

THE ABO GROUPS AND RH FACTOR OF THE AMI TRIBE¹

OO-KEK KHAW², KUEI-YU WANG³ and SHUOU-I CHU⁴

Received for publication March 21, 1965

ABSTRACT

A survey was made from June to August 1963 of the distribution of ABO blood types and Rh factors among 2,969 Ami tribesmen including 1,533 males and 1,436 females. The distribution of ABO blood types was found to be O:31.0%; A:26.7%; B:31.2% and AB:11.1% (TABLE II). The excess of percentage of B group over that of A group is noteworthy and would place the Amis in the same category as the aborigines of China, Indo-China, Indonesia and Malaysia and the Philippines. Prehistorically, they might have come from the same ancestors (TABLE VI). The biochemical racial index (Hirzfeld) was 0.89%. The frequency of ABO blood types are O=B>A>AB. The Rh factor of 2,969 Amis was all positive. No Rh negatives were found. As a routine it is expensive, unless indicated to test blood for Rh factor, because in Taiwan only 0.15% of Taiwan Chinese and Mainlanders is Rh negative and there is none in blood of 2,969 Amis. The slide agglutination method using blood obtained from ear lobes is most suitable for mass surveys. It is simple and easy to carry out and is economical of time and material. The origin of Ami tribe is briefly discussed.

There are eight aboriginal tribes in Taiwan numbering about 200,000 persons. The most numerous are the Atayal (58,200), Bunun (23,700), Paiwan (43,600) and the Ami (85,900). Except the Ami, they all inhabit the mountainous areas of the 260-mile-long Island Central Range (*Map 1*). They differ from one another in their dialect, dress, customs, traditional practices and habits. Hunting and shifting dry cultivation are their main occupation, though many have since World War II turned to manual labor, wood carving and exhibition dancing as additional means of earning livelihood.

Now that mixed marriages are taking place, some characteristic features of the ethnic group may soon be imperceptible except to specialists. For this reason, it seems opportune to find out the blood groups and Rh factor of one tribe, who lives in the lowland and is easily accessible, the Ami tribe. Regarding the other tribal people, many investigations had been made by Japanese anatomists, ethnologists and their Taiwan Chinese students. The results are shown in TABLE I (1).

Another reason for making this investigation is the establishment of a blood bank in Hualien in August, 1963. The other studies on this topic by previous authors may now need confirmation and restatement in view of the current racial trend and mixed marriages. As Rh factor was discovered only in 1940 by Landsteiner and Wiener (2) in association with studies

1 Paper read in part at First Asian Congress of Blood Transfusion. Aug. 26-28, 1963, Hakone, Japan.

2 Professor and Head, Department of Medical Biomorphics, National Defense Medical Center, Taipei, Taiwan.

3 Associate professor of Microbiology, Department of Medical Biomorphics, National Defense Medical Center, Taipei, Taiwan.

4 Chief Technician, Department of Medical Biomorphics, National Defense Medical Center, Taipei, Taiwan.

of Levine and Stetson (3), its frequency could not be determined by the Japanese workers, who did the survey about the same time (TABLE I).

TABLE I
*ABO blood groups of the 5 subtribes of Ami tribe and
 other tribes in Taiwan*
 Surveyed by Kutsuna *et al.* (1)

