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DERMATOGLYPHICS OF THE REMBRRANGA TRIBE

(Northern Territory, Australia)

INTRODUCTION

The first Czechoslovak expedition to Australia, organized by the Moravian Museum took place in 1969. The purpose of the expedition was to study the Rembrrangas, a tribe of the Australian Aborigials living in the Northern Territory. Due to the advancing europeanization the Rembrrangas loose their integrity, they leave the territory of their forefathers and their hunting grounds in the area of Bulman Waterhole in Arnhem Land. The Rembrranga tribesmen now live scattered on various cattle stations, government settlements and missions. Dermatoglyphic research formed part of the complex anthropological research of the Rembrrangas, living mostly in the Katherine District in the Northern Territory. The dermatoglyphic features originating from the course of the embryonic development remain unchanged for the given individual during his lifetime. Very suitable for dermatoglyphic research are especially small populations with a limited number of members belonging to various age groups. In populations whose origin has not been satisfactorily explained, as is the case with the Australian Aboriginals, detailed dermatoglyphic analyses can determine their relationship to other population groups and thus can contribute to the solution of the question of their origin. The material was collected in July—October 1969 in the following localities: Bamyili, Roper Valley, Roper River Stn., Urapunga, Moroak, Beswick Stn., Mainoru, Mountain Valley, Kormilda College in Darwin and Maningrida.

MATERIAL AND METHODS

We took the fingerprints and palmprints of both hands of the individuals in the following way: we applied a thin layer of printing ink with the help of a roller on a perspex and the individual finger were rolled, beginning with the little finger towards the thumb of the left hand and from the thumb to the little finger of the right hand, along the edge of the perspex, so as to apply the ink on the finger cushions and on the sides of the fingers — the fingerprints were than realized on a sheet of white paper fixed to the edge of the table. Each finger was printed twice. Then ink was applied with the help of the roller also on the palm and the palmprint was made by rolling a bottle, rolled into a sheet of paper [the method of J. Malý, well reproducing the dermatoglyphs of the cavity of the central palm region (see *Foto 1*)].

We obtained thus the fingerprints and palmprints of 116 males, 85 of them fullblood Rembrrangas, 31 half-breeds (11 Remb. — Ngalkbun, 7 Remb. — Maiali, 3 Remb. — Jimba, 3 Remb. — Mara, 3 Remb. — Ritarranga, 2 Remb. — Wugymun, 1 Remb. — Aranda, 1 Remb. — Wandarang). The number of female fingerprints and palmprints thus obtained amounted to 95, 68 of them fullblood Rembrrangas, and 27 half-breeds (6 Remb. — Ngalkbun, 5 Remb. — Maiali, 4 Remb. — Jimba, 3 Remb. — Wandarang, 2 Remb. — Wagait, 2 Remb. — Wugymun, 2 Remb. — Aranda, 1 Remb. — Mara, 1 Remb. — Nalakan, 1 Remb. — Burera). 64 of the men were below 18 years of age

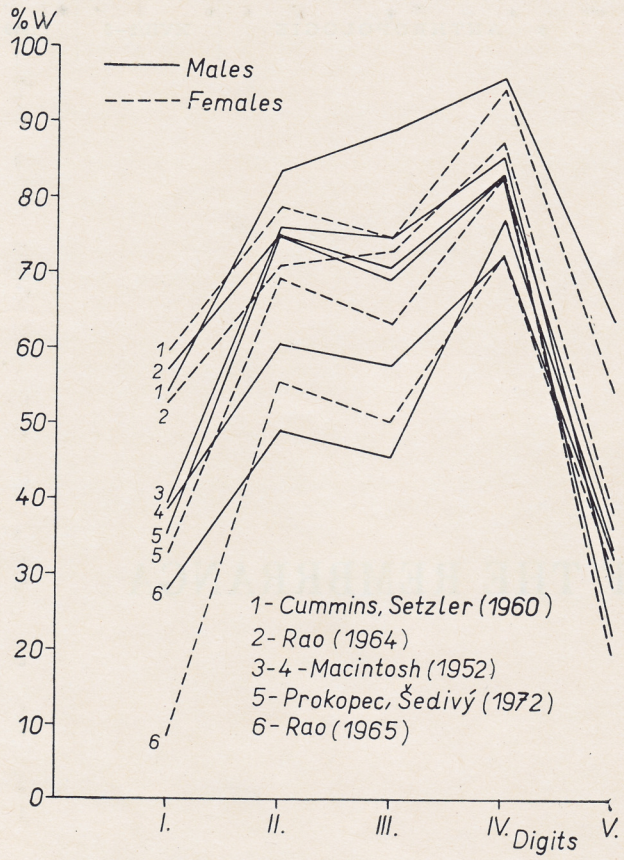

FIG. 1. *Comparison of samples of Australian Aboriginals with regard to percent frequencies of whorls on individual fingers.*

and 52 were above 18 years. 63 females were younger than 18 years and 31 were older.

The values of types of the dermatoglyphs, the number of lines, number of triradii, existence of the Simian line, -atd- angle values, number of triradii on the palm, presence of patterns on the hypothenar, thenar and the 1st interdigital area, and in the rest of the interdigital areas and the formula following from the termination of main lines were put down into blank forms. The TRC, ARC and MLI values, both according to Cummins and Midlo (1961) and according to Penrose (1968) were calculated additionally.

The final processing of fingerprints was realized according to the nomenclature by Penrose (1968), both in the quantitative and qualitative evaluation of the material. We calculated the three basic indices (Furuhata's, Dankmeijer's and Pattern Intensity). Besides we were examining the pattern intensity of the fingers directly by counting the triradii, since in our material occurred also combined patterns with three triradii. In the palmprints we evaluated the presence and degree of the Simian line (Vierfingerfurche) according to M. Weninger and Navratil (1967). As -atd- angle we considered the largest angle, in case of the presence of two or more triradii. The division of angles was realized according to Penrose, and in a more detailed way according to Mavalwala (1963). The patterns on the hypothenar were determined according to Penrose. As patterns on the thenar and I., II., III. and IV. interdigital areas only the true patterns were considered (i.e. if there was vestige according to Bettmann on Th/I (Quer Muster). The pattern intensity of the palm, the ending of the main lines and the formulae were evaluated according to Penrose's nomenclature. The main line index was calculated both by the method of Cummins and Midlo (1961) and by the new method of Penrose.

PROCESSING AND RESULTS

a) *Finds on the fingerprints*

The per cent frequency of the finger patterns on the individual fingers of the right and left hands of male and female Rembrrangas are indicated both separately and also together in *Tables 1, 2 and 3.* Whorls are more frequent than loops on the IV, III and II fingers, in 82.99 %, 66.25 % and 70.81 %. Loops, on the other hand, are more frequent on the V and I fingers, with the following frequency: 78.43 % and 61.67 %. Arches occur on the I, II and V fingers in 5.84 %, 2.79 % and 0.76 %. In women more frequent is the occurrance of arches and loops, and less frequent are the whorls than in men. Between the right and left hands of the women there are no substantial differences, while in men the right hands have higher frequency of whorls and arches than the left hands. Radial loops appear in women only on the II finger, while in men they appear also on the III and I fingers and are much more frequent. For the individual fingers of the men holds that on the right hand there is a regularity in the frequency of the whorls and arches. There is no such regularity in women. *Tables 1, 2, 3, Fig. 1.*

Furuhata's index (% of whorls / % of loops) $\times$ 100 is high in both sexes due to the high frequency of whorles and is higher in men than in women.

