

More Genetic Sharing among the population of Taiwan than expected: A plain tribes (Pinpu) perspective

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About this talk:

- **Recent genetic Origin**_Plain tribes shares ancestry with Taiwan Aborigines (TwA), Island Southeast Asian (ISEA) and Continental Southeast Asian (CSEA)
- **Prehistoric Origin**_Ancient DNA (and Coalescence) studies indicate that Plain tribe ancestors moved to Taiwan from continental east Asia ca. 4000 years ago and cohabited in the western plains with TwA ever since.

Taiwan

馬偕紀念醫院

Mackay Memorial Hospital

Populations of Taiwan according to census (2002)

Taiwan Aborigines (TwA)

↕ 2%

Non-Taiwan Aborigines (NTwA)

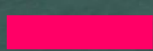
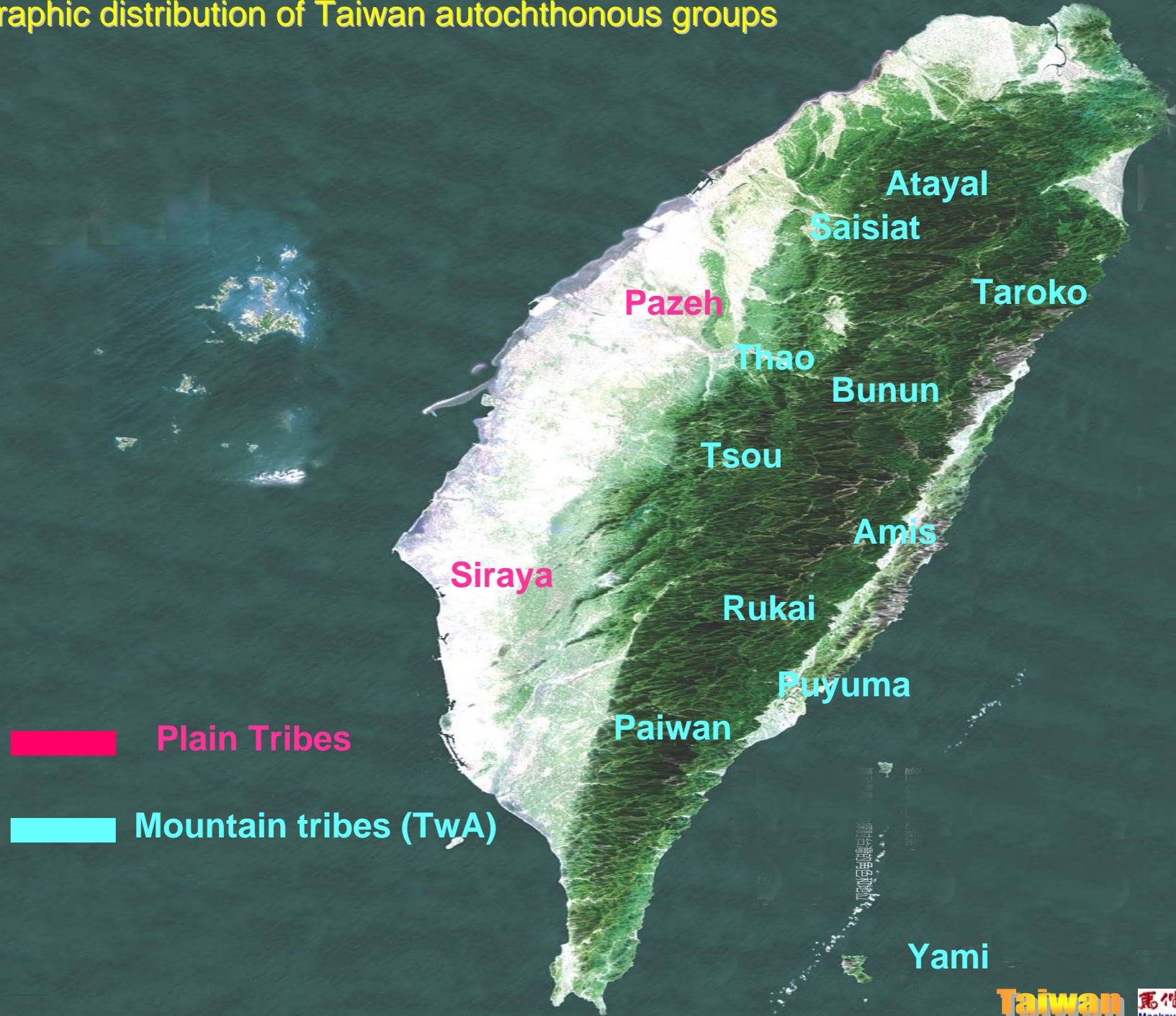
Minnan and Hakka (“Taiwanese”)