	Total number	O		A		B		AB	
		No.	%	No.	%	No.	%	No.	%
Ami subtribes									
Nan-shih Ami	2,439	815	33.4	655	26.9	729	29.9	240	9.8
Hsiu-ku-luan Ami	5,589	1,951	34.9	1,624	29.1	1,629	29.1	385	6.9
Hai-an Ami	3,295	1,242	37.7	1,004	30.5	804	21.4	245	7.4
Pei-nan Ami	2,757	979	35.5	1,037	37.6	426	15.5	315	11.4
Heng-chuin Ami	1,144	409	35.8	351	30.7	305	26.7	79	6.9
	15,224	5,396	35.4	4,671	30.7	3,893	25.5	1,264	8.4
Other tribes:									
1. Atayal									
a. Sqoloq	7,179	3,410	47.6	2,280	31.8	1,162	16.2	327	4.5
b. Tsole	2,230	835	37.1	703	31.5	536	24.0	156	7.4
c. Sedeq	4,482	1,986	43.3	1,229	27.4	987	22.0	280	6.2
2. Saisett	643	244	37.9	195	30.3	158	24.6	46	7.2
3. Tsou	628	378	60.2	172	27.4	72	11.5	6	1.0
4. Bunun	340	151	44.4	125	36.8	50	14.7	13	3.8
5. Paiwan	315	189	60.0	43	13.7	77	24.4	6	1.9
6. Puyuma	496	222	44.8	93	18.7	154	31.0	27	5.4
7. Rukai	277	145	52.3	28	10.1	97	35.0	7	2.5
8. Yami	629	268	42.6	251	39.9	79	12.6	31	4.9

MATERIALS AND METHODS

The Ami tribe:

The home of the Ami is the narrow coastal strip of lowland along the Pacific Ocean in Hualien and Taitung Counties, between 22°20'-24°20' N. Lat. and 121°25'-121°32' East Long. The people are civilized, educated and live by rice, sweet potato and sugar-cane farming and rearing of pigs, buffaloes and poultry. In their pastime, they enjoy singing, characteristic dancing and sports in which they excel. Their origin was lost in legends and myths, but they betray their Malayan ancestry by their speech which comprises many common words understandable by present-day Malays. They believe, according to

Mackay (4), that their forefathers came in boats from the southern direction, lived in huts of reed, rattan and bamboo, built near the sea. Their former proclivity to head-hunting to prove their prowess seems to point to Borneo or other islands in the Malay Archipelago as their original fatherland. Supported by observations of their traditional practices, customs and anthropological features for over 24 years, Mackay (4) thought the Amis and other tribesmen reached Taiwan from distant islands to the south in their frail boats which were carried by the prevailing ocean currents that sweep from Celebes, Java and Borneo northwards by the east and west coasts of the island. It was the

same current, Kura-siwa, that guided the vessel of Count de Benyowski, the Hungarian adventurer, to follow the windings of the eastern shore when he touched Taiwan at 23°22' on August 26, 1771 (5). As a matter of fact, the Yami tribesmen who settled in Botel Tobago (present Orchid Island), still regards Batan Islands chain, off northern Luzon, as their homeland (6). They came, according to traditional memory culture and narrative of a family member, 19 generations ago, about the end of 15 A. D. (7).

The Amis and other tribes might have arrived earlier with the first wave of Malay emigrants who, according to Prof. Ludwig Riess (5), came at the end of the 6th Century A. D. from the south and conquered the aboriginal inhabitants, the Lonkius, and drove the few survivors to the mountains. The Lonkius were known to the Chinese who were surprised to find the Malays there on their subsequent visits in 601, 605 A. D. instead of the former occupants.

The Amis have so far kept their ethnic identity fairly pure by their observance of traditional practices, albeit not through aloofness and isolation. The total population is about 85,900 distributed among 5 subtribes: Nan-shih Ami, Hsui-ku-luan Ami, Hai-an Ami, Pei-nan Ami Heng-chiun Ami.

The present survey occupied a period of one month, in July 1963 in Hualien

County from Taroko Gorge to Hsui-ku-luan River. The number of people examined were: in Hualien Shih, 270; Hsiulin Hsiang, 48; Chi-an Hsiang, 1,333; Kuang Fu Hsiang, 1,047; Jui-sui Hsiang, 271; a total of 2,969 persons, including 1,533 males and 1,436 females. They were all of pure blood. Persons of obviously mixed blood or known to be so were excluded (*Map 2*).

