one millimeter in length of cranium and so appears in the diagram. For the most part the direction of the curves is very similar and the differences constant. As previously stated they are variations in absolute size. The Semang differ from the Andamanese more than do the Philippine Negrito. Their brain cases are relatively considerably longer. Both the Semang and the Philippine Negrito have wider nasal apertures than the Andamanese. Quite characteristic of the Negrito as a whole is the value of the transverse fronto-parietal index which reveals the relationship between the narrow frontal region and the rather wide parietal region. The average is very low. Although the different methods of measuring the orbits make it difficult to compare them throughout, the indications are that the orbits are relatively high. The proportions of the foramen magnum also are nearly equal.

In conclusion, it may be said that while the three groups are quite different in some respects, on the whole, the differences are not as great as might be expected under the conditions. The data at hand do not seriously contradict the assumption that these three groups are quite closely related racially and the offspring of the same stock. Incidentally the question arises as to their relationship to the reported Negrito from New Guinea. Very little data are available. That a dwarfed negroid type exists in New Guinea cannot be further doubted after the reports of Van den Broek,¹ Williamson,² and Wollaston.³ That they are Negrito in the

¹Van den Broek, 1915 (on p. 251 Van den Broek has included in his table of measurements on the nose the data of Chalmers which are obviously not comparable since Chalmers has recorded the breadth of nose of an individual 70 years of age as 9 millimeters!)

²Williamson, 1912.

³Wollaston, 1912.

TABLE IX

COMPARISON OF DIFFERENCES OF THE AVERAGES OF MEASUREMENTS OF ANDAMANESE AND PHILIPPINE NEGRITOS WITH THE VARIABILITY OF THE AVERAGES

Measurement	Male		Female		Male and Female	
	A ₂ -A ₁	$\sqrt{e_1^2 + e_2^2}$	A ₂ -A ₁	$\sqrt{e_1^2 + e_2^2}$	A ₂ -A ₁	$\sqrt{e_1^2 + e_2^2}$
Cranial Capacity	140*	31.70	91	30.01	144*	26.38
Greatest Width	7.6*	1.07	4.1*	1.29	6.6*	.97
Basion Bregmatic Height	6.1*	1.40	7.5*	1.32	7.3*	1.04
Breadth-Height Index	-0.4	1.01	3.4*	.97	1.2	.71
Minimum Frontal Breadth	0.1	1.24	0.3	1.04	0.5	.87
Bizygomatic Diameter	6.7*	1.45	5.3*	1.56	7.0*	1.29
Basion-Nasion Length	6.1*	1.10	2.9	1.24	5.5*	.86
Basion-Prosthion Length	2.0	1.46	-1.8	1.81	1.0	1.09
Index of Alveolar Projection	-4.0*	.86	-3.7	1.39	-4.0*	.75
Nasal Height	5.1*	.77	4.7*	.70	4.1*	.61
Nasal Width	3.9*	.50	2.7*	.50	3.7*	.37
Nasal Index	2.3	.94	1.8	.98	2.3*	.69
Orbital Width	5.5*	.42	4.7*	.60	5.4*	.37
Orbital Height	2.6*	.37	2.5*	.49	2.6*	.30
Orbital Index	-5.8*	1.22	-4.5*	1.34	5.5*	.87

* = Denotes real mathematical difference.

A₁ = Average of Andamanese.A₂ = Average of Philippine Negrito.

sense of being more nearly related to the Andamanese, Semang, and Philippine Negrito than to the Melanesian Negroes remains to be proved. Most certainly the skulls figured by Williamson are not Negrito, nor, I believe, are those of Pycraft.¹ Pycraft in the description of a series of skulls from Dutch New Guinea has seen fit to tear down the structure of craniometry and to substitute what he chooses to call morphological description. His arguments are far from convincing and in the end he leaves us only his own opinion that in the sixteen skulls described he finds eight different racial blends of six racial types. Few anthropologists would pose as such an expert. His Negrito element is characterized by conspicuous subnasal prognathism, the broad sweep of the dental arch, deep suborbital fossae, presence of a fronto-temporal articulation and a short wide ascending ramus of the mandible. These characters, together with the contours of the normae, are his criteria. In the contours figured

¹Pycraft, 1916.

it is hard to read Negrito affinities. One of the skulls, which he characterizes as a Negrito blend, has a cephalic index of 68 and a nasal index of 46. It is interesting to notice that a majority of the skulls designated as Negrito are female and would naturally show a few of the infantile characters which are common in Negrito skulls but by no means confined to them. The data available at present are not adequate to determine whether in the case of the so-called Negrito type we are dealing with a single racial type or a series of local types. The entire Negrito group is worthy of more detailed study. The Andamanese, particularly, on account of their isolation are deserving of more serious study by anthropologists.

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