Plain tribes

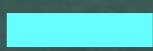
Mainland Chinese who arrived
after World War II

↑ 98%

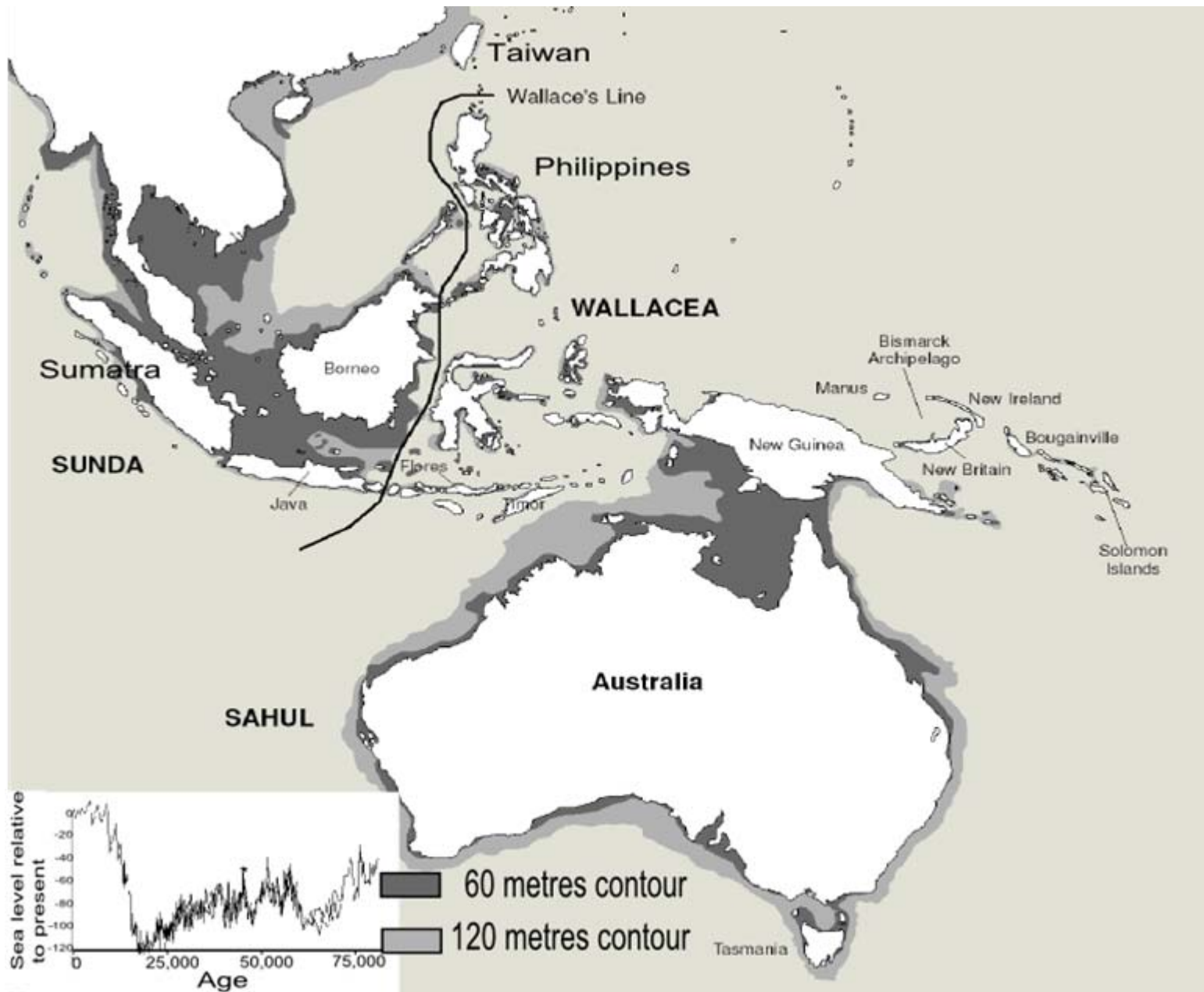
Geographic distribution of Taiwan autochthonous groups