The slide method was used. Blood was taken from the ear-lobe and in the usual way, tested with antisera of AB group and Anti-Rh (Hyland Laboratories, Michael Reese Research Foundation, USA).

RESULTS

ABO blood types:

The distribution of ABO blood types in the entire group was O:31.0%, A:26.7%, B:31.2%, AB:11.1%, with a biochemical racial index (8) $\left(\frac{A\%+AB\%}{B\%+AB\%}\right)$ of 0.89. There was hardly any difference between the males and females except that there was excess of 3.1% of A group in females over those of the males, and 2.4% of O in the males more than in the females (TABLE II).

After adding the figures together for the two sexes the frequencies of each group were calculated and arranged in descending order as follows: O=B>A>AB.

TABLE II

The distribution of ABO groups of Ami tribe (present survey)

Groups	Males		Females		Males—Females %	Males+Females	
	Frequency	%	Frequency	%		Frequency	%
O	493	32.2	428	29.8	2.4	921	31.0
A	387	25.3	407	28.4	-3.1	794	26.7
B	482	31.4	444	30.4	0.5	926	31.2
AB	471	11.4	157	10.9	0.2	328	11.1
Total	1,533		1,436			2,969	

Rh factors:

The Rh reaction of blood of 2,969

Amis was all positive. There were no Rh negatives (TABLE III).

TABLE III
Rh factor of the Ami tribe

District (old name)	Number	Rh positive		Rh negative
		No.	%	%
Hualien Shih (Ka-len-ko-shi)	270	270	100%	0
Hsiulin Hsiang (Bushi-lim-bayashi)	48	48	100%	0
Chi-an Hsiang (Yoshi-no)	1,333	1,333	100%	0
Kuang-fu Hsiang (Wue-yamato)	1,047	1,047	100%	0
Jui-sui Hsiang (Mizu-ho, Jui-ho)	271	271	100%	0
Total	2,969	2,969	100%	

DISCUSSION

The surveys carried out by Katsuna and Matsuyama (1) in 1939, involving 15,224 persons of the 5 subtribes of Amis in Hualien Prefecture showed that the average percentage of frequencies was: of O, 35.4%; A, 30.7; B, 25.5% and AB, 8.4%. The figures come nearest to those of Tsole-Atayal and Saisette tribes who were not neighbours. The Saisette is a small tribe inhabiting the western side of the Central Range (TABLE I). The frequency figures were almost the same as those of the Mainland Chinese (TABLE V).

The present survey was confined to Nan-shi Ami subtribesmen, the data for whom were also available from the reports of Maruyama (8) and Katsuna (1) as given in TABLE IV. With minor differences, they more or less tally and show no change of frequencies after an

interval of over 30 years. The inheritance of ABO genes remain fairly static within the subtribe, particularly in the preponderance of group B over that of A.

Comparison of ABO groups frequencies of the Nan-shih Ami tribe with those of Chinese is brought out in TABLE V, in which it is seen that the percentage of B (31%) is higher than A (26.7%) in the Amis, the reverse of that of Taiwan, Mainland (9) and Pescadores Chinese (10) (26.1, 29.9 and 30.22% of A group against 23.5, 26.8 and 22.09% of B group); while O group in the Amis is less (31%) than that in the Chinese (39% average); but their AB frequency is higher (11 against an average of 7%).

There is no marked difference between the Amis, Taiwan Chinese and Mainlanders in respect to Rh factors. The absence in 2,969 Nan-shih Amis may be fortuitous. If larger number of Amis were examined the slight difference in

TABLE IV
ABO blood groups of Nan-shih Ami on Taiwan

Ami subtribe	Number	O		A		B		AB		Authors
		No.	%	No.	%	No.	%	No.	%	
Nan-shih Ami	2,439	815	33.4	655	26.9	729	29.9	240	9.8	Katsuna <i>et al.</i> (1)
	1,048	296	28.3	310	28.7	326	31.1	125	11.9	Maruyama <i>et al.</i> (8)
	2,969	921	31.0	794	26.7	926	31.2	328	11.1	Khaw <i>et al.</i> (present study)