Dankmeijer's index (% of arches / % of whorls) $\times$ 100, is on the contrary, small. This is caused by the low frequency of arches, whose proportion is higher in women, and therefore this index is higher.

The index of pattern intensity

$$\frac{(2 \times \% \text{ of whorles} + 1 \times \% \text{ of loops})}{10}$$

is high in both sexes, since the frequency of whorls is high. The approximate proportion of whorls compared with loops is 60:40, which is characteristic of Veddoids and Australoids, is seemingly shifted in the Rembrrangas, but it has not been proved statistically (54.67 : 43.45). It may be caused by the fact that in our samples prevail materials obtained from younger individuals. Later there is a generation shift in the pattern types towards

TAB. 1.
Percentage Frequencies of the Fingerprint Configurations in the Rembrranga Tribe. (108 Males)

Digit	Hand	Whorls			Loops			Arches
		True Whorls	Double Loops	Total	Radial	Ulnar	Total	Total
I.	R	30,55	6,48	37,04	—	58,33	58,33	4,63
	L	20,37	7,41	27,78	0,91	67,59	68,50	3,70
	R+L	25,46	6,94	32,41	0,46	62,96	63,42	4,67
II.	R	60,18	12,96	73,15	11,11	12,04	23,15	3,70
	L	63,89	7,41	71,30	7,14	20,37	27,51	0,92
	R+L	62,04	10,18	72,22	9,26	16,20	25,46	2,31
III.	R	56,48	12,96	69,44	0,92	29,63	30,55	—
	L	62,04	6,48	68,52	—	31,48	31,48	—
	R+L	59,26	9,72	69,98	0,46	30,55	31,01	—
IV.	R	75,93	11,11	87,04	—	12,96	12,96	—
	L	63,89	14,81	78,70	—	21,30	21,30	—
	R+L	69,91	12,96	82,87	—	17,13	17,13	—
V.	R	24,07	3,70	27,78	—	71,30	71,30	0,92
	L	12,04	3,70	15,74	—	84,26	84,26	—
	R+L	18,05	3,70	21,76	—	77,78	77,78	0,46
All	R	—	—	58,89	—	—	39,26	1,85
	L	—	—	52,41	—	—	46,67	0,92
	R+L	—	—	55,65	—	—	42,96	1,39

TAB. 2.
Percentage Frequencies of the Fingerprint Configurations in the Rembrranga Tribe. (89 Females)

Digit	Hand	Whorls			Loops			Arches
		True Whorls	Double Loops	Total	Radial	Ulnar	Total	Total
I.	R	21,35	7,86	29,21	—	64,04	64,04	6,74
	L	29,21	6,74	35,95	—	55,06	55,06	8,99
	R+L	25,28	7,30	32,58	—	59,55	59,55	7,86
II.	R	61,80	10,11	71,91	3,37	21,35	24,72	3,37
	L	57,30	8,99	66,29	5,62	24,72	30,34	3,37
	R+L	59,55	9,55	69,10	4,49	23,03	27,52	3,37
III.	R	50,56	10,11	60,67	—	39,93	39,93	—
	L	58,43	6,74	65,17	—	34,83	34,83	—
	R+L	54,49	8,43	62,92	—	37,08	37,08	—
IV.	R	77,53	6,74	84,27	—	15,73	15,73	—
	L	71,91	10,11	82,02	—	17,98	17,98	—
	L+R	74,72	8,43	83,15	—	16,85	16,85	—
V.	R	15,73	3,37	19,10	—	79,77	79,77	1,12
	L	15,73	4,49	20,22	—	78,65	78,65	1,12
	R+L	15,73	3,93	19,66	—	79,21	79,21	1,12
All	R	—	—	53,03	—	—	44,72	2,25
	L	—	—	53,93	—	—	43,37	2,70
	R+L	—	—	53,48	—	—	44,04	2,47

an increase of the frequency of arches and loops (explanation follows below).
Table 4.

Several interesting conclusions follow from *Table 5.* In men the number of ridges is always larger than in women. It holds for both sexes that the largest number of papillar ridges occurs on the IV and I fingers and the lowest on the V finger. On the I. II and V fingers of the left hand there is a smaller number of ridges than on the corresponding fingers of the right hand. On the III and IV fingers of both hands the number is the same, on the average.

The TRC (total ridge count) occurs in the Rembrranga within the ranges of 40—289 in men, and 30—249 in women, the mean values being 160.83 and 143.76. P. Rao found in men from Kalumburu Mission (Rao, 1964) a mean TRC of 160.4 in men, and 148.0 in women. The limits of the ARC (absolute ridge count) are 40—469, with a mean value of 232.31 in men, and 30—409, with a mean value of 209.44 in women.
Tables 6, 7, 8.

The total sum of triradii on the fingers of one hand (pattern intensity) is indicated in Table 9. The highest frequency can be seen at value 8, but the

TAB. 3.
Percentage Frequencies of the Fingerprint Configurations in the Rembrranga Tribe. (108 Males and 89 Females)

Digit	Hand	Whorls			Loops			Arches
		True Whorls	Double Loups	Total	Radial	Ulnar	Total	Total
I.	R	26,39	7,11	33,30	—	60,91	60,91	5,58
	L	24,36	7,11	31,47	0,51	61,93	62,44	6,09
	R+L	25,38	7,11	32,49	0,25	61,42	61,67	5,84
II.	R	60,91	11,67	72,58	7,61	16,24	23,85	3,53
	L	60,91	8,12	69,03	6,60	22,33	28,93	2,03
	R+L	60,91	9,90	70,81	7,11	19,29	26,40	2,79
III.	R	53,81	11,67	65,48	0,51	34,01	34,52	—
	L	60,41	6,60	67,01	—	32,99	32,99	—
	R+L	57,11	9,14	66,25	0,25	33,50	33,75	—
IV.	R	76,65	9,14	85,79	—	14,21	14,21	—
	L	67,51	12,69	80,20	—	19,80	19,80	—
	R+L	72,08	10,91	82,99	—	17,00	17,00	—
V.	R	20,30	3,53	23,83	—	75,13	75,13	1,01
	L	13,70	4,06	17,76	—	81,72	81,72	0,51
	R+L	17,00	3,81	20,81	—	78,43	78,43	0,76
All	R	—	—	56,24	—	—	41,72	2,03
	L	—	—	53,10	—	—	45,48	1,72
	R+L	—	—	54,67	—	—	43,45	1,88

mean values of the individual hands are lower. There was no value lower than 3, a characteristic feature of the Australian Aboriginal population, in which arches are rare. *Table 9.*

b) *Finds on palmprints.*

Besides papillar features we evaluated also the course of the flection creases of the palms. A detailed analysis of the types of four-finger creases or Simian lines was realized by M. Weninger and Navratil (1957); see *Fig. 2.*

From Table 10 follows the high frequency of various types of Simian lines in Rembrrangas. The highest proportion is formed by type III in both sexes, and by types IIa and Ia in men and types Ib and IIa in women. The occurrance of all types is much higher in men than in women; 25.85 % and 16.66 %. The "Simian crease" appears more frequently on the right hands of both sexes than on the left ones.
Table 10.