Plain Tribes



Mountain tribes (TwA)



Map modified from O'Connell JF, Allen J (2004) Dating the colonization of Sahul (Pleistocene Australia-New Guinea): a review of recent research. . J Archaeol Sci 31:835–853.

Taiwan Aborigines (TwA)

Genetic evidence of ancient settlements

1. The earliest (late Paleolithic) arrival in Taiwan dates up to 15000 years ago and correspond to haplogroups found only among TwA and ISEA (Island Southeast Asia): B5a2, F1a4 and M7b3
2. The second period (early Holocene/Neolithic) 6000-10000 years ago:
B4a1a, B4a2a, B4b1a, E1a1a, F1a1a tw, M7c3c
3. Late “recent local expansion” of 1000 to 4000 years ago: E2b1, R9c, F3b2b and N9a10



Non-Taiwan Aborigines (NTwA)

Minnan and Hakka

1. Descendants of the immigrants during the last 400 years from southeast coast of China, they were sinicized indigenous peoples of ethnic Yueh origin (southeast Asian) .
2. After settled in the southwestern plains of Taiwan, they cohabitated with plain tribe people (matriarchal society) with resulting admixture, sinicization and disappearance of the plain tribe cultures.



Plain tribe children
attended school
(sinicization)

◆圖 6-15
平埔族孩童在
「社學」接受
儒化教育（採
自《番社采風
圖》）。