TABLE V
Comparison of ABO groups of Mainlanders, Taiwanese and Ami tribe

Population	Number	O		A		B		AB	
		No.	%	No.	%	No.	%	No.	%
Mainlanders	3,864	1,341	34.7	1,154	29.9	1,038	26.8	331	8.6
Taiwanese	16,636	7,454	44.8	4,334	26.1	3,912	23.5	936	5.6
Ami tribesmen	2,969	921	31.0	794	26.7	926	31.2	328	11.1
Pescadores	1,340	567	42.31	405	30.22	296	22.09	72	5.37

frequency of 15 in 10,000 Rh negative found in 7,335 Chinese Mainlanders and Taiwanese would probably be equalized (11).

Inheritance of ABO blood groups is in accordance with Mendelian laws (12, 13). For this reason its application to disputed paternity and maternity is often invoked. The distribution of ABO group frequencies is important not only for blood transfusion but also for human genetics, as the Hirszfelds had shown in 1919 (14). For uses of this kind, data have been compiled by Boyd (15) and Mourant *et al.* (16).

In connection with the present study, frequency figures of neighbouring countries are tabulated to trace or confirm the postulated origin of the Ami and other Taiwan tribes from the Malay race and from the coasting regions of China Mainland (17) and from the north and northwest, from which a few tribes state that their forefathers came (TABLE VI).

Consultation of the maps of distribution of ABO genes in Mourant's (16) shows that the percentage of gene A in Taiwan is 15-20% and has the same distribution as in coastal regions of China from Shantung to Indo-China as well as to Malay Peninsula, Borneo, Indoesia and the Philippines; that of B gene is also from 15-20%, covering coastal and Central West-central China below Yellow River and South China, Vietnam and the Philippines; that of O gene is from 50-55%, the shading applying to the Philippines only. They are partially revealing. In details, the characteristic higher

percentage of B group over A seems to correspond to Senois of Malaya (18); Annamites (Farinaud, 1940) (16); the Dusuns of North Borneo (Ride, 1932) (16); Moros and Samals of the Philippines (Groove, 1926) (16). The aborigines of Mainland China exhibit the same incidence of low group A and high group B. The percentages of A and B for Shansi (16) were 22.20 and 34.00 of 1,000 persons; for Szechuan (16), 11.22 and 39.00 of 205; for Kweichow (16), 22.56 and 37.20 of 164; and for the Li tribe of Hainan, 29.84 and 37.17 of 151 persons examined (16).

As to their origin, therefore, the Amis might have stemmed from the common stock to which the aborigines of South-western China, Indo-China, Malaya, Borneo and Philippines belong. Though there is not much fact to go by, their blood might be contaminated by Lonkius and other prehistoric inhabitants of the island, whose cultural remains by way of stone implements, and soft green jade ornaments potteries and bronze fragments were found, among other sites in Yuan-shan Mount in North Taiwan; in Hsin-kang in Miao-li Hsien, in Feng-pi-tou in Kaohsiung on the western side. In the south-east coast, the prehistoric culture was megalithic where menhirs, stone walls, bowls, and pestles were unearthed as well as some kinds of green soft jade ornaments and red polished pottery in addition to types found on the west coast. Taiwan painted pottery is akin to those found at Haifong and in Hongkong. Chronologically, they belonged to about 1500-800 B.C. the same period

TABLE VI
The percentage frequencies of ABO groups of population of S. E. Asia countries
 (From the ABO groups, by Mourant *et al.*, 1958)

