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Supplemental Data

Denisova Admixture and the First Modern Human Dispersals into Southeast Asia and Oceania

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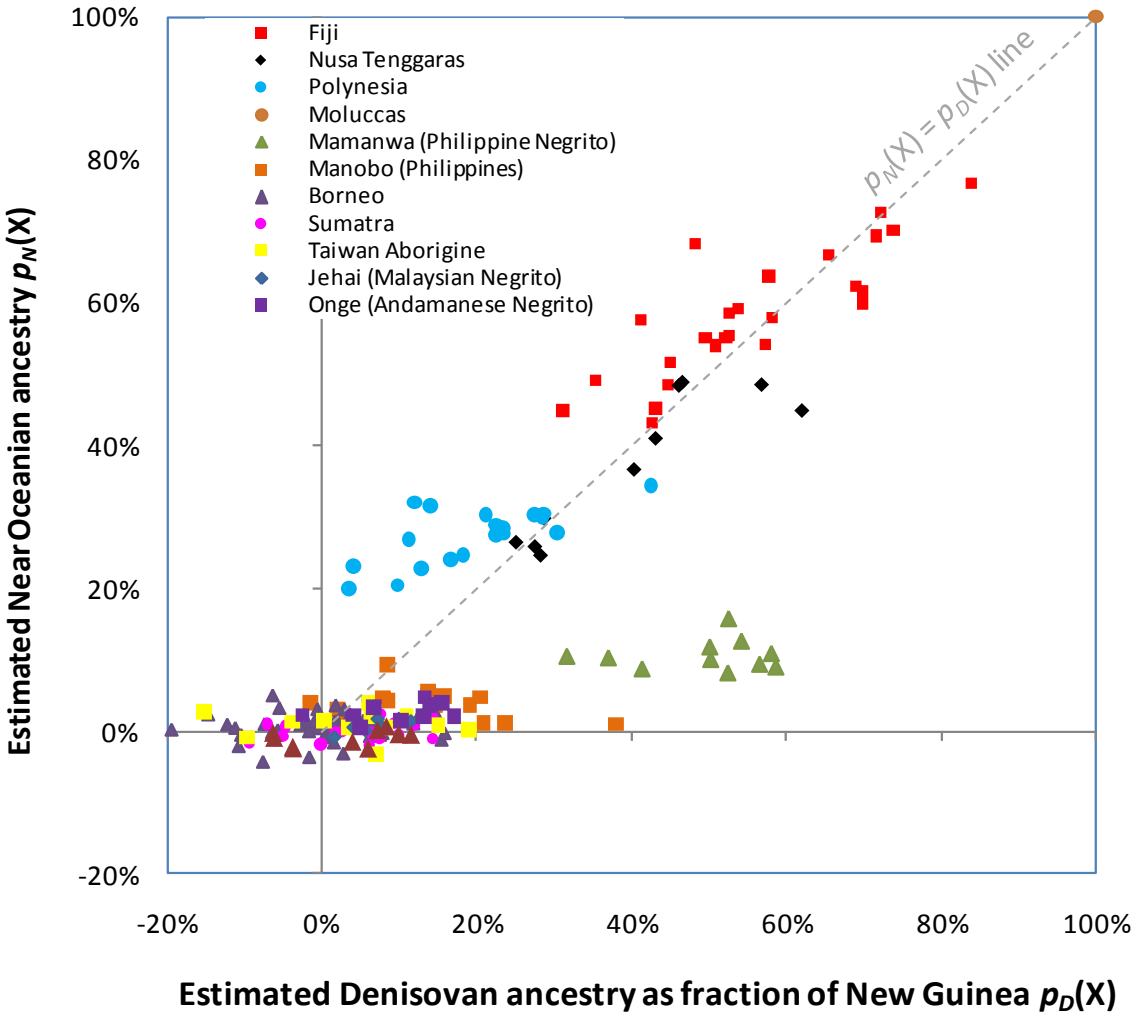

Figure S1. Estimates of Denisovan and Near Oceanian Admixture by Individual
The x-axis plots $p_D(X)$, the estimate of Denisova mixture proportion in a sample as a fraction of that in New Guinea, and the y-axis plots $p_N(X)$, the estimate of Near Oceanian admixture. This plot presents the same information as Figure 2, but by individual rather than by population. As in Figure 2, the Mamanwa (Philippine Negritos) stand out relative to the $p_D(X) = p_N(X)$ line, reflecting Denisova genetic material in the Mamanwa that cannot be explained by Near Oceanian gene flow.