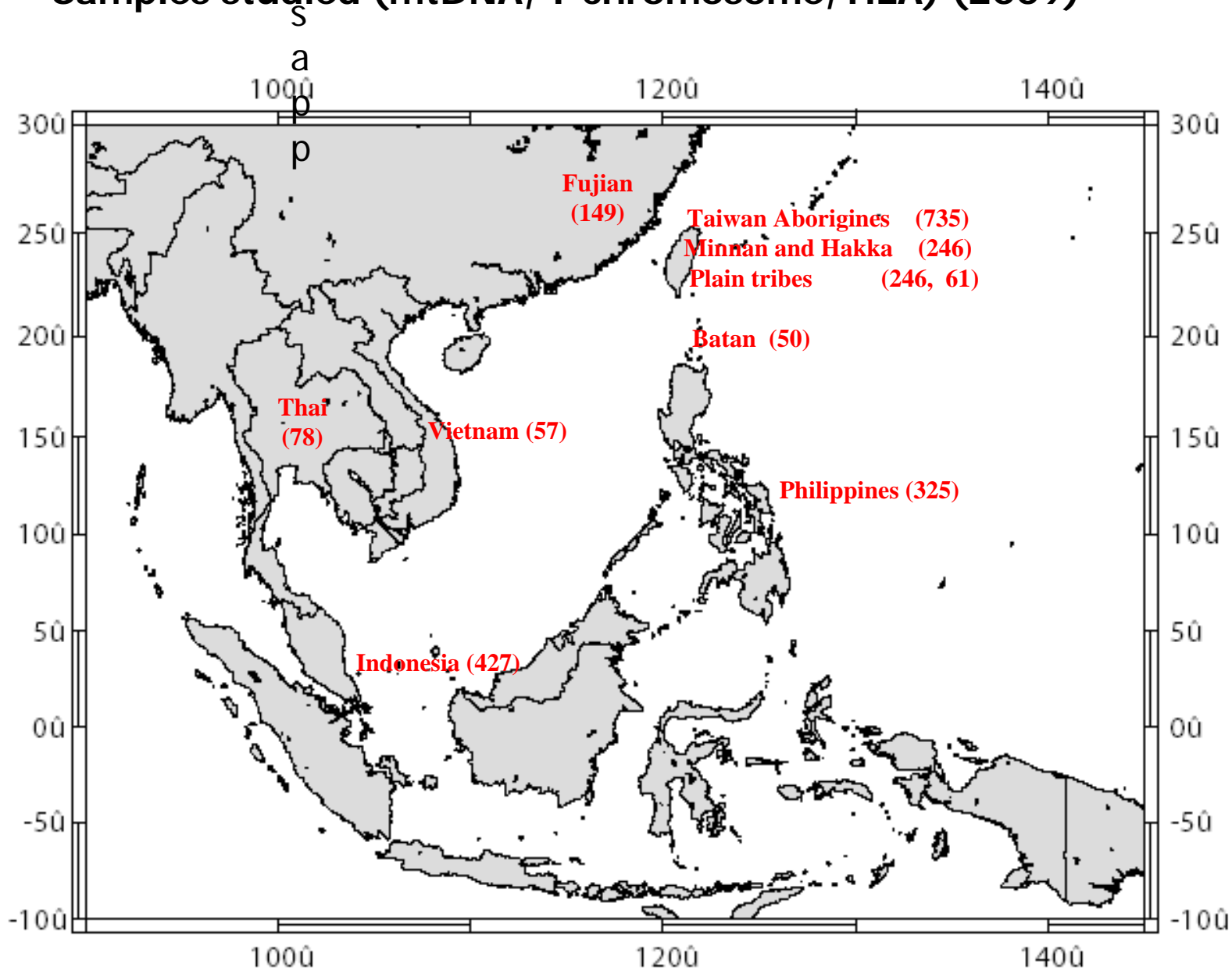
Genetic sharing between plain tribes and TwA, ISEA (pre 2005 results)

	mtDNA	YSTR#	HLA(A-B-DR)	Carried at least one gene of TwA or ISEA
Siraya	56%	75%	56%	95%
Pazeh	34%	72%	40%	89%

only Y-STRs of O1* were used.

95% of Siraya individuals carried at least one gene (mtDNA, YSTR, HLA) of TwA or ISEA origin. Pazeh showed 89%.

Samples studied (mtDNA, Y chromosome, HLA) (2009)



Methods

Maternal lineage (mtDNA)

Sequence based typing (Control and coding regions)

Paternal lineage

STR SNP haplogrouping and Y STR analysis

Autosomal recombining system (HLA)

HLA-A-B-DRB1 haplotyping (sequence based typing)

Preliminary results and Discussion

Maternal lineages of plain tribes

Plain tribes Haplotypes shared with TwA and ISEA	45%
B4a1a, B4b1, B4c1b, B5a2, E1a, E1a1a, F1a1a, F1a3, F1a4, F3b2b, F4b, M7b1, M7b3, M7c3c, R9c	
Plain tribes Haplotypes shared only with TwA	20%
B4a2a, B4b1a, E2b1, M7c3a	
Plain tribes Haplotypes shared with CSEA	30%
B4a, B4a1, B4c1b, B5a1, C6, D4, D4a, D5a, F1a, F1a5, F2, F3a, M7, M7b, M7c2, M7c3b, M10a2, R9b1, R9e, Z3	
Plain tribes Haplotypes shared only with continental northeast Asia (CNEA)	
C, D4b2, D4e, M8a, N9a and others.	