Place	Population	Number	O		A		B		AB		Authors
			No.	%	No.	%	No.	%	No.	%	
Singapore	Malays	1,963	794	40.45	521	26.54	504	25.67	144	7.34	Allen & Scott, 1947
Ulu Jelai (east Semai of Main watershed)		135	76	56.30	2	1.48	53	39.26	4	2.96	Pojunin, 1953
Annam, Binh-Dinh	Annamites	352	171	48.58	69	19.60	93	26.42	19	5.40	Parinand, 1940
Cochin China, Saigon & Cholon		8,430	3,594	42.63	1,754	20.81	2,567	30.45	515	6.11	Gamet & Chat, 1956
Bataan	Aeta Hambal	67	30	44.78	37	55.22	0	0	0	0	Schebesta, 1952
Bagnio	Igorotes	214	108	50.47	47	21.96	47	21.96	12	5.61	Groove, 1926
Zambales & Bataan	Ilocano-Tagalog	254	110	43.31	71	27.95	63	24.80	10	3.94	Schebesta, 1952
North Borneo	Dusuns	371	173	46.63	48	12.94	140	37.73	10	2.69	Ride, 1932
Siasi	Moros, Samals	501	129	25.75	91	18.16	225	44.91	56	11.18	Groove, 1926
Okinawa Prefecture		3,787	1,327	35.04	1,315	34.72	794	20.97	351	9.27	Furuhata, 1933
<i>Indonesian</i>											
Java, Diakarta	Indonesians (soldiers)	7,129	2,795	39.21	1,907	26.75	1,948	27.32	479	6.72	Sutarman, 1951
Java, Jogiakarta		614	268	43.65	137	22.31	171	27.85	38	6.19	Maasland, 1938
<i>China</i>											
Hainan, Loan	Li (aborigines)	191	42	21.99	57	29.84	71	37.17	21	10.99	Kobayasi, K. & Hasegawa, 1942
Kweichow, South-west	Pa-miao (aborigines)	164	41	25.00	37	22.56	61	37.20	25	15.24	Woo, 1947
Shansi, Central part	Aborigines	1,000	325	32.50	222	22.20	340	34.00	113	11.30	Curran <i>et al.</i> , 1930
Szechwan	Chwan-miao (aborigines)	205	74	36.10	23	11.20	80	39.00	28	13.66	Yang, S. C. <i>et al.</i> , 1938
Pescadores Archipelago		1,340	567	42.31	405	30.22	296	22.09	72	5.37	Tseng and Chin, 1954

as the Liang-chu site in South China (19). The land connection between Fukien and the Penghu (Pescadores) group of islands disappeared 5,400 B.P. and between the Penghu and Taiwan 6,200 B.P. (before present). So there was communication with mainland China up to that time (20).