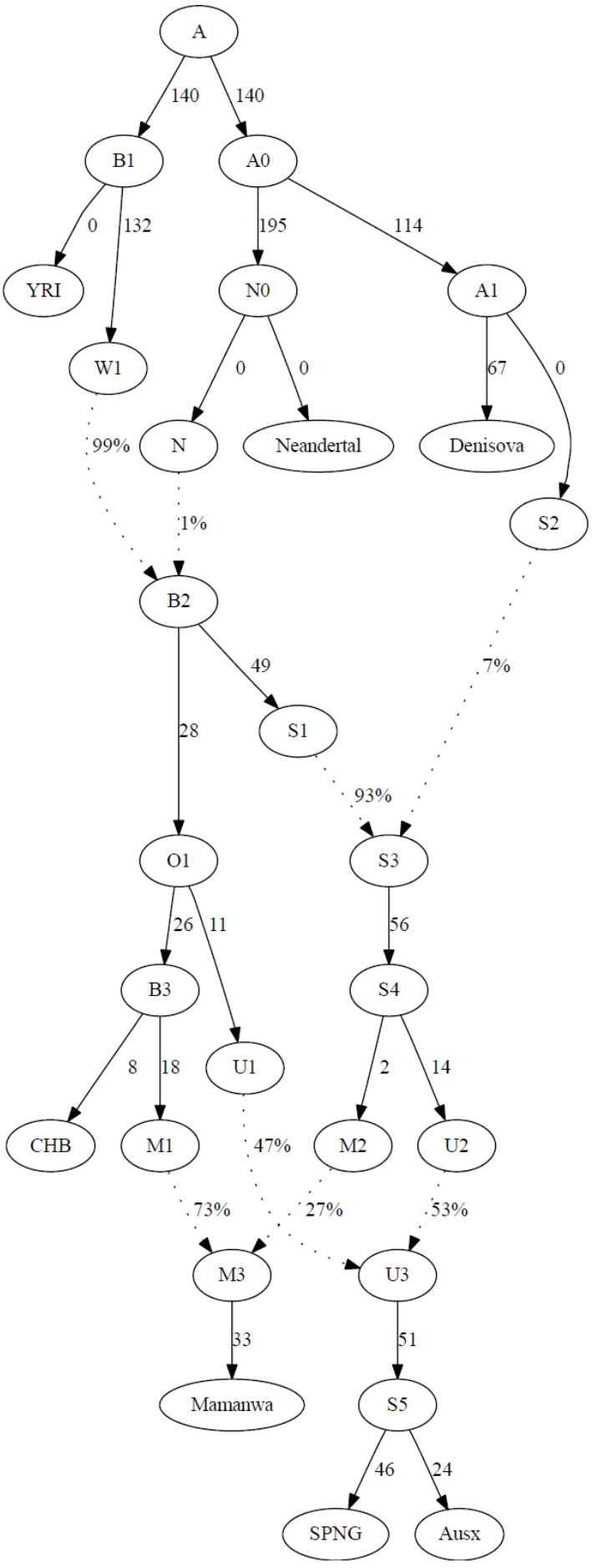

Figure S2. An Admixture Graph that Fits the Data for 7 Populations We show the estimated genetic drift on each branch (as fractions of 1000), along with the best fit mixture proportions. Labels on internal nodes (e.g., B1, B2, S1, A0, U1) correspond to hypothetical ancestral populations.