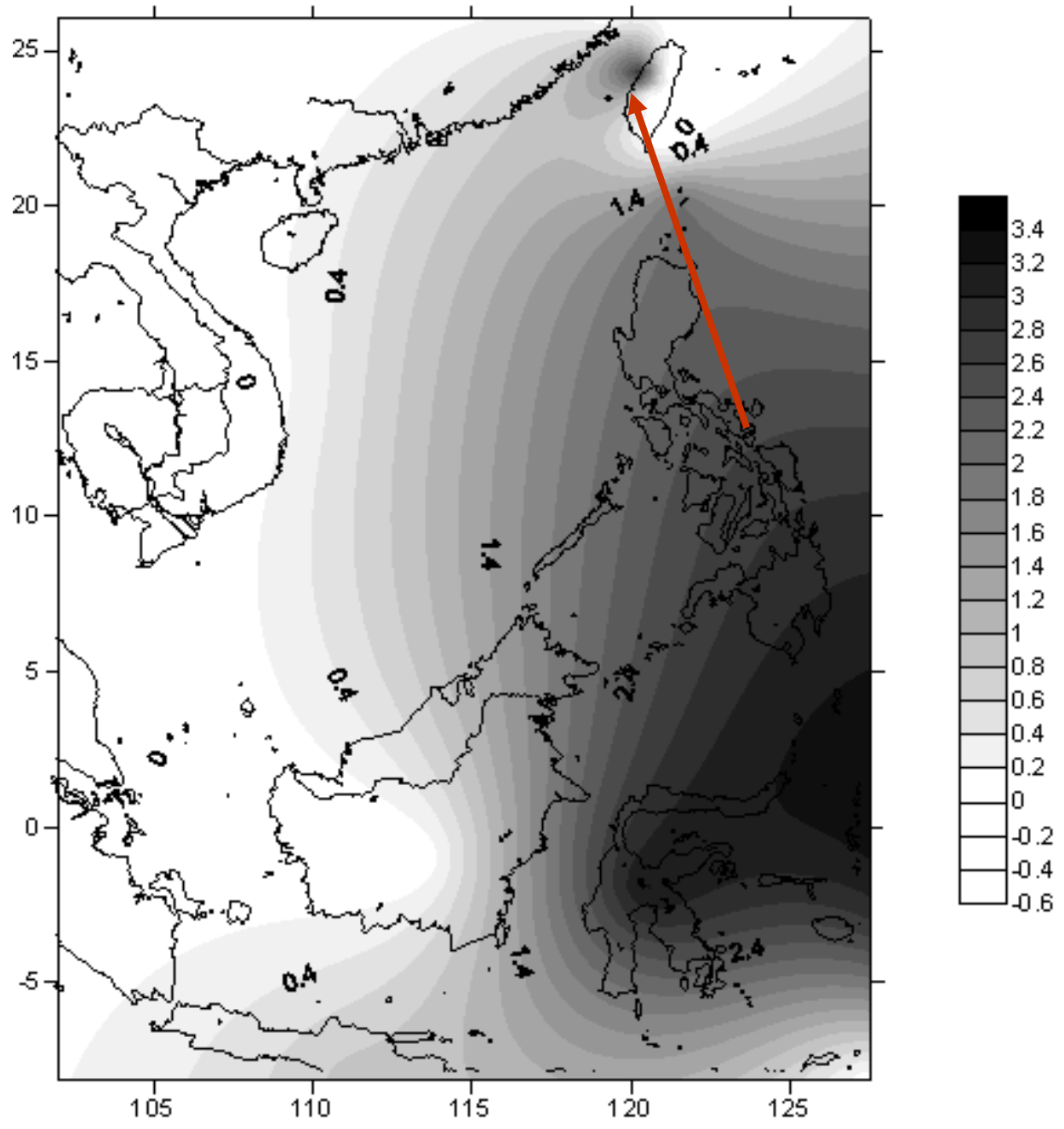
TwA= Taiwan Aborigines

ISEA= Island Southeast Asia

CSEA= Continental Southeast Asia

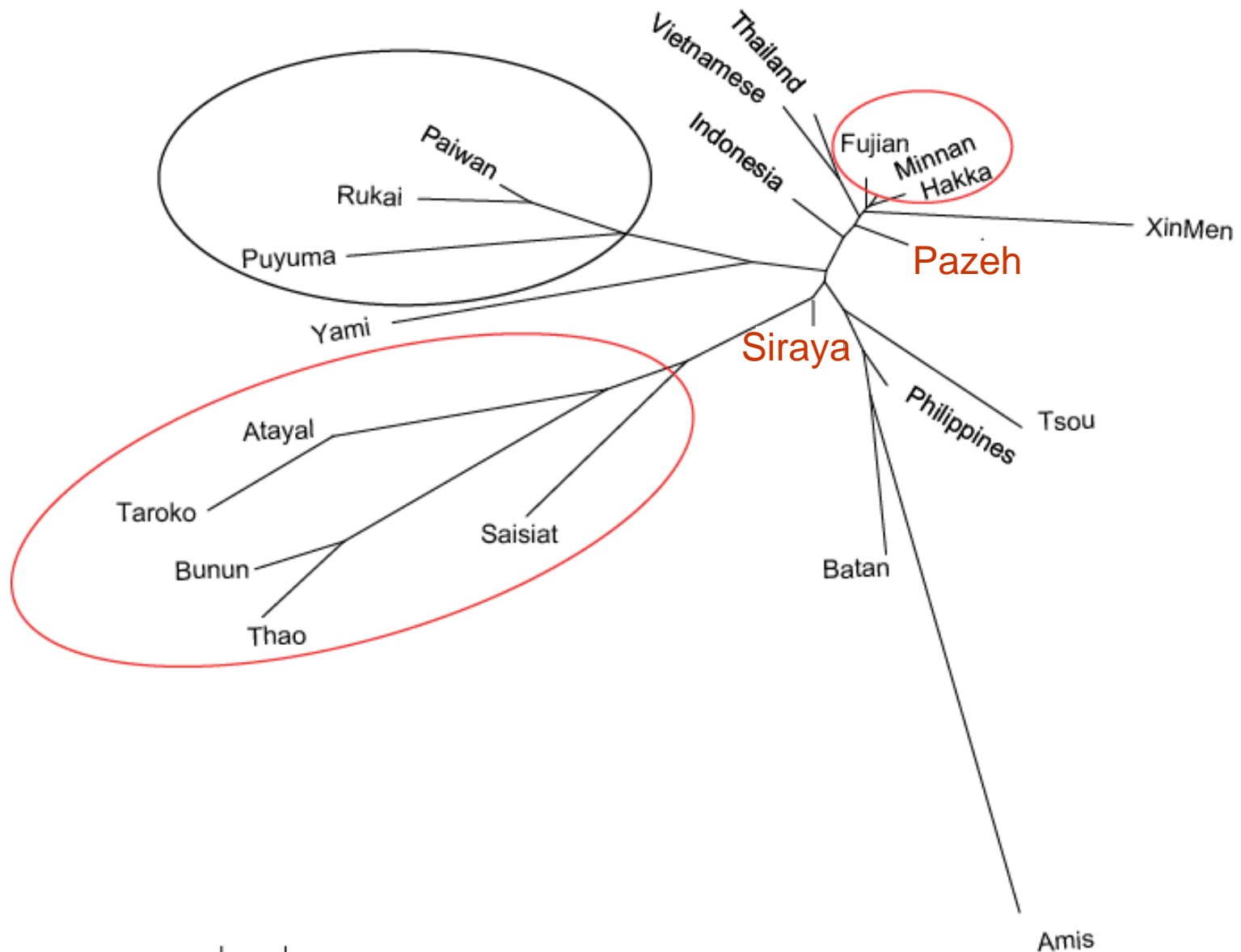
CNEA= Continental Asia

Population movement between Philippines and Taiwan plain tribes- E2a is only seen in these two populations



Frequency distribution of E2a haplogroup (supported by diversity distribution)

Mitochondrial DNA (neighbor joining Phylogram)