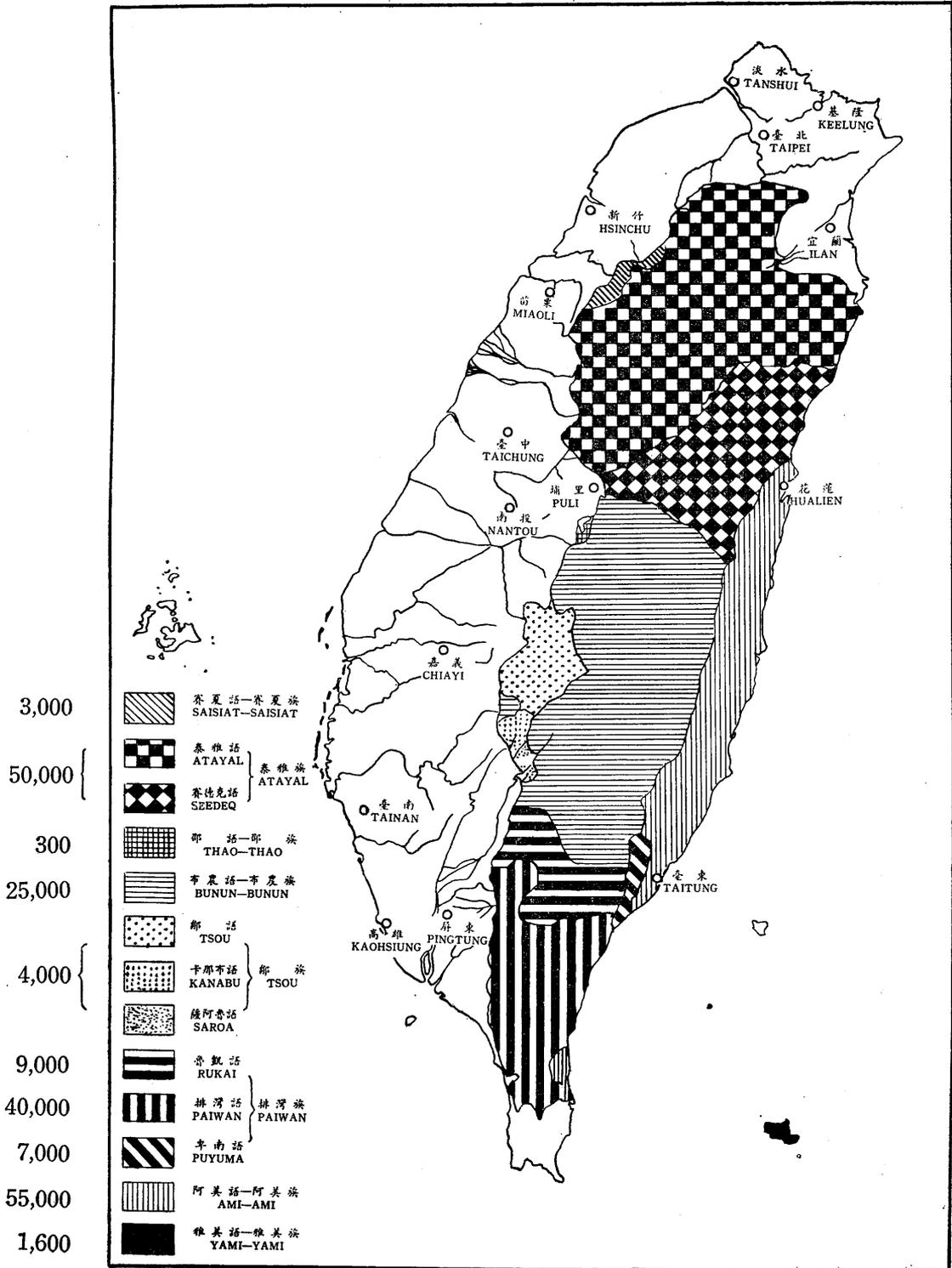
According to Blackwell *et al.* (21), the Amis are exceptional in having abnormal hemoglobin G (0.57% of 1,571 persons) which is absent in all the other tribes in Taiwan. Hemoglobin E which is found in Taiwan Chinese and other peoples in South-east Asia is conspicuously absent in all the tribes here. They take this to mean that the aborigines in Taiwan got separated from other members of the ancestral stock before the latter acquired the Hb E.

Therefore it is apparent that present day aborigines were of Malayan S.E. Asian stock, differing in culture from the prehistoric inhabitants of the island who had migrated from the coastal regions of China before the land connection disappeared 6,200 B.C.. The low frequency of group A and high incidence of group B make Amis akin to aborigines of Malaya (the Senois), of Indo-China and the Philippines.