We were not able to express always the height of the axial triradius in % of the palm length from all palmprints, since the carpal flection crease — the starting point of the measuring — was often missing.

The -atd- angle informs us about the position of the axial triradius, the disadvantage, however, is that it is changing with the age of the individual. On processing the angles measured according to Penrose we found that in men the high share of angles below 45° is more frequent than in women, in which there is an increased share of angles between 45° and 56° and above 56°. During processing the palmprints according to Mavalwala we found that in men more frequent are the angles

TAB. 4. *Values of the Three Principle Indices.*

	No.	Furuhata Index	Denkmeijer Index	Pattern Intensity Index
Males	108	129,54	2,50	15,43
Females	89	119,59	4,62	15,10
Total	197	125,82	3,44	15,28

TAB. 5.
Mean Ridge Count for Each Finger in the Rembrranga Tribe. (108 Males and 89 Females)

Digit	Males				Females			
	R		L		R		L	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
I.	18,62	7,20	15,47	7,18	15,65	6,81	13,68	6,34
II.	15,24	6,01	14,36	5,49	14,69	6,87	14,08	6,31
III.	16,58	5,76	16,54	5,65	14,98	5,26	15,09	5,71
IV.	18,20	5,06	18,34	5,23	17,73	5,36	17,90	6,10
V.	13,62	3,79	13,11	3,94	12,62	4,25	11,94	4,55

TAB. 6. *Distribution of the Total Ridge Counts in the Rembrranga Tribe. (108 Males and 89 Females)*

	Males	Females	Males + Females
30— 39	—	1	1
40— 49	1	—	1
50— 59	2	2	4
60— 69	—	1	1
70— 79	—	5	5
80— 89	1	—	1
90— 99	2	6	8
100—109	3	3	6
110—119	5	3	8
120—129	9	8	17
130—139	10	5	15
140—149	11	14	25
150—159	8	8	16
160—169	18	5	23
170—179	9	10	19
180—189	5	2	7
190—199	7	2	9
200—209	3	5	8
210—219	6	4	10
220—229	1	3	4
230—239	3	—	3
240—249	1	2	3
250—259	—	—	—
260—269	2	—	2
270—279	—	—	—
280—289	1	—	1

TAB. 7. *Distribution of the Absolute Ridge Counts in the Rembrranga Tribe. (108 Males and 89 Feamales)*

	Males	Females	Males + Females		Males	Females	Males + Females
30— 39	—	1	1	240—249	13	3	16
40— 49	1	—	1	250—259	1	3	4
50— 59	1	2	3	260—269	4	2	6
60— 69	1	—	1	270—279	2	2	4
70— 79	—	2	2	280—289	2	5	7
80— 89	1	1	2	290—299	2	3	5
90— 99	1	1	2	300—309	4	1	5
100—109	—	2	2	310—319	2	—	2
110—119	5	4	9	320—329	1	2	3
120—129	1	5	6	330—339	2	2	4
130—139	2	1	3	340—349	4	5	9
140—149	4	3	7	350—359	3	1	4
150—159	1	3	4	360—369	3	2	5
160—169	8	5	13	370—379	1	—	1
170—179	3	3	6	380—389	1	—	1
180—189	7	3	10	390—399	1	—	1
190—199	7	6	13	400—409	—	1	1
200—209	3	1	4	410—419	—	—	—
210—219	8	2	10	420—429	—	—	—
220—229	3	6	9	430—439	1	—	1
230—239	2	6	8	440—449	—	—	—
				450—459	1	—	1
				460—469	1	—	1

between 35.1° and 40° and with the increasing angle the number of cases is dropping. In women larger angles appear more frequently — this, however, could have been caused by the larger number of young individuals among women.
Table 11.

The number of all triradii on the palm (pattern intensity) reaches in some cases the value of 4, which is caused by the absence of either the axial triradius or of the c triradius. Most frequent is value 5, more frequent in males than in females. The mean value in males is 5.34 and in females 5.53. Higher values were found in the left hands of both sexes.
Table 12.

On the hypothenar of the studied palms we discovered 14 various patterns. Absent in men were types T^u and A^c/L^r, in women types A^r/A^u, L^d, A^u/L^r and W. Most frequent in both sexes is pattern A^u and further very frequent patterns are L^u and A^c.
Table 13.

The frequency of patterns on the thenar and in the interdigital areas is indicated in *Table 14.*

Since only the "genuine" patterns were taken into account, i.e. patterns with formed triradius, eventually in the case of thenar, and of the interdigital area I. also the formation of the Bettmann's vesetige (Quer Muster) — we must bear this in mind in considering the results. On Th/I the occurrence of samples and vestiges in higher on the left hands, both in men and women. On evaluating

TAB. 8. *Mean Values of the TRC and ARC*

		Males	Females
TRC	Mean	160,83	143,76
	S. D.	42,46	45,56
ARC	Mean	232,31	209,44
	S. D.	80,27	84,43

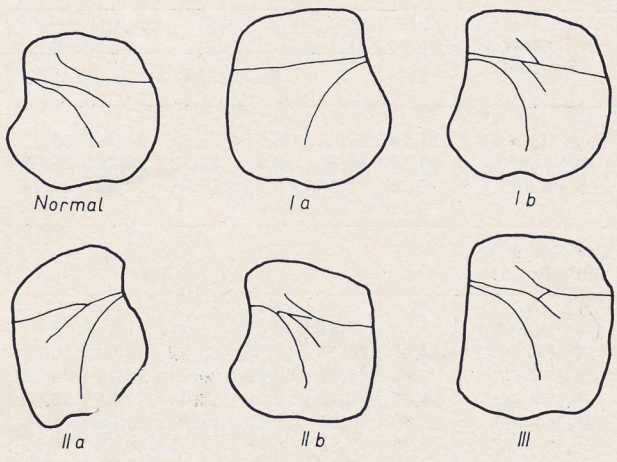

FIG. 2. *Possible manifestation of "simian creases" according to M. Weninger and Navratil - 1957. (from P. M. Becker: Humangenetik, 1969)*

TAB. 9. *Frequence of Pattern Intensity of Digits in the Rembrranga Tribe. (108 Males and 89 Females)*

Pattern Intensity Value	Males			Females		
	R	L	R+L %	R	L	R+L %
3	2	—	0,92	1	2	1,68
4	1	3	1,85	3	3	3,37
5	7	9	7,40	7	5	6,74
6	8	14	10,17	12	12	13,48
7	21	18	18,05	14	16	16,85
8	30	33	28,88	24	22	25,84
9	21	24	20,83	19	20	21,90
10	18	7	11,57	9	9	10,11
Mean	7,12	7,53	—	7,56	7,56	—
S. D.	1,74	1,48	—	1,64	1,67	—