Paternal lineages of plain tribes

	Siraya	Pazeh
Haplogroups shared with TwA and ISEA O1a*, O1a1*, O1a2, O3*, O3a*, O3a3*	55%	70%
Haplogroups shared with CSEA and ISEA O2*, O2a*, O3a4*, O3a3c*, O3a3c1	40%	28%

Autosomal recombining system (HLA)

HLA-A-B-DRB1 haplotypes of plain tribes
(% of minimal sharing)

	Siraya	Pazeh
Haplotypes shared with TwA	34%	16%
Haplotypes shared with CSEA (Fujian)	18%	14%
Haplotypes shared with ISEA		
Philippines	9%	3%
Indonesians	7%	7%

Findings on the genetic ancestry of plain tribe and TwA using ancient DNA (aDNA)

1. MtDNA haplogroup F2a was found in an ancient bone of aboriginal burial site in southwestern plain dated more than 400 years . F2a is found in NTwA, rarely in TwA but is common in CSEA.
2. aDNA M33 was found in mixed layers of southwestern plain (South Science Park) estimated 5 to 800 years or more. An identical haplotype was found in an NTwA family. M33 has never been seen in TwA.
3. Two aDNA D4 and M7c3 were found in southwestern plain dating 4500 years old.
_D4, in today's populations, is found in CSEA and is not seen among TwA.
_M7c3 is an Austronesian marker (Hill et al.), found in TwA and ISEA.
4. Four aDNA C4 were found in east coast of Taiwan (Hualien) dating 2 to 4000 years old. An identical lineage has also been found in a NTwA (Minnan). C4 is usually present among CNEA and have never been seen among extant TwA.

Summary of ancient DNA findings

Haplotypes	Sharing populations	Identical haplotype in Taiwanese	Dating (years BP)
F2a	CSEA, NTwA		> 400
M33	NTwA	A Minnan family	> 5-800
D4	CSEA		4500
M7c3	TwA, ISEA		4500
C4	CNEA	A Minnan	2-4000

M33 never found in other populations, is a plain tribes specific lineage.

Conclusion (1)

Both maternal and paternal, and the autosomal recombining systems (HLA) of Taiwan populations revealed that plain tribes shared their genes with TwA, ISEA and CSEA but rarely with CNEA.

Conclusion (2)

Ancient DNA study revealed that the genetic heritage of CSEA (and CNEA) of the Taiwan plain tribes was not only acquired during the past 400 years from people of the southeast coast of China (current belief), but could have also been acquired as far back as 4000 years ago (or more) from ancient prehistoric sailing migrants from continental East Asia.

Conclusion (3)

Two genetic "aboriginalities" of the plain tribes

1. Genetic heritage (haplogroups > 50%) shared with mountain tribe Aborigines (TwA) and/or ISEA.
2. Possibility of an ancient heritages from CSEA. The arrival time of plain tribe ancestors who carried CSEA lineages could be traced back to several thousand years prior to the commonly accepted recent 400 years from "Taiwanese".

Acknowledgment

We would like to thank to Prof. Cheng-hwa Tsang, Institute of History and Philology, Academia Sinica; Dr. Cheng-Heng Fu, Department of Anthropology, Tsu-Chi University, and Prof. Chong-Jen Chien for giving us the ancient bone for ancient DNA study

Minimal sharing (%) between Plain tribes and TWA, Fujian, Philippines and Indonesian

	mtDNA	Y SNP	HLA
Siraya/TWA	46	61	34
Siraya/Fujian	33	56	18
Siraya/Philippines	39	31	9
Siraya/Indonesian	26	26	7
Pazeh/TWA	21	68	16
Pazeh/Fujian	37	50	14
Pazeh/Philippines	31	36	27
Pazeh/Indonesian	22	34	7

HLA-A-B-DRB1 haplotypes in plain tribe (Siraya)

The most common haplotypes:

A*2402-B*4002-DRB1*1401 shared with TwA and ISEA

A*1101-B*1525-DRB1*1602 shared between plain
tribes than in TwA

A*3303-B*5801-DRB1*0301 shared with NTwA, CSEA
and ISEA.