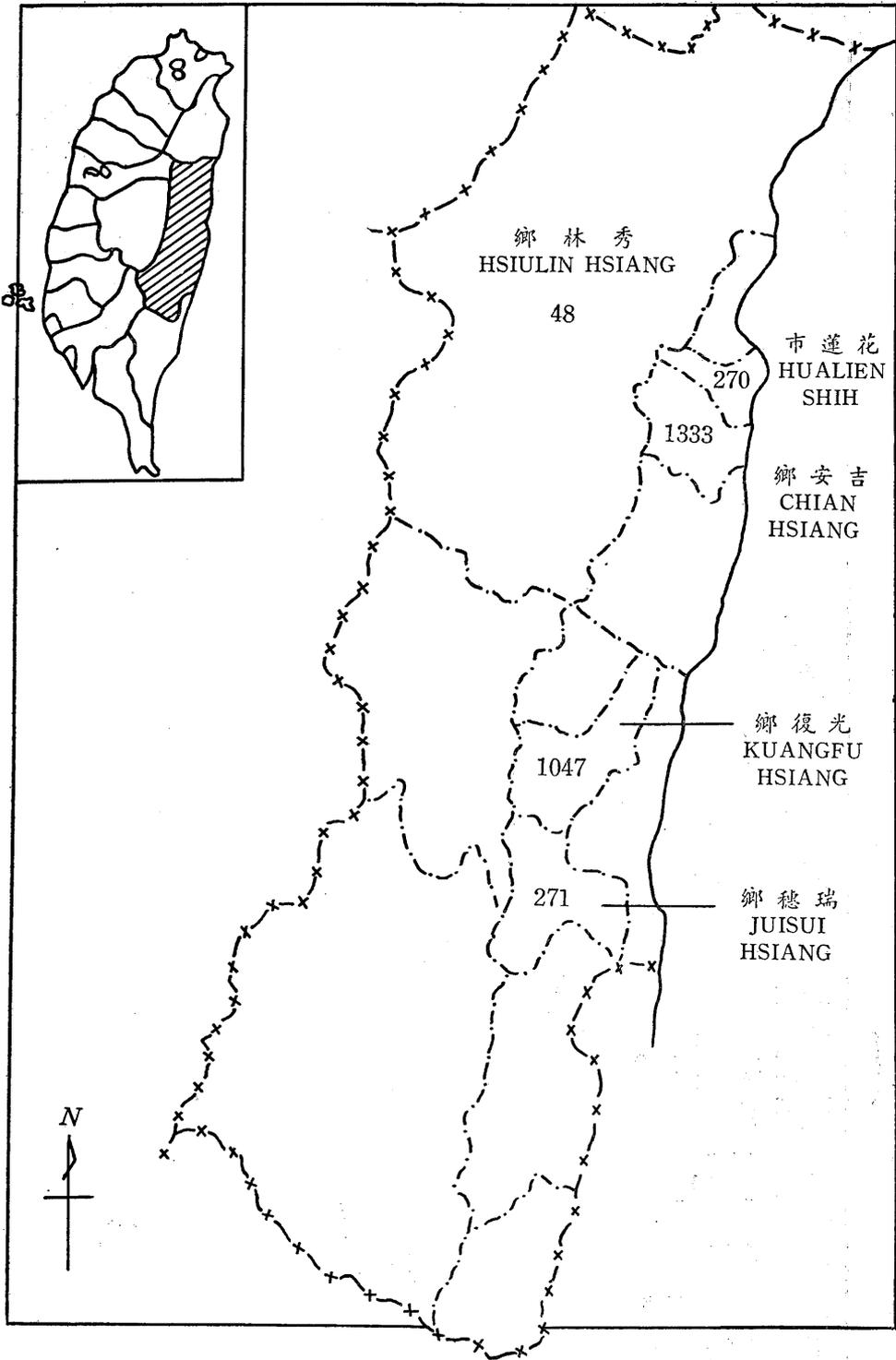
LITERATURE CITED

1. KUTSUNA, E. and MATSUYAMA. 1939. Under die Blutgruppen der eingeborenen Formosaner. *J. Formosan Med. Ass.* **38**: 1153-1178.
2. LANDSTEINER, K. and A. S. WIENER. 1940. An agglutinable factor in human blood recognized by immune sera for Rhesus blood. *Proc. Soc. Exp. Biol. N. Y.* **43**: 223.
3. LIVING, P. and R. E. STETSON. 1939. An unusual case of intragroup agglutination. *J. Amer. Med. Ass.* **113**: 126-127.
4. MACKAY, G. L. 1895. *From Far Formosa*. 4th edition. Fleming H. Revell Company, New York. pp 96-98 (Taiwan edit).
5. DAVIDSON, J. W. 1903. *The Island of Formosa, Historical Review 1430-1900*. Paragon Book Gallery, New York, N. Y., U. S. A. pp 3, 84 and 85.
6. KANO, T. and K. SEGAWA. 1954. *An Illustrated Ethnography of the Formosan Aborigines, The Yami*. Maruzen, Tokyo, Japan. pp 2-11.
7. BEAUCLAIR, I. D. 1959. Three genetical stories from Botel Tobago. *Ethnol. Academia Sinica* No. 7. pp 106-115.
8. MARUYAMA *et al.*, 1931. (a) Blood grouping of Taiwan aborigines (First report). *J. Formosan Med. Ass.* **30**: 508-519 (In Japanese). Ditto, 1934. (b) Blood grouping of Taiwan aborigines (Third report, especially about the migration of Ami tribe). *Formosan Med. Ass.* **33**: 1786-1793.
9. WANG, K. Y., J. S. LIU and S. I. CHU. 1955. The distribution of ABO blood types among Taiwan Chinese and Mainlanders. *Selected Papers, N.D.M.C.* 10-13. (in Chinese).
10. TSENG, T. M. and F. S. CHIU. 1954. The blood groups of the fishermen in Peng-hu Prefecture. *47th Ann. Meeting of the Formosan Med. Ass. abstract* No. 105.
11. WANG, K. Y., J. S. LIU and S. I. CHU. 1959. The distribution of Rh factor among Chinese school girls in Taiwan. *Selected Papers, N.D.M.C.* 7-11. (in Chinese).