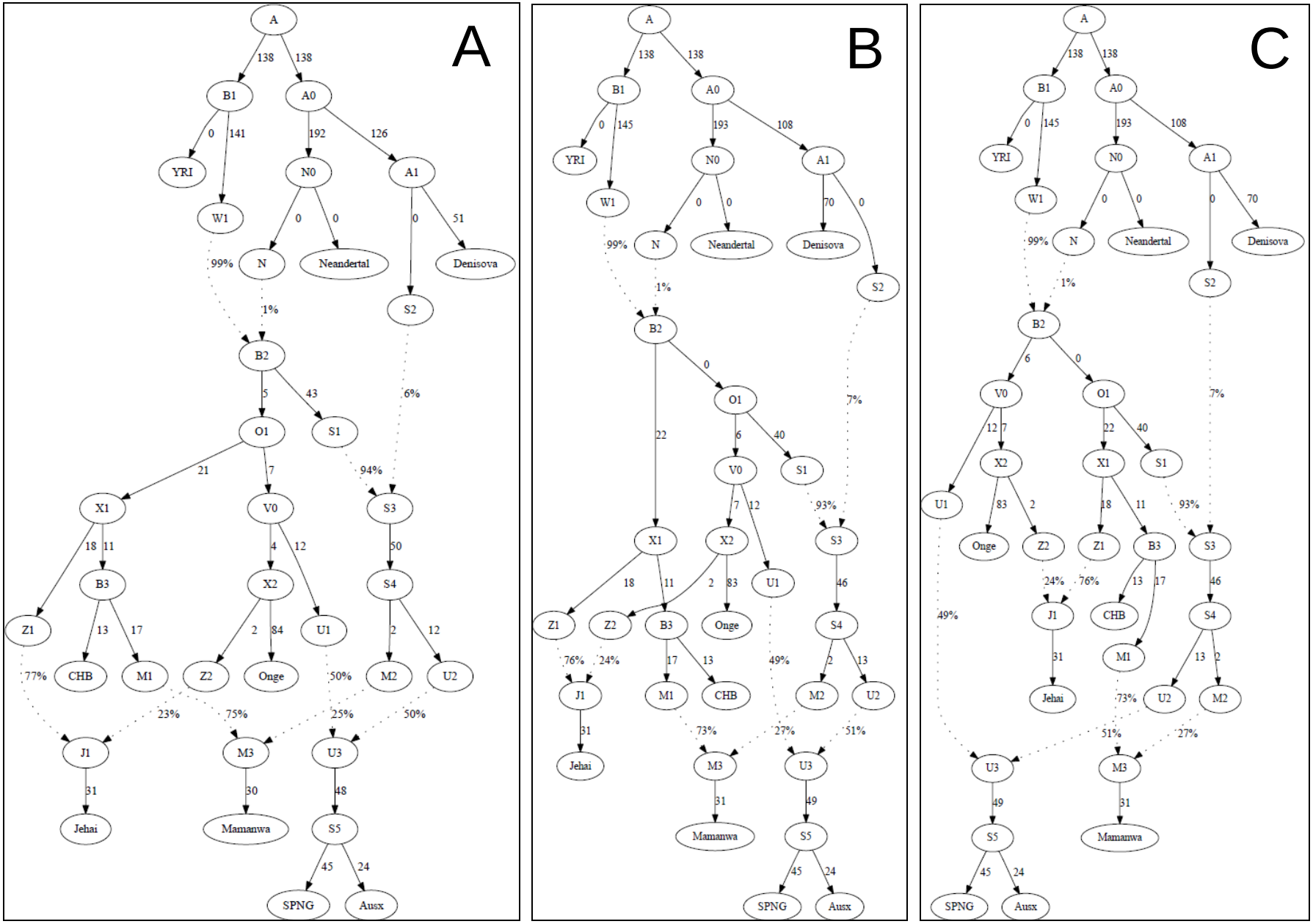

Figure S3. Three Admixture Graphs that Are Equally Good Fits to the Data for 9 Populations

We show the estimated genetic drift on each branch (as fractions of 1000), along with the best fit mixture proportions. Labels on internal nodes correspond to hypothetical ancestral populations. (A) Australians, New Guineans, and Mamanwa are outgroups to other non-Africans; (B) Chinese are an outgroup; (C) Onge and Jehai are outgroups. We cannot distinguish these 3 scenarios statistically, so represent them as a trifurcation in Figure 3.

Table S1. Summary Statistics for DNA Sequence Data Newly Collected for This Study

	New Guinea Highlander (SH10)		Mamanwa (ID36)	
	Map to human (*hg18*)	**Map to chimp (*pantro2*)**	**Map to human (*hg18*)**	**Map to chimp (*pantro2*)**
Raw clusters	63,032,951	63,032,951	25,388,386	25,388,386
Aligned reads (Post filtering)	80,946,976	67,803,202	32,497,235	29,612,798
Properly paired reads	72,902,096	60,863,602	31,300,134	28,532,254
Fraction aligned (Post filtering)	64.21%	53.78%	64.00%	58.32%
Gigabases (Gb) (Post filtering)	8.44	7.07	3.35	3.05
Coverage (divide Gb by 2.8)	3.01	2.53	1.20	1.09

Table S2. Stability of Denisovan Admixture Estimate $p_D(X)$

		A YRI			A San			A YRI			A YRI			A Chimp			A YRI		
		B Denisova			B Denisova			B Neandertal			B Chimpanzee			B Denisova			B Denisova		
		C CHB			C CHB			C CHB			C CHB			C CHB			C Borneo		
	N	Ratio	Std.Err.	Z-score	Ratio	Std.Err.	Z-score	Ratio	Std.Err.	Z-score	Ratio	Std.Err.	Z-score	Ratio	Std.Err.	Z-score	Ratio	Std.Err.	Z-score
Australian 1	8	103%	6%	16.6	101%	6%	15.8	108%	11%	9.6	103%	9%	11.0	104%	9%	12.0	103%	6%	16.4
Australian 2	2	103%	7%	14.1	98%	8%	12.9	94%	12%	7.5	103%	12%	8.6	105%	11%	9.6	103%	7%	13.9
Fiji	25	56%	3%	17.7	53%	3%	15.8	56%	5%	10.2	56%	5%	10.7	57%	5%	11.8	55%	3%	17.5
Philippine Mamanwa (Negrito)	11	49%	5%	9.2	48%	6%	8.5	53%	10%	5.2	56%	10%	5.8	41%	8%	5.2	49%	6%	8.8
Nusa Tengarras	10	40%	3%	12.8	41%	3%	12.0	46%	6%	7.7	43%	5%	8.3	37%	5%	7.5	40%	3%	13.2
Moluccas	10	35%	4%	10.1	33%	4%	9.3	42%	6%	6.6	42%	6%	7.2	32%	5%	6.0	35%	3%	10.0
Polynesia	19	20%	4%	5.1	19%	4%	4.7	17%	7%	2.4	27%	6%	4.4	17%	6%	2.9	18%	4%	4.9
Philippine Manobo	16	13%	3%	4.2	13%	3%	3.8	13%	6%	2.3	20%	5%	3.7	6%	5%	1.2	12%	3%	4.0
Andamanese Onge (Negrito)	10	10%	6%	1.6	-7%	7%	-1.0	2%	12%	0.1	20%	11%	1.9	7%	10%	0.7	9%	6%	1.4
Malaysian Jehai (Negrito)	8	7%	5%	1.4	9%	5%	1.7	16%	9%	1.8	15%	8%	1.8	4%	8%	0.5	6%	5%	1.2
Sumatra	17	4%	3%	1.4	2%	3%	0.8	9%	5%	1.6	11%	5%	2.3	-3%	5%	-0.7	3%	3%	1.1
Taiwan Aborigine	12	4%	3%	1.2	2%	3%	0.5	12%	6%	2.0	12%	6%	2.2	-3%	5%	-0.5	3%	3%	0.8
Malaysian	10	3%	4%	0.8	2%	4%	0.6	1%	7%	0.2	8%	6%	1.3	-1%	6%	-0.3	2%	3%	0.5
Borneo	49	1%	2%	0.6	1%	3%	0.3	1%	5%	0.2	5%	4%	1.4	-2%	4%	-0.5			
CHB (Chinese in Beijing)	88																-1%	3%	-0.5
CHD (Chinese in Denver)	86	0%	1%	0.0	0%	1%	-0.3	0%	2%	0.2	2%	2%	0.9	-2%	2%	-0.8	-1%	2%	-0.6
JPT (Japanese in Tokyo)	87	-3%	2%	-1.8	-1%	2%	-0.8	-3%	3%	-0.9	-2%	3%	-0.7	-5%	3%	-1.6	-5%	3%	-1.6

Note: The Denisova mixture proportion is expressed as a fraction of that in Papua New Guinea highlanders.

Table S3. Stability of Near Oceanian $p_N(X)$ and Australian $p_A(X)$ Estimates

		A YRI E CHB			A San E CHB			A Chimpanzee E CHB			A YRI E Bornean		
Population	**N**	**Ratio**	**Std.Err.**	**Z-score**	**Ratio**	**Std.Err.**	**Z-score**	**Ratio**	**Std.Err.**	**Z-score**	**Ratio**	**Std.Err.**	**Z-score**
***p N (X)* estimate of Near Oceanian admixture**													
Fiji	25	58%	0.6%	92.9	58%	0.6%	89.7	59%	0.8%	73.0	58%	0.6%	92.6
Philippine Mamanwa (Negrito)	11	11%	0.9%	11.4	10%	1.0%	9.8	7%	1.2%	5.4	10%	0.9%	10.7
Nusa Tengarras	10	38%	0.7%	54.4	38%	0.7%	52.0	37%	0.9%	43.1	37%	0.7%	55.7
Moluccas	10	34%	0.7%	45.3	33%	0.8%	42.4	33%	0.9%	36.0	33%	0.7%	45.0
Polynesia	19	27%	0.8%	34.6	28%	0.8%	32.5	27%	1.0%	27.0	27%	0.8%	34.5
Philippine Manobo	16	4%	0.6%	5.7	3%	0.7%	5.2	2%	0.8%	2.6	3%	0.6%	5.0
Andamanese Onge (Negrito)	10	3%	1.4%	1.8	0%	1.6%	0.0	1%	1.8%	0.6	2%	1.4%	1.4
Malaysian Jehai (Negrito)	8	1%	1.1%	0.8	1%	1.1%	1.0	0%	1.3%	-0.3	0%	1.0%	0.2
Sumatra	17	0%	0.6%	0.3	0%	0.6%	-0.3	-1%	0.8%	-1.0	-1%	0.5%	-1.0
Taiwan Aborigine	12	1%	0.7%	1.7	1%	0.7%	1.1	0%	0.8%	0.2	0%	0.6%	0.7
Malaysian	10	-1%	0.8%	-0.9	-1%	0.8%	-1.0	-1%	1.0%	-1.5	-1%	0.7%	-2.1
Borneo	49	1%	0.5%	1.4	1%	0.5%	1.1	0%	0.6%	0.5			
CHB (Chinese in Beijing)	88										-1%	0.5%	-1.4
CHD (Chinese in Denver)	86	0%	0.2%	1.7	0%	0.3%	1.1	0%	0.3%	0.8	0%	0.5%	-0.7
JPT (Japanese in Tokyo)	87	1%	0.3%	2.0	1%	0.4%	2.9	1%	0.4%	2.1	0%	0.6%	-0.1
***p A (X)* estimate of Australian admixture**													
Fiji	25	78%	0.9%	82.5	78%	1.0%	79.1	80%	1.2%	66.3	77%	0.9%	81.7
Philippine Mamanwa (Negrito)	11	13%	1.0%	13.0	12%	1.1%	11.4	9%	1.2%	7.1	12%	1.0%	11.8
Nusa Tengarras	10	55%	0.9%	59.0	55%	1.0%	57.4	56%	1.2%	48.6	54%	0.9%	58.7
Moluccas	10	51%	1.0%	51.7	51%	1.0%	49.0	51%	1.2%	43.5	50%	1.0%	50.9
Polynesia	19	37%	0.9%	41.3	37%	1.0%	38.4	38%	1.1%	33.6	36%	0.9%	41.4
Philippine Manobo	16	5%	0.6%	8.7	5%	0.7%	8.1	4%	0.8%	5.2	4%	0.6%	7.0
Andamanese Onge (Negrito)	10	3%	1.5%	2.0	0%	1.6%	0.1	1%	1.8%	0.7	2%	1.4%	1.1
Malaysian Jehai (Negrito)	8	1%	1.1%	1.0	1%	1.1%	1.2	0%	1.3%	-0.1	0%	1.0%	-0.3
Sumatra	17	1%	0.6%	2.0	1%	0.6%	1.4	0%	0.8%	0.5	0%	0.5%	-0.2
Taiwan Aborigine	12	1%	0.7%	2.0	1%	0.7%	1.4	0%	0.8%	0.4	0%	0.7%	0.0
Malaysian	10	0%	0.8%	-0.1	0%	0.8%	-0.2	-1%	1.0%	-0.8	-1%	0.7%	-2.2
Borneo	49	1%	0.5%	2.6	1%	0.5%	2.3	1%	0.6%	1.5			
CHB (Chinese in Beijing)	88										-1%	0.5%	-2.5
CHD (Chinese in Denver)	86	1%	0.2%	2.5	1%	0.3%	2.0	0%	0.3%	1.6	-1%	0.5%	-1.5
JPT (Japanese in Tokyo)	87	0%	0.3%	1.3	1%	0.4%	2.2	1%	0.4%	1.5	-1%	0.6%	-1.5

Note: This table shows estimates of the Near Oceanian $p_N(X)$ and Australian ancestry $p_A(X)$ for a variety of outgroup populations. We find that similar results are obtained for diverse choices of reference populations *A* and *E*.