TAB. 10. *Percentage Frequencies of the „Simian Crease" in the Rembrranga Tribe. (116 Males and 93 Females)*

According to Weninger, Navratil:	Males			Females		
	R	L	R+L	R	L	R+L
Ia	6,03	1,72	3,88	1,07	1,07	1,07
Ib	0,86	—	0,43	2,15	2,15	2,15
IIa	7,76	5,17	6,46	1,07	4,30	2,69
IIb	1,72	—	0,86	—	1,07	0,54
III	17,24	11,21	14,22	12,90	7,53	10,21
Total Ia—III	32,61	18,10	25,85	17,19	16,12	16,66
Absent	66,38	81,90	74,14	82,79	83,87	83,33

TAB. 11. *Percentage Distribution of the Angle „atd" in the Rembrranga Tribe. (116 Males and 93 Females)*

According to Penrose:	Males			Females		
	R	L	R+L	R	L	R+L
Less than 45°	77,19	73,45	75,35	51,61	54,84	53,23
45°—56°	20,17	18,58	19,38	33,33	24,73	29,03
Above 56°	2,63	7,76	5,29	15,05	20,45	17,74
According to Mavalwala:						
Less than 30°	1,75	3,34	2,64	1,07	1,07	1,07
30,1°—35°	14,91	14,16	14,54	6,45	9,68	8,06
35,1°—40°	38,60	41,59	40,09	24,73	24,73	24,73
40,1°—45°	24,56	16,81	20,70	23,65	19,35	21,50
45,1°—50°	11,40	12,39	11,89	18,28	13,98	16,13
50,1°—55°	5,26	2,65	3,96	7,53	6,45	6,99
55,1°—60°	0,88	3,34	2,20	8,60	9,68	9,14
60,1°—65°	1,75	3,34	2,64	4,30	3,22	3,76
Above 65°	0,88	1,77	1,32	5,38	11,83	8,60
Angle absent	1,72	2,54	2,13	—	—	—

TAB. 12. *Frequencies of Pattern Intensity of Palms in the Rembrranga Tribe. (116 Males and 94 Females)*

Pattern Intensity Value	Males			Females		
	R	L	R+L %	R	L	R+L %
4	3	3	2,58	1	1	1,06
5	87	79	71,55	58	51	57,97
6	19	23	18,10	26	30	29,76
7	4	8	5,17	8	9	9,04
8	3	2	2,15	—	1	0,53
9	—	1	0,43	1	1	1,06
Mean	5,28	5,40	—	5,48	5,58	—
S. D.	0,695	0,801	—	0,758	0,807	—

TAB. 13. *Percentage Frequencies of the Hypothenar Patterns in the Palms in the Rembrranga Tribe. (116 Males and 93 Females)*

Pattern	Males			Females		
	R	L	R+L	R	L	R+L
A^u	61,29	55,91	58,60	75,00	70,69	72,84
A^c	10,75	9,68	10,21	5,17	7,76	6,46
A^u/A^c	1,07	5,38	3,22	4,31	4,31	4,31
A^r/A^u	1,07	—	0,54	—	—	—
T^u	—	—	—	0,86	—	0,43
L^u	19,35	19,35	19,35	6,90	8,62	7,83
L^r	1,07	3,22	2,15	4,31	1,72	3,02
L^d	1,07	—	0,54	—	—	—
A^u/L^u	2,15	2,15	2,15	—	1,72	0,86
A^u/L^r	1,07	1,07	1,07	—	—	—
A^c/L^u	2,15	2,15	2,15	—	1,72	0,86
A^c/L^r	—	—	—	—	0,86	0,43
L^u/L^r	—	1,07	0,54	—	0,86	0,43
W	—	1,07	0,54	—	—	—

TAB. 14. *Percentage Frequencies of the Thenar /I., II., III., IV. Interdigital Patterns on the Palms in the Rembrranga Tribe. (116 Males and 93 Females)*

Area of the Palm	Pattern	Males			Females		
		R	L	R+L	R	L	R+L
Th/I.	True	5,17	11,21	8,19	7,53	10,75	9,14
	Q[1])	4,31	7,76	6,03	3,22	11,83	7,53
II.	True	6,03	4,31	5,17	1,07	1,07	1,07
III.	True	41,38	30,17	35,77	51,61	37,63	44,62
IV.	True	60,34	75,86	68,10	58,06	59,14	58,60
2 Patterns on II.—IV.		7,76	14,65	11,20	13,98	5,38	9,68
3 Patterns on II.—IV.		1,72	0,86	1,29	—	1,07	0,53

[1]) *Bettmann's Vestige (Quer Muster)*

TAB. 15.

Percentage Frequencies of Terminations of the Palmar Main Lines of the 116 Males in the Rembrranga Tribe

	Line D		Line C		Line B		Line A	
	R	L	R	L	R	L	R	L
1	—	—	—	—	—	—	1,72	4,31
2	—	—	—	—	—	—	0,86	0,86
3	—	—	—	—	—	0,86	24,14	40,52
4	—	—	—	—	—	—	3,45	6,03
5′	—	—	—	0,86	10,34	12,93	43,96	33,62
5″	—	—	18,96	27,59	39,65	45,69	19,83	12,07
6	—	—	2,59	1,72	2,59	1,72	—	—
7	18,96	33,62	31,90	34,48	29,31	36,21	6,03	2,59
8	2,59	1,72	—	—	5,17	—	—	—
9	28,45	25,00	26,72	25,86	10,34	2,59	—	—
10	2,59	1,72	5,17	—	—	—	—	—
11	41,38	35,34	11,21	2,59	0,86	—	—	—
12	—	—	—	—	—	—	—	—
13	6,03	2,59	—	—	—	—	—	—
X	—	—	2,59	6,90	1,72	—	—	—
0	—	—	0,86	—	—	—	—	—

TAB. 16.

Percentage Frequencies of Terminations of the Palmar Main Line of the 94 Females of the Rembrranga Tribe

	Line D		Line C		Line B		Line A	
	R	L	R	L	R	L	R	L
1	—	—	—	—	—	—	2,13	10,64
2	—	—	—	—	—	—	4,25	2,13
3	—	—	—	—	—	1,06	24,47	27,66
4	—	—	—	—	—	—	5,32	6,38
5′	—	—	—	—	9,57	13,83	46,81	39,36
5″	—	—	7,45	22,34	36,17	37,23	15,96	11,70
6	—	—	3,19	4,25	5,32	4,25	—	—
7	7,45	22,34	35,11	26,59	38,30	41,49	1,06	2,13
8	3,19	3,19	—	—	4,25	1,06	—	—
9	35,11	25,53	37,23	34,04	6,38	1,06	—	—
10	5,32	5,32	4,25	1,06	—	—	—	—
11	47,87	41,49	6,38	1,06	—	—	—	—
12	—	—	—	—	—	—	—	—
13	1,06	2,13	—	—	—	—	—	—
X	—	—	4,25	9,57	—	—	—	—
0	—	—	2,13	1,06	—	—	—	—

the patterns in the II, III and IV interdigital areas, in men in the II interdigital area we found higher frequency of patterns than in women. The same applies for the IV interdigital area, in contrast to the III interdigital area. In men more frequently appear also 2—3 patterns simultaneously as compared with women.
Table 14.

Tables 15 and 16 express the percentage of occurrence of the termination of the main palmar lines.

In males the termination of D-lines on the right hand at area 7 is considerably lower than in the left hand, and on the contrary — at areas 9 and 11 it is higher than on the left. According to the modal types of Cummins and Midlo on the right hand there are 47.41 % of type 11, 31.04 % of type 9 and 21.55 % of type 7, while on the left hand there are 37.93 % of type 11, 26.72 % of type 9 and 35.34 % of type 7. In both hands the modal types are represented by 42.67 %, 28.88 % and 28.44 %. Reduction -X of C-line higher on the left hand than on the right one appears also on the right hand in line B. Absence -O occurs only on the right hand at C-line. As regards the termination of lines in men we can say in general that on the left hands all lines terminate more often in areas with lower numbers, i.e. the right hand is more inclined to transversality.

In females the termination of D-line on the right hand at area 7 is much lower than on the left hand, on the contrary at areas 9 and 11 it is higher than on the left hand. According to Cummins' and Midlo's modal types on the right side there are 48.95 % of type 11, 43 % of type 9 and 10.64 % of type 7, on the left side 43.62 % of type 11, 30.85 % of type 9 and 25.53 % of type 7. On both hands the modal types are represented by a total of 46.28 % of type 11, 35.64 % of type 9 and 18,08 % of type 7. Exit of the C-line shows the reduction -X, higher on the left hand, and an absence -O. They do not appear on other lines. As regards the termination of lines in females we can generally say, that in the left hands they usually terminate in areas with lower figures, i.e. the right hand has higher inclination towards transversality.

TAB. 17. *Distribution of the Main Line Formulae in the Rembrranga Tribe. (116 Males and 94 Females)*

Formula	Males		Females		Formula	Males		Females		Formula	Males		Females	
	R	L	R	L		R	L	R	L		R	L	R	L
13, 11, 11, 7	1	—	—	—	11, X, 7, 1	—	—	—	1	9, 7, 5, 2	—	—	3	1
13, 11, 9, 7	5	2	—	—	11, 0, 9, 5	1	—	—	—	9, 7, 5, 1	—	3	—	3
13, 11, X, 7	1	—	—	—	11, 0, 7, 5	—	—	1	1	9, X, 5, 5	1	—	—	1
13, 9, 7, 7	—	1	1	1	11, 0, 7, 3	—	—	1	—	9, X, 5, 3	—	2	1	2
13, X, 7, 7	—	—	—	1	10, 9, 6, 5	1	—	1	1	8, 6, 5, 5	2	1	—	—
11, 11, 9, 5	5	1	3	1	10, 9, 6, 4	—	—	1	—	8, 6, 5, 4	1	—	—	1
11, 11, 9, 3	—	—	3	—	10, 9, 6, 3	—	—	—	2	8, 6, 5, 3	—	1	2	1
11, 11, X, 5	1	—	—	—	10, 7, 6, 5	2	1	1	2	8, 6, 5, 2	—	—	1	—
11, 10, 8, 5	6	—	3	1	10, 7, 6, 3	—	1	1	—	8, 6, 5, 1	—	—	—	1
11, 10, 8, 3	—	—	1	—	10, 7, 6, 1	—	—	1	—	7, 9, 5, 5	1	—	—	—
11, 9, 7, 5	24	21	25	16	9, 9, 5, 5	3	3	2	5	7, 7, 5, 5	—	1	—	—
11, 9, 7, 4	—	—	3	—	9, 9, 5, 4	—	—	—	1	7, 7, 5, 3	—	3	—	—
11, 9, 7, 3,	1	1	2	6	9, 9, 5, 3	1	4	—	—	7, 5, 5, 5	9	7	1	4
11, 7, 7, 5	5	9	1	6	9, 9, 5, 2	1	—	—	—	7, 5, 5, 4	1	3	1	1
11, 7, 7, 4	—	1	—	1	9, 9, 3, 2	—	—	—	1	7, 5, 5, 3	10	20	4	11
11, 7, 7, 3	2	3	—	1	9, 7, 9, 5	1	—	—	—	7, 5, 5, 2	—	1	—	—
11, 7, 7, 1	—	1	—	—	9, 7, 5, 5	10	6	16	6	7, 5, 5, 1	2	1	1	5
11, X, 7, 5	2	4	2	5	9, 7, 5, 4	2	3	—	2	7, 5, 3, 2	—	1	—	—
11, X, 7, 3	—	1	—	—	9, 7, 5, 3	14	8	8	3	7, X, 5, 3	—	1	—	—

TAB. 18.
Percentage Frequencies of the Three Principal Main Line Formulae in the Rembrranga Tribe. (116 Males and 93 Females)

Formula	Males			Females			Males + Females		
	R	L	R+L	R	L	R+L	R	L	R+L
11, 9, 7,—	21,74	19,13	20,43	31,18	24,73	27,96	25,96	21,63	23,80
9, 7, 5, —	22,61	18,26	20,43	31,18	16,13	23,65	26,44	17,31	21,87
7, 5, 5, —	18,26	26,96	22,61	8,60	21,50	15,05	13,94	24,52	19,23
11, X, 7, —	1,74	4,35	3,04	2,15	6,45	4,30	1,92	5,29	3,60
9, X, 7, —	0,87	1,74	1,30	2,15	2,15	2,15	1,44	1,92	1,68

In both sexes the modal types have been represented in the following way:
11 — 44.47 %, 9 — 32.26 % and 7 — 23.26 %.
Table 15, 16.

As follows from Table 17 the entire material comprises 57 various main line formulas. 25 of these formulas are common for both sexes. In the group of men there are 17 formulas not occuring in women, while the group of women has 15 formulas not appearing in men.
Table 17.

In the men we can observe on the right hand, as compared with the left, a larger share of transversally running palm ridges and a lower share of reduction of the C-line. The same can be said about women, but with a wider scope of differences. In the group of men there are no substantial differences in the presence of formulas 11, 9, 7, —, 9, 7, 5, —, and 7, 5, 5, —, in both hands, while in women there is a clear shift towards more transversal formulas.
Table 18.

The per cent frequency in the distribution of the main line index is indicated in *Table 19.* The processing according to Cummins and Midlo has revealed differences between the right and left hands of both men and women; for both hands the difference between males and females is not great. The same can be concluded from the processing according to Penrose.
Table 19.

COMPARING OUR RESULTS WITH THE RESULTS OF OTHER AUTHORS

The pattern intensity index (PII) has been worked out by all authors who studied the papillar lines of the Australian Aboriginals. The survey of their results is comprised by *Table 20.* Pattern intensity index in men oscillates within the ranges of 14.58— 17,85 — in Rembrrangas it is 15.43. This position near the bottom limit has probably been caused by more numerous representation of younger individuals, as proved with the help of the X^2 test of the frequency of finger patterns in the younger age group below 18 years, and in the group above 18 years. The same applies for women, where PII oscillates between 14.18 and 17.80, and in Rembrranga woman reaching 15.10. *Table 20, Figs. 3,4.*

We compared the main line index with the results obtained by Rao (1964), Cummins—Setzler (1960) and Singh (1968) from other samples of Australian Aboriginal population. The

TAB. 19. *Percentage Frequency Distribution of Main-Line-Index in the Rembrranga Tribe. (116 Males and 94 Females)*

According to Cummins Midlo:	Males			Females			According to Penrose:	Males			Females		
	R	L	R+L	R	L	R+L		R	L	R+L	R	L	R+L
3	1,72	0,86	1,29	1,06	5,32	3,19	8	1,72	0,86	1,29	1,06	5,32	3,19
4	—	0,86	0,43	—	1,06	0,53	9	—	0,86	0,43	—	1,06	0,53
5	9,48	23,27	16,38	4,25	15,96	10,11	10	9,48	23,27	16,37	4,25	15,96	10,11
6	1,72	3,45	2,59	7,45	4,25	5,85	11	1,72	3,45	2,58	7,45	4,25	5,85
7	22,14	19,83	21,12	10,64	11,70	11,17	12	22,14	19,83	20,98	10,64	11,70	11,17
8	3,45	4,31	3,88	1,06	5,32	3,19	13	3,45	5,17	4,31	1,06	5,32	3,19
9	13,79	12,07	12,93	29,79	18,08	23,94	14	15,52	11,21	13,36	30,85	19,15	25,00
10	7,76	4,31	6,03	6,38	8,51	7,45	15	2,59	1,72	2,15	5,32	4,25	4,79
11	21,55	18,96	20,26	24,47	19,15	21,81	16	37,07	31,03	34,05	38,30	30,85	34,57
12	18,10	12,07	15,09	14,89	10,64	12,76	17	—		—	—	—	—
							18	—	—	—	—	—	—
Mean	9,03	8,34	8,69	9,42	8,36	8,89	19	—	—	—	—	—	—
S.D.	2,42	2,59	2,51	2,12	2,67	2,39	20	6,03	2,59	4,31	1,06	2,13	1,59
							Mean	14,18	13,21	13,70	14,20	13,36	13,78
							S.D.	2,64	2,65	2,64	2,03	2,71	2,37

TAB. 20. *Pattern Intensity Index of Various Australian Aboriginal Populations*

Population	Males		Females		Source
	n	PII	n	PII	
Western Australia					
— generally	53	15,12	—	—	Macintosh (1952)
Western Australia					
— Kalumburu	44	16,23	40	16,25	Rao (1964)
Arnhem Land					
— Mainoru, Old Beswick	73—75	15,98	—	—	Macintosh (1952)
Arnhem Land					
— Yirrkala	41	17,85	51	17,80	Cummins, Setzler (1960)
— Groote Eylandt	43	17,64	38	16,45	
Arnhem Land					
— Rembrranga	108	15,43	89	15,10	Prokopec, Šedivý (1972)
Central Australia					
— Yuendumu	61	14,94	44	14,18	Rao (1965)
Central Australia					
— *Pintubi*	64	16,78	57	16,46	
— *Pitjantjatjara*	139	16,33	148	15,50	Mader, Parsons,
— Aranda	86	15,93	102	15,06	Conner, Hatt (1965)
— Wailbri	73	15,64	109	14,06	
Mornington Island					
— Lardiil	55	15,44	65	16,29	Singh (1968)
— Kaiadilt	19	14,58	16	14,74	

TAB. 21. *Main Line Index of Various Australian Aboriginal Populations*

Populations	n	Males			n	Females			Source
		R	L	R+L		R	L	R+L	
Western Australia									
— Kalumburu	44	9,55	8,32	8,93	40	8,18	8,03	8,10	Rao (1964)
Arnhem Land									
— Yirrkala	47	9,09	7,81	8,45	45	8,90	8,34	8,62	Cummins, Setzler (1960)
— Groote Eylandt	43	9,09	8,53	8,81	56	8,70	8,11	8,41	
Arnhem Land									
— Rembrranga	116	9,03	8,34	8,69	94	9,42	8,36	8,89	Prokopec, Šedivý (1972)
Mornington Island									
— Lardiil	56	9,61	8,79	9,20	65	9,65	8,97	9,31	Singh (1968)
— Kaiadilt	19	8,63	7,68	8,15	19	8,90	8,05	8,42	

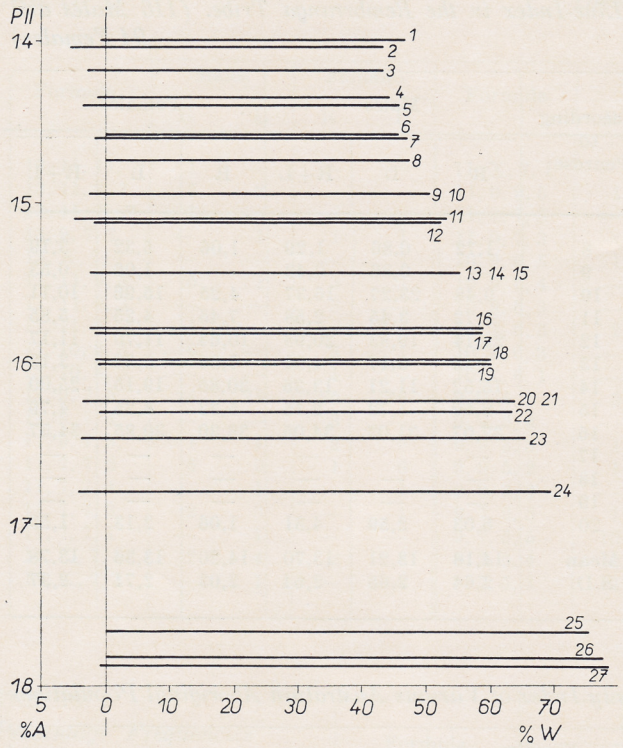

FIG. 3. *Comparison of racial samples with regard to percent frequencies of arches and whorls, arranged in order to increasing pattern intensity. (Based on data from M. Weninger, 1952, where referrences to the relevant literature are given.)*

1. *Aeta — Zambales (M + F; M. Weninger, 1953)*
2. *Japanese (M+F; Hasebe, 1918)*
3. *Austr. Aboriginals — Yuendumu (F; Rao, 1965)*
4. *Igorotos (M+F; M. Weninger, 1953)*
5. *Japanese (M; Kubo, 1918)*
6. *Austr. Aboriginals — Kaiadilt (M; Singh, 1968)*
7. *Malaya Islanders (M+F; Grützner, 1927)*
8. *Austr. Aboriginals — Kaiadilt (F; Singh, 1968)*
9. *Chinese (M; Kubo, 1918)*
10. *Austr. Aboriginals — Yuendumu (M; Rao, 1965)*
11. *Austr. Aboriginals — Rembrranga (F; Prokopec, Šedivý, 1972)*
12. *Austr. Aboriginals — Western Australia (M; Macintosh, 1952)*
13. *Ilokanos (M+F; M. Weninger, 1953)*
14. *Austr. Aboriginals — Lardiil (M; Singh, 1968)*
15. *Austr. Aboriginals — Rembrranga (M; Prokopec, Šedivý, 1972)*
16. *Aeta — Bata`an (M+F; M. Weninger, 1953)*
17. *South Melanesians (M+F; Hesch, 1932)*
18. *Austr. Aboriginals — Arnhem Land (M; Macintosh, 1952)*
19. *Semangs (M+F; M. Weninger, 1953)*
20. *Austr. Aboriginals — Kalumburu (M; Rao, 1964)*
21. *Austr. Aboriginals — Kalumburu (F; Rao, 1964)*
22. *Austr. Aboriginals — Lardiil (F; Singh, 1968)*
23. *Austr. Aboriginnals — Groote Eylandt (F; Cummins, Setzler, 1960)*
24. *Aeta — Camarines (M+F; M. Weninger, 1953)*
25. *Austr. Aboriginals-Groote Eylandt (M; Cummins, Setzler, 1960)*
26. *Austr. Aboriginals — Yirrkala (F; Cummins, Setzler, 1960)*
27. *Austr. Aboriginals — Yirrkala (M; Cummins, Setzler, 1960)*

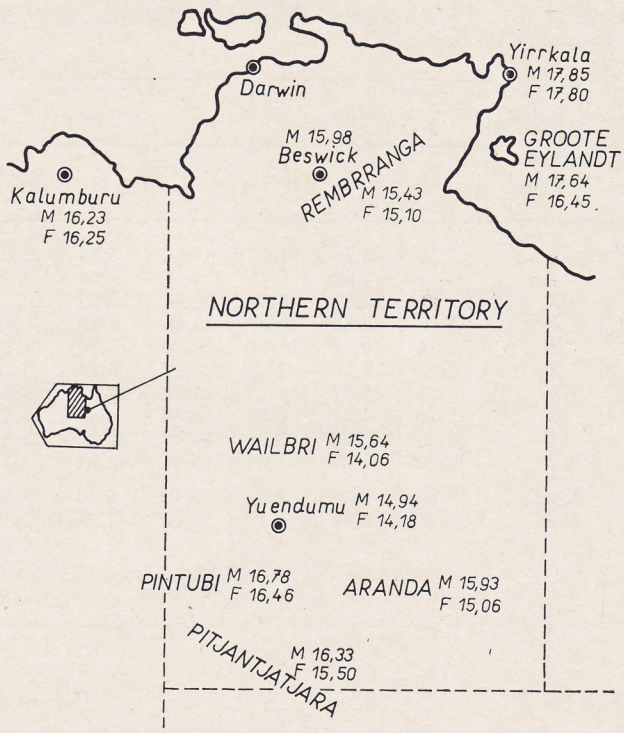

FIG. 4. *Geographical distribution of pattern intensity index in Australian Aboriginals in the Northern Territory.*

main line index (MLI) in the right hand of males oscillates between 8.63—9.61, in Rembrrangas it is 9.03. In the left hand the ranges are between 7.68 and 8.53, in Rembrrangas it is 8.34. In the two hands it is between 8.15—9.20, in our sample it is 8.69. On the right hand of females it is between 8.18 and 9.65, in our sample group it is of 9.42. On the left hand it is between 8.03—8.97 — in our sample group 8.36. In both hands it oscillates between 8.10—9.31 in Rembrranga females it is 8.89. *Table 21.*

THE TESTING OF GENERATION DIFFERENCES IN REMBRRANGAS

To find out eventual generation differences both the group of males and the group of females have been divided into two age groups — one below, and the other above 18 years of age. As one of the characteristic features of fingerprints the differences in the distribution of finger patterns were studied with the help of the X^2. It has been found out that in the group of males below 18 years the frequency of arches increased from 0.42 % to 2.13 % and the whorl frequency went up from 51.70 % to 58.85 %, while the share of loops showed a drop from 47.87 % to 39.02 %, compared with the older age group. On the other hand in the group of females below 18 years the frequency of arches went up from 1.07 % to 3.22 % and of the loops from 37.50 % to 46.27 %, while

the share of whorls declined from 61.43 % to 50.51 %, compared with older women. All these differences are significant on the 0.01 significance level.

As characteristic pattern of palmprints the main line index (according to Cummins) had been chosen. In this case too, the differences were tested by the Student's t-test. These differences did not results as significant, neither in the group of males, nor in females.

An unexpected shift in the distribution of the finger patterns between generations can be seen in *Fig. 1*, where No. 6, i.e. the children of Australian Aboriginals from Yuendumu, processed by R a o (1965), occupy the lowest position as regards the frequency of whorls on the individual fingers. Rao concludes in his paper from 1965 that the proportion of whorls to loops is about 50:50. The question remains, whether the shift in the distribution of finger patterns in the children of the Wailbri tribe has been caused by "generation" change — since there are no comparative data from the adult population of the tribe. The problem, whether these changes are due to the degree of mixing, would deserve further research indeed.

DISCUSSION

Loops prevail in Europeans (Caucasoids) and in Black Africans. The Mongoloids have more whorles than loops. Typical for the Australian Aboriginals is the frequent occurrance of whorls and low frequency of arches on the fingerprints. The highest number of whorls is on the IV finger and of arches on the I finger — this fact contrasts with the highest frequency of arches on the II finger in the European population (northern regions). It seams that the high frequency of loops on the I and V fingers is a typical character of the Australian Aboriginals. Equally interesting is the high proportion of ulnar loops on the hypothenar in the Australian Aboriginals, while in Europeans it is the high proportion of radial loops. With the low number of patterns in the II interdigital area the Australian Aboriginals are close to the Mongols, American Indians and Eskimos.

The pattern intensity index expressing the complexity of the qualitative values of the fingerprints is considerably high in the Australian Aboriginals — it is between 14.5—18.0, ranking them with the populations of South Asia and of the Indonesian Islands (see *Fig. 3*). It is evident from *Fig. 4* that the Aboriginal groups from the eastern Arnhem Land (Yirrkala and Groote Eylandt), and from Western Australia (Kalumburu) have a high pattern intensity index. The Pintubi and Pitjantjara tribes in the south-western part of the Northern Territory have also high PII. The tribes in the southern part of the Northern Territory and of the western Arnhem Land have lower PII. Europeans have concentrated along the north-south road (Stuart Highway), namely during the gold-rush and there were numerous contacts between them and between the Aboriginals. Also in the recent history, the Stuart Highway was the biggest construction of the Northern Territory. During World War II several hundred thousand soldiers of the Allied Forces were working here. At the break of the centuries there were Chinese workers constructing the railway. The construction sites attracted the Aboriginals even from distant regions. It is very probable that the shift in the PII in the Rembrrangas below 18 years is due to these circumstances. The data indicated in Fig. 4 support this explanation. *Fig. 1*, on the other hand, suggests, that the groups of Aboriginals in eastern Arnhem Land and in western Australia form population isolates. The figure contains also curves *No. 1* and *2*. Their course is influenced by the highest frequency of whorls. On the contrary, the group of Aboriginal children from Yuendumu marked as *No. 6*, has a lower frequency of whorls. This group, however comes from the region relatively not far from the Stuart Highway.

R a o (1965) holds that the proportion of the termination of D-line in field 11:7 is used for ethnic comparisons. Europeans show a value of around 2.00, while Asians and Africans have a proportion lower than 1.00. In Negroids it is usually below 0.5, while in Mongoloids it oscillates between 0.5—1.00. The children of Australian Aboriginals from Yuendumu had a proportion of D-line termination 11:7 in the value of 2.77, the Aboriginals from Kalumburu 2.50. In Rembrrangas the proportion is 2,22.

CONCLUSION

1. The anthropological research of the Czechoslovak Anthropos Expedition to Australia comprised 116 Rembrranga males and 94 females of various age groups. The fingerprints and palmprints of these individuals were subjected to dermatoglyphic analysis.

2. We found in both sexes a high number of whorls and low number of arches on the fingers: men and women:

W — 54.7 %, L — 43.4 %, A — 1.9 %

in men:

W — 55.6 %, L — 43.0 %, A — 1.4 %

in women:

W — 53.5 %, L — 44.0 %, A — 2.5 %

3. The high number of whorls reflects itself also in the values of Furuhuta's index (men — 129.5, women — 119.6), and also in the pattern intensity index (men — 15.4, women — 15.1). The low proportion of arches has had influence also on Dankmeijer's index — according to various authors they vary in the Australian Aboriginals between 14.6 to 17.8 in men, and between 14.2—17.8 in women, while the values of the Rembrrangas are 15.4 for men and 15.1 for women.

4. We indicate the values of the mean ridge count for each finger of the right and left hand and for each sex separately.

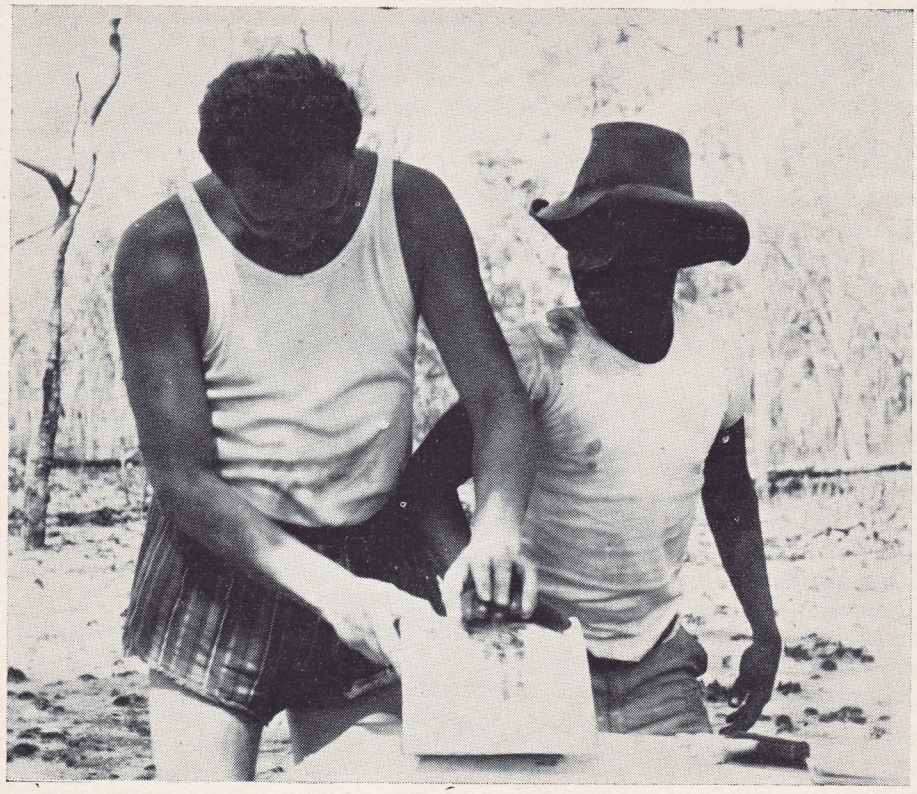

FOTO 1. *M. Prokopec taking a palm print using the method by J. Malý. (Foto by Dr. J. Brinke)*

5. The mean values of the total ridge count (TRC) are 160.8 in men and 143.8 in women. The mean absolute ridge count (ARC) for man is 232.3 and for women 209.4.

6. The number of triradii in Rembrrangas on the right hand averages 7.1 in men and 7.6 in women, on the left hand 7.5 in men and 7.6 in women.

7. The frequency of the occurrance of the individual type of "Simian creases" in the studied group has been enumerated according to the method of M. Wenninger and Navratil — up to now this character has not been studied in the Australian Aboriginals. All types are represented in 25.8 % of males and in 16.7 % of females. The typical 1a crease is represented in 3.9 % of men and in 1.0 % of women.

8. The distribution of angles -atd- has been worked out according to Penrose and Mavalwala. Both methods show that larger angles occur in women.

9. The mean number of triradii on the palm of the right hand of men was 5.3, and 5.5 of women; on the left palm 5.5 in men and 5.6 in women. In spite of similar mean values the distribution of numbers differs in the two sexes.

10. Thirteen of the hypothenar patterns indicated by Penrose occur in the Rembrranga materials, besides there is also the L^d type.

11. An analysis of the terminations of the palmar main lines has shown in both sexes of the Rembrranga a greater inclination to transversal course of lines in the left palms.

12. The studied sample group contained altogether 57 different palm formulas, 17 of them occuring in men and 15 in women only. The three basic formulas, i.e. 11, 9, 7, —; 9, 7, 5, — and 7, 5, 5, — were represented in men in equal proportions, approximately at 20 %. Their proportion in women was 23.8 %, 21.9 % and 19.2 %.

13. The distribution of the main line index was evaluated both through the Cummins—Midlo method, and also according to Penrose. Both methods showed MLI differences between the two sexes, as well as differences between the right and left hands. The differences between sexes and the two hands are negligible (in men and women an average of 8.9 according to Cummis and Midlo, 13.7 in men and 13.8 in women according to Penrose). The main line index in the Rembrranga well fits with its mean values in the data published by other authors studying the MLI of the Australian Aboriginals.

14. In order to find out the stability of the dermatoglyphic characteristics of the population the groups of men and women were divided into two age groups — one below, the other above 18 years of age. It has been concluded that the differences are statistically significant (the X^2 test), differences in the distribution of the MLI, on the other hand, proved to be insignificant. In comparing population groups, age structure should be taken into consideration because of possible changes due to admixture.

15. It can be derived from graphs comparing various populations according to the whorl and

arch percentages and according to the pattern intensity index, that the Australian Aboriginals, (including the Rembrranga) have a characteristically high proportion of whorls and low proportion of arches, and as regards PII value, they are between 14.5 and 18, ranking thus with the populations of southern Asia and of the Indonesian Islands, while the European populations and the American Indians have their values between 10.0 to 14.5. The value 10 was found in African Pygmies.

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