12. DUNGERN, E. V. and L. HIRSZFELD. 1910. Ueber Vererbung gruppenspezifischer strukturen des Blutes. *Z. Immun. Focsch.* **6**: 284-292.
13. BERNSTEIN, F. 1924. Ergebnisse einer biostatischen zusammenfassenden betrachtung über die erblichen. *Blutstrukturen des Menschen Klin. Wschr.* **3**: 1495-1497.
14. HIRSZFELD, L. and H. HIRSZFELD. 1919. Serological difference between the blood of different races. The results of researches on the Macedonian front. *Lancet* **ii**: 675-679.
15. BOYD, W. C. 1939. Blood groups. *Tabulae Biologicae* **17**: 113-240.
16. MOURANT, A. E., ADA C. KOPEC and K. DOMANIEWSKA-SOBCZAK. 1958. *The ABO Blood Groups*. Charles Thomas, Springfield, Illinois, U. S. A. pp 135-152.
17. LING, S. S. 1954. The Ancient Min-yüeh people and the Formosan aborigines. *Coll. Papers of Taiwan Culture* **1**: 1-30.
18. POLUNIN, L. 1953. The Medical Natural History of Malayan Aborigines. *Medical J. Malaya* **8**: 55-174.
19. YOUNG, CONRAD L. S. 1962. A general survey of archaeology in Taiwan at the present time. *J. China Soc. USIS*, pp 50-56.
20. MA, TING-YING H. 1964. Research on the past climate and continental drift: The last sudden total displacement of the earth mantle and dating of when Taiwan was

- last land-connection to the mainland of China. *National Taiwan University, Taipei, Taiwan, Republic of China. The 1st. Ser. Pvt. Pub.* 18: 1-9.
21. BLACKWELL, R. Q., T. H. HUANG and L. C. CHIEN, 1965. Abnormal hemoglobin characteristics of Taiwan aborigines. *Dept. of Biochemistry, Nav. Med. Res. Unit-2, Taipei, Taiwan, R. O. C.* (in press).



Map 1. Distribution of the 8 tribes on Taiwan.



Map 2. Rh survey of Ami tribe in Hualien-Hsien
Number of persons examined in various district: