

1 **Supporting Information**

2 **Population Samples and Data**

3 We report 168 new samples from 20 populations of Oceania and Southeast Asia
4 ([Table S1](#)) genotyped on the Affymetrix Human Origins SNP Array, in which SNPs
5 are cleanly ascertained (1). We merged the new data with those previously released
6 samples (2) genotyped on the same array, resulting in 2890 samples from 236 world
7 wide modern human populations, and one chimpanzee sample. The full dataset was
8 filtered to 2493 individuals from 221 populations ([Table S2](#)) after removing outlier
9 individuals or relatives, based on visual inspection of PCA plots and/or model-based
10 clustering analysis as described previously (2). We then merged high coverage
11 sequences of archaic hominins into the dataset: Altai Neanderthal (52×) (3) and
12 Denisova (31×) (4). Problematic SNPs were filtered out following the approach
13 described previously (2), and analyses were carried out on a set of 594,903 autosomal
14 SNPs.

15 **Principal Component Analysis**

16 Principal component analysis was performed with EIGENSOFT (5) version 5.0.1. We
17 performed PCA on a subset of individuals from which the top two eigenvectors could
18 determine a plane and then projected others onto the plane. To explore the
19 relationship between modern humans and archaic hominins, we carried out PCA on
20 the chimpanzee, Neanderthal and Denisovan only and projected present-day human
21 samples onto the map defined by the top two eigenvectors of archaic hominins and

1 chimpanzee.

2 **Statistical Analysis to Detect Archaic Ancestry in Modern Humans**

3 We applied f_4 statistics (1, 6) with the form

4
$$f_4(A, B; C, D) = \frac{\sum_{i=1}^N (p_A - p_B) \times (p_C - p_D)}{\sum_{i=1}^N p_{Outgroup} \times (1 - p_{Outgroup})}$$
, where p is the allele frequency for

5 populations A, B, C, D or outgroup, to assess the correlation between the allele

6 frequency differences of the two pairs of populations. If populations A and B are

7 consistent with forming a clade in an unrooted tree with respect to populations C and

8 D, the statistic is expected to be 0. We computed f_4 statistics with the form

9 $f_4(African, Archaic; WestEurasian, EE/NA)$ to detect gene flow between archaic

10 hominins and non-Africans. Additional gene flow from archaic hominins to EE/NA

11 will yield significant positive values, while additional gene flow from archaic humans

12 to West Eurasian will yield significant negative values. A Weighted Block Jackknife

13 procedure (7, 8), which drops 5 centimorgan (cM) blocks of the genome in each run,

14 was used to compute standard errors.

15 **Estimating Denisovan Ancestry in Oceanians**

16 Oceanians have been previously shown to contain both Denisovan and Neanderthal

17 ancestry (9, 10). We computed the proportion of Denisovan ancestry in Oceanians

18 $p_D(X)$ by the following f_4 ratio:

$$p_D(X) = \frac{f_4(Yoruba, Neanderthal; Han, X)}{f_4(Yoruba, Neanderthal; Han, Denisovan)}$$

19 which assumes that Han and Oceanians have similar amounts of Neanderthal

1 ancestry.

2 To evaluate if Neanderthal ancestry in Oceanians is indeed similar to that in Han,
3 we investigated the following f_4 statistics (1, 6) for each population of Oceania:

4
$$f_4(Yoruba, Neanderthal; Han, X) = W \times q + (W + M) \times r$$

5
$$f_4(Yoruba, Denisovan; Han, X) = (W + L) \times q + W \times r$$

6 in which W , M and L are the quantitative measures of branch length in the
7 phylogenetic model (Fig. S8), and q and r are the proportion of Denisovan ancestry
8 and Neanderthal ancestry, respectively. If there is no Neanderthal ancestry ($r = 0$),
9 then the values of these two f_4 statistics should be correlated and correspond to a
10 linear model crossing the origin point $(0,0)$ with

$$Slope = \frac{f_4(Yoruba, Neanderthal; Han, X_i) - f_4(Yoruba, Neanderthal; Han, X_j)}{f_4(Yoruba, Denisovan; Han, X_i) - f_4(Yoruba, Denisovan; Han, X_j)}$$

11
$$= \frac{W \times q_i - W \times q_j}{(W+L) \times q_i - (W+L) \times q_j} = \frac{W}{W+L}$$

12 Otherwise, Neanderthal ancestry ($r > 0$) will yield a linear model with the same slope

$$Slope = \frac{f_4(Yoruba, Neanderthal; Han, X_i) - f_4(Yoruba, Neanderthal; Han, X_j)}{f_4(Yoruba, Denisovan; Han, X_i) - f_4(Yoruba, Denisovan; Han, X_j)}$$

13
$$= \frac{W \times (q_i - q_j) + (r_i - r_j) \times (W+M)}{(W+L) \times (q_i - q_j) + (r_i - r_j) \times W} \approx \frac{W}{W+L}$$

14 and the same intercept $(0,0)$ if $r_i \approx r_j$. If $r_i \neq r_j$, then the intercept will be shifted.

15 With Han as the comparison to different Oceanian populations, the intercept does not

1 differ from (0,0), whereas replacing Han with French results in an intercept that is
2 significantly different from (0,0) ([Fig. S5](#)). Thus, this analysis indicates that the
3 amount of Neanderthal ancestry is roughly the same in Han and Oceanians, but not in
4 French and Oceanians.

5 **Detecting Denisovan introgression in East Eurasian and Native
6 American populations**

7 To detect Denisovan introgression in EE/NA populations, we investigated the ratio of
8 two f_4 statistics

$$R_D(X) = \frac{f_4(\text{Yoruba}, \text{Denisovan}; \text{French}, X)}{f_4(\text{Yoruba}, \text{Neanderthal}; \text{French}, X)}$$

9 Given the null hypothesis that there is no Denisovan admixture in population X , the
10 expected value of the numerator should be $W \times r$, which is smaller than the expected
11 value of the denominator $((W + M) \times r)$, in which W and M are the branch lengths
12 in the phylogenetic model (the same as that in Fig. S8, replacing Han with French),
13 and r is the admixture proportion from Neanderthals. If population X has
14 Denisovan ancestry, then the numerator could be larger than the denominator,
15 depending on the admixture proportion q from Denisovans and the branch length L
16 ([Fig. S8](#)). Thus, populations with large ratios ($R_D(X) > 1$) are inferred to have
17 Denisovan ancestry.

18 **Simulations for evaluating $R_D(X)$**

19 We applied coalescent simulations implemented in *ms* (11) to evaluate the
20 performance of $R_D(X)$ in investigating Denisovan ancestry in EE/NA populations.

1 We specify the population split time between modern humans and the common
2 ancestor of Neanderthals and Denisovans to be 560 kya ago, and the split time
3 between Neanderthals and Denisovans to be 380 kya ago (3). We assumed a
4 generation time of 29 years and mutation rate of 5×10^{-8} per base pair per year. We
5 simulated 100 EE/NA populations for each scenario: (1) no admixture with
6 Denisovan and (2) admixture with Denisovan, with the admixture proportion set as a
7 random variables ranging from 0.005 to 0.015. Neanderthal admixture was set to a
8 constant value of 0.02 before the split of West and East populations. The excess of
9 Neanderthal ancestry in East populations was set as a random variable ranging from
10 0.005 to 0.015. We sampled 20 haploid sequences from each simulated modern
11 human population. Simulations followed the demographic model in Fig. S6.

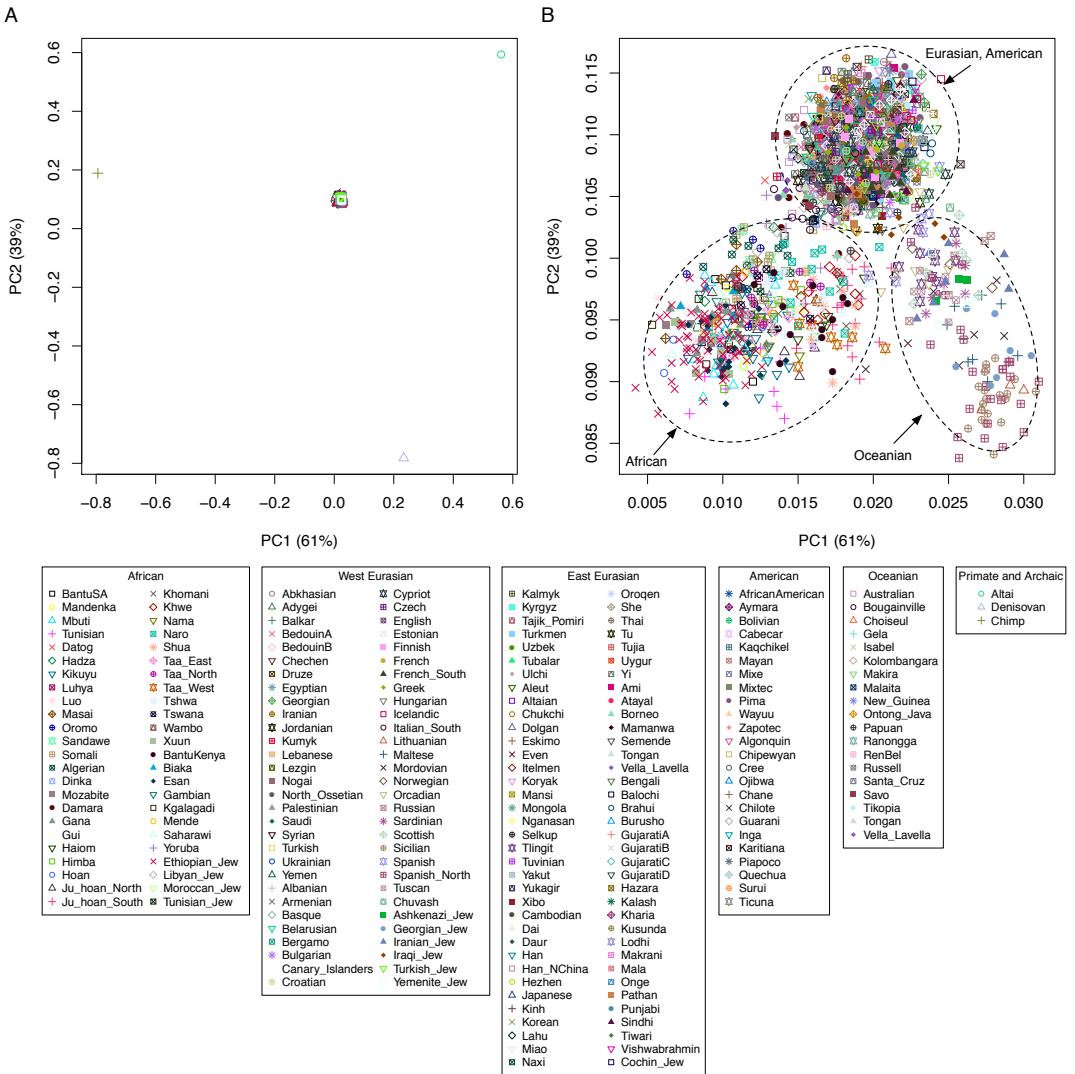
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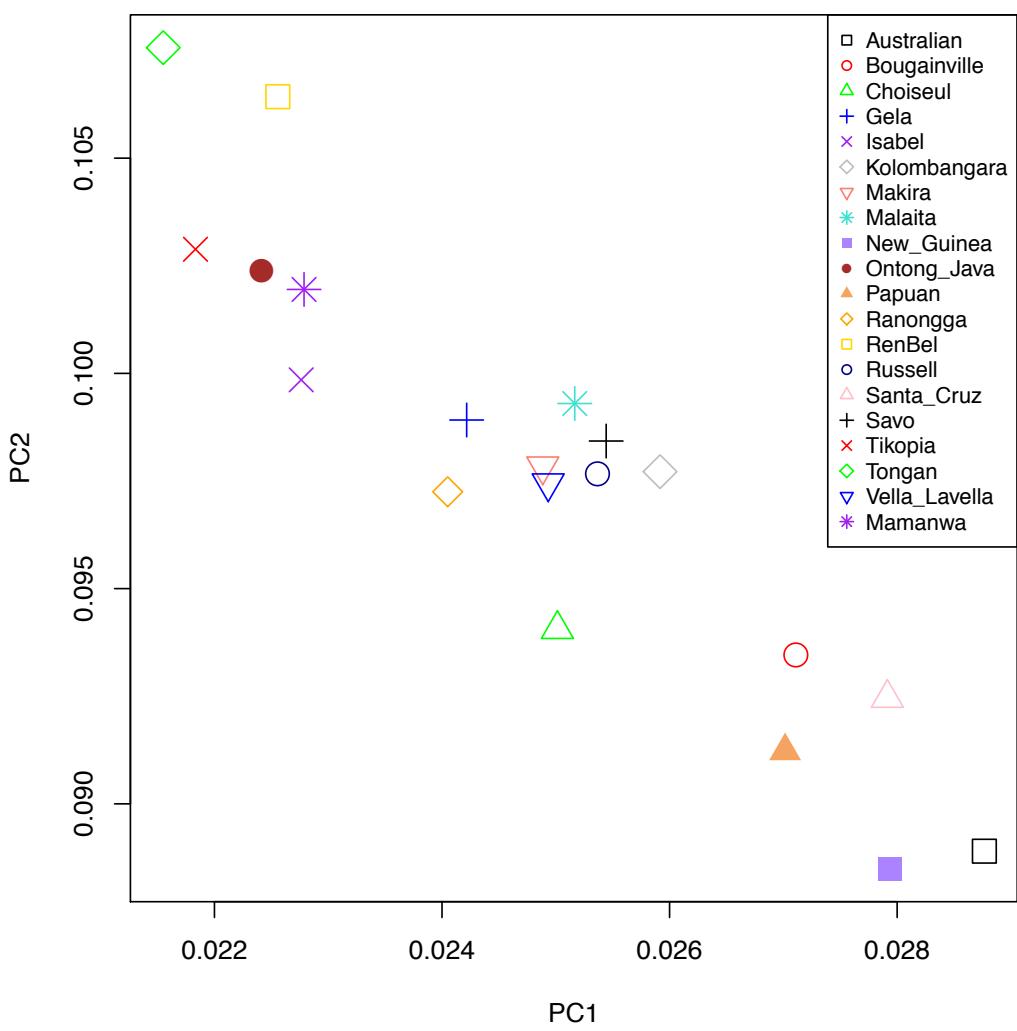
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12 genetic variation. *Bioinformatics* 18:337–338.
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1

2 **Fig. S1.** PCA to explore the relationships of modern humans relative to archaic
 3 humans and chimpanzee. (A) Modern humans (2493 individuals from 221
 4 populations) were projected onto the top two eigenvectors defined by the PCA of
 5 archaic humans and chimpanzee. (B) Enlargement of the modern human portion of
 6 the plot. We also plotted the mean of eigenvectors 1 and 2 for each of the populations
 7 in Fig. 1A to more clearly visualize the patterns.

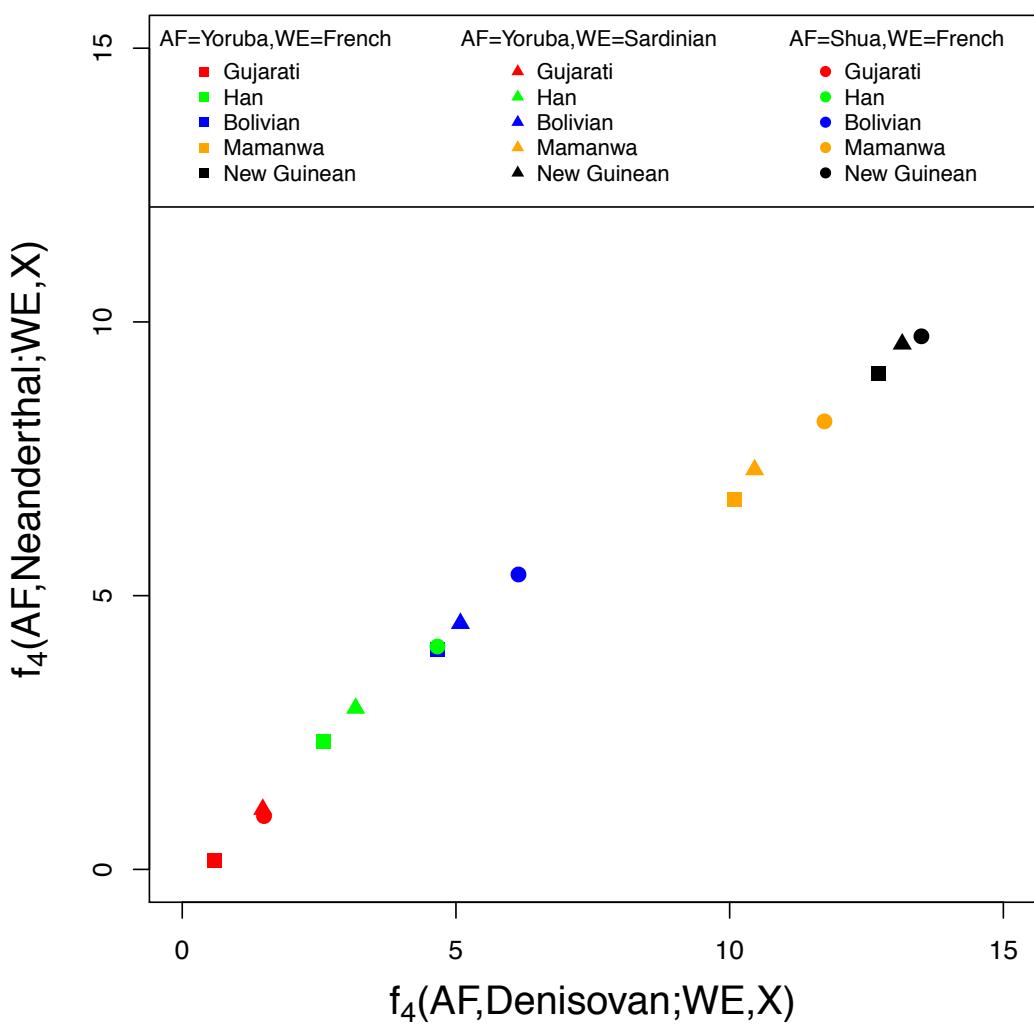
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2 **Fig. S2.** Cline of Neanderthal vs. Denisovan ancestry in the PCA plot. This is a
3 magnified view of Oceanians and Mamanwa in Fig. 1A.

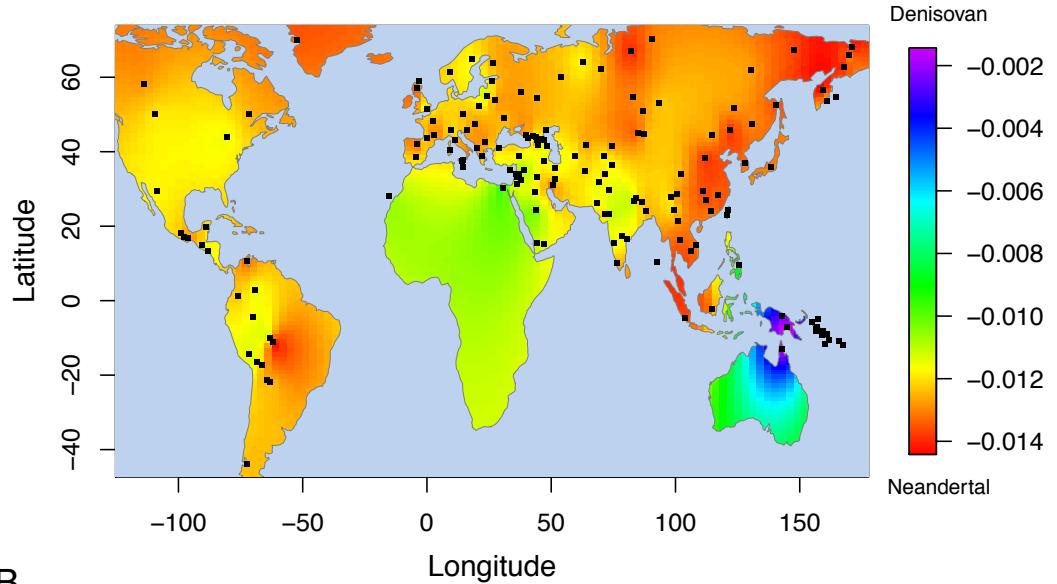
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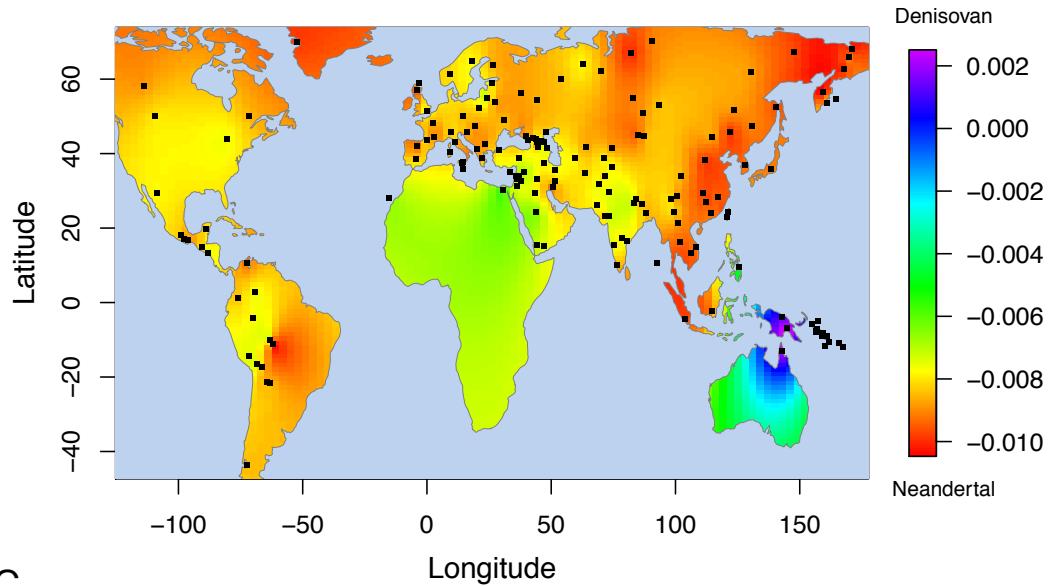
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2 **Fig. S3.** Formal test using different reference populations. We repeated the formal f_4
 3 test using different pairs of references, which are Yoruba-French, Yoruba-Sardinian
 4 and Shua-French. Genetic interactions between African (AF) and West Eurasian (WE)
 5 reference populations will influence the overall value of f_4 statistics, but the relative
 6 value for one population to another will not be significantly affected.
 7

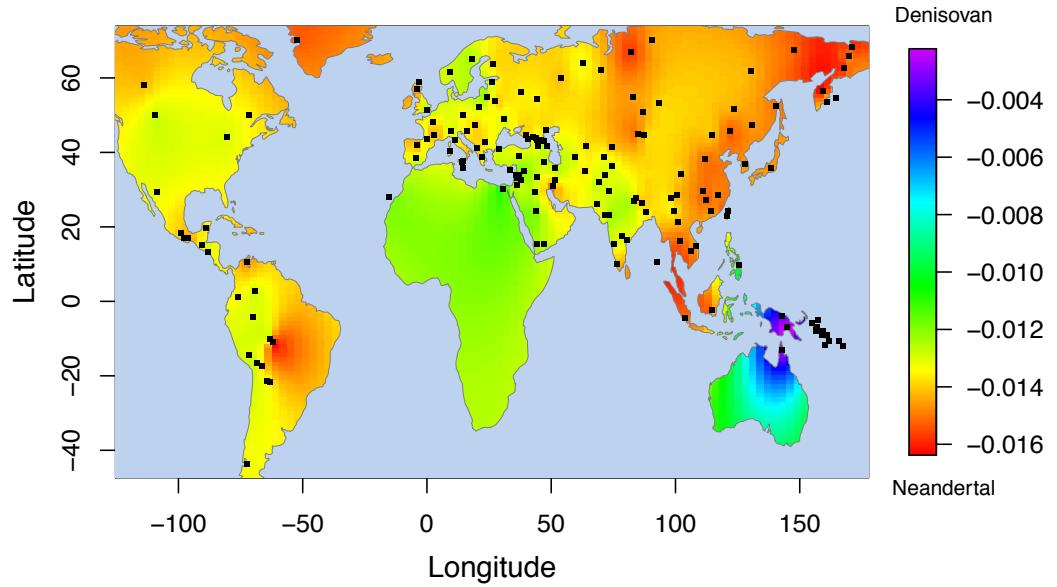
A



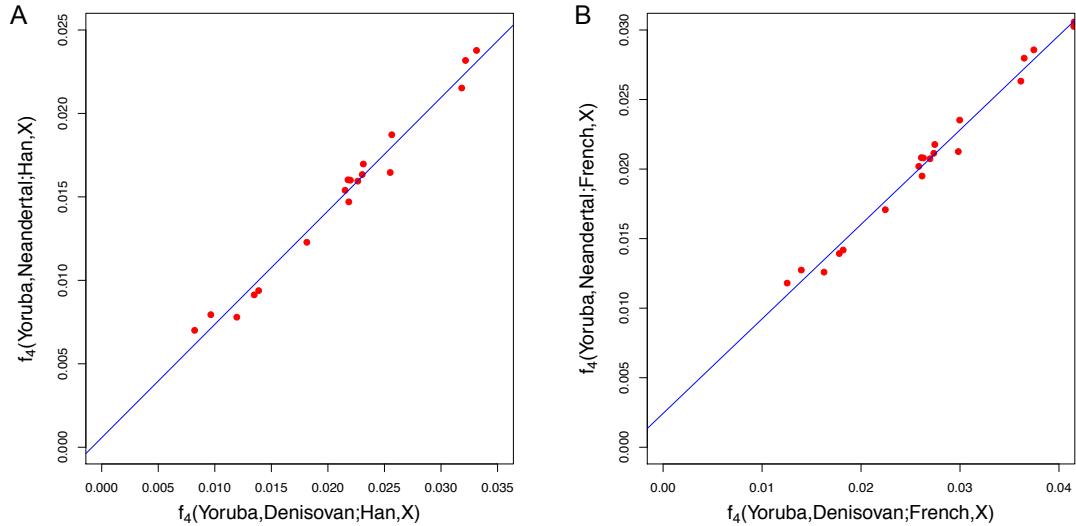
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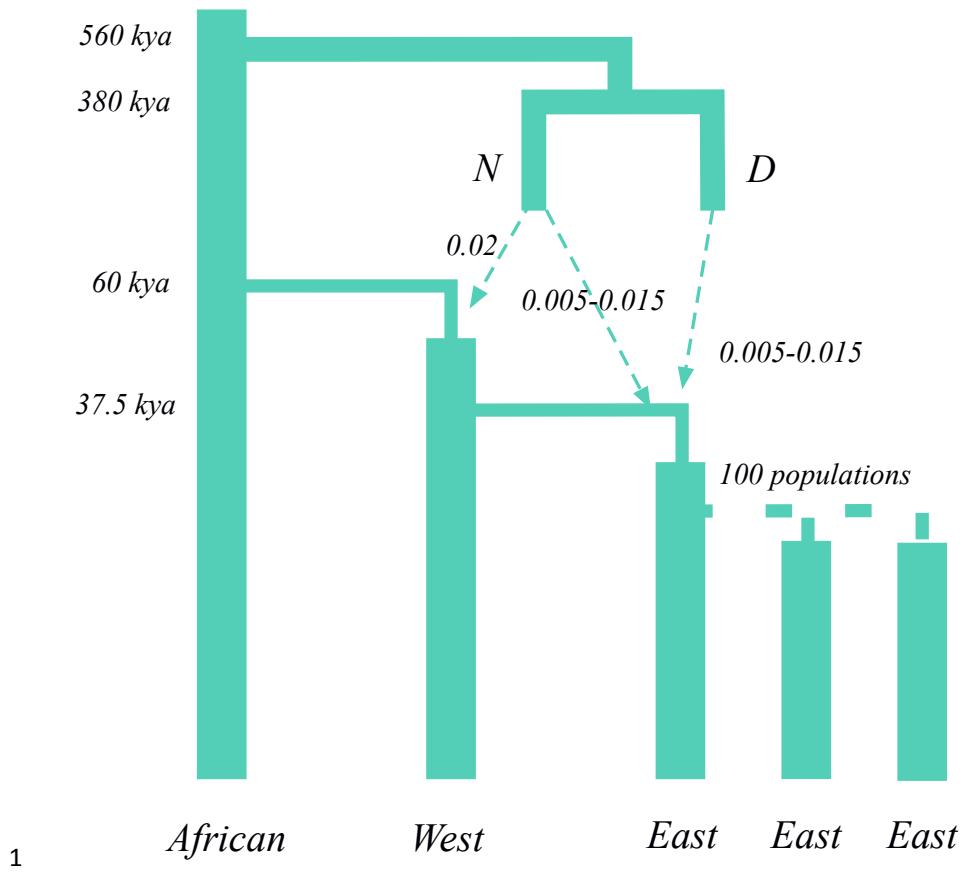


1 **Fig. S4.** f_4 statistics with form $f_4(\text{African}, X; \text{Neanderthal}, \text{Denisovan})$ reveals
2 the different contribution of archaic hominins in present-day non-Africans. We
3 carried out the computation using different African populations: (A) Yoruba, (B)
4 Ju_hoan_North and (C) Mbuti. The heat plot results are valid only for regions on the
5 map covered by our samples.

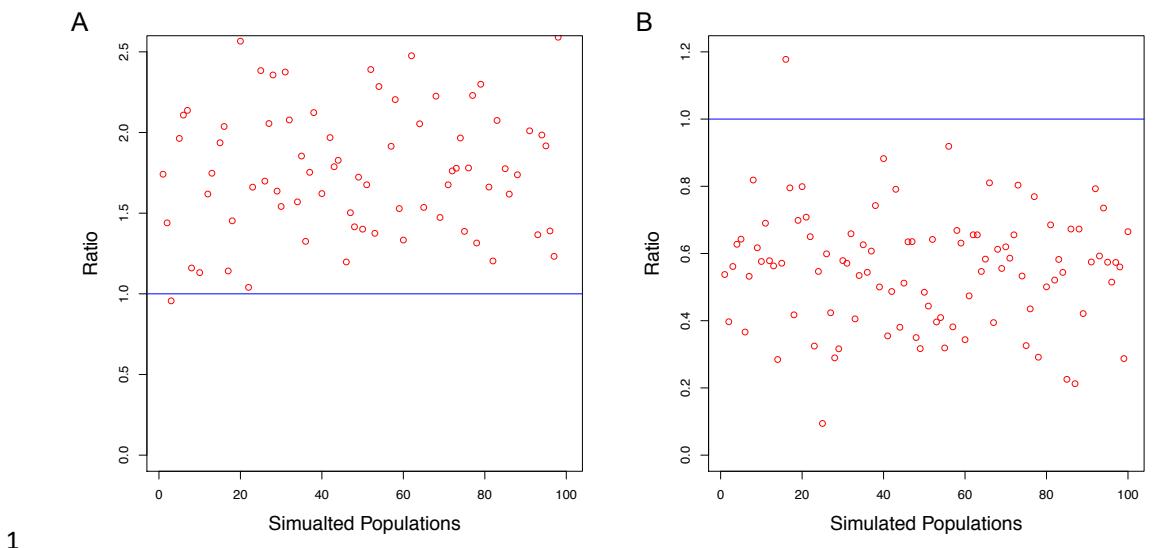


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2 **Fig. S5.** f_4 statistics indicating that Neanderthal ancestry in Oceanians is equivalent
 3 to that in Han. (A) Using Han as a control population, we fitted a linear model with
 4 intercept = 0.00057 ± 0.00046 and a slope = 0.68 ± 0.02 for
 5 $f_4(\text{Yoruba, Neandertal; Han}, X)$ and $f_4(\text{Yoruba, Denisovan; Han}, X)$. The
 6 intercept does not differ significantly from (0,0). (B) Using French as a control
 7 population, the linear model has intercept = 0.00244 ± 0.00054 but the same
 8 slope = 0.68 ± 0.02 . Here the intercept is significantly different from (0,0),
 9 indicating that Neanderthal ancestry in Oceanians is not equivalent to that in French.
 10



1 **Fig. S6.** Demographic model for simulations. We simulated 100 East populations with
 2 both Neanderthal and Denisovan admixture ranging from 0.005-0.015, and another
 3 100 East populations with Neanderthal but without Denisovan admixture.
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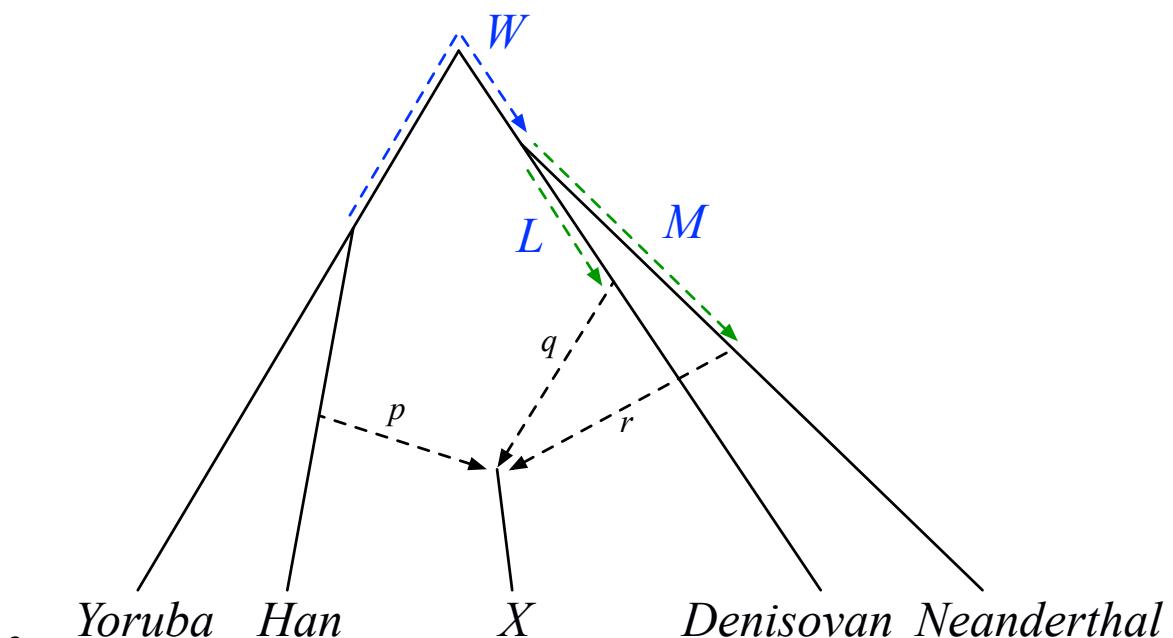


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2 **Fig. S7.** The $R_D(X)$ ratio in simulated data. (A) with Denisovan admixture; (B)
3 without Denisovan admixture.

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4 **Fig. S8.** Phylogenetic model for admixture between archaic humans and Oceanians.

5 Han is used as a control for the Neanderthal ancestry in Oceanians (X), as equivalent

6 Neanderthal ancestry in Han and X will result in $r = 0$.

7

1 **Table S1.** Newly genotyped samples.

Population	Region	Samples	After QC	Latitude	Longitude
Australian_WGA	Oceania	7	5	-13	143
Choiseul	Oceania	7	7	-7.01	156.92
Gela	Oceania	6	6	-9.03	160.1
Isabel	Oceania	8	8	-8.05	159.16
Kolombangara	Oceania	6	6	-7.99	157.12
Makira	Oceania	7	7	-10.64	161.86
Malaita	Oceania	6	6	-8.98	160.96
New_Guinea	Oceania	20	19	-6.94	144.78
Ontong_Java	Oceania	8	7	-4.92	157.39
Ranongga	Oceania	6	6	-8.02	156.57
RenBel*	Oceania	8	7	-11.65	160.27
Russell	Oceania	4	3	-9.1	159.12
Santa_Cruz	Oceania	8	7	-10.74	165.9
Savo	Oceania	7	7	-8.94	160.04
Tikopia	Oceania	6	6	-11.95	167.36
Tongan	Oceania	10	6	-21.18	175.19
Vella_Lavella	Oceania	6	6	-7.7	156.6
Borneo	Southeast Asia	10	9	-2.33	114.67
Mamanwa	Southeast Asia	18	16	9.67	125.61
Semende	Southeast Asia	10	10	-4.55	103.77

2 *a combined sample from the islands of Renell and Bellona

3

4

5

6 **Table S2.** Summary of modern human samples.

Region	Before QC		After QC	
	Samples	Population	Samples	Population
Africa	675	55	535	49
America	231	24	213	24
Central Asia and Siberia	322	23	270	23
East and Southeast Asia	290	25	274	25
Oceania	169	20	141	19
South Asia	329	22	280	22
West Eurasia	874	67	780	59
Total	2890	236	2493	221

7

1 **Table S3. Formal test for archaic admixture in EE/NA populations.**

Population	Region	f_{4-N}	Z score	f_{4-D}	Z score
Aymara	America	0.00654649	3.34581	0.00780973	4.41745
Bolivian	America	0.0073668	4.13747	0.00761626	4.7924
Cabecar	America	0.00502822	2.29092	0.00633129	3.17902
Kaqchikel	America	0.00592824	3.00805	0.00637507	3.60876
Mayan	America	0.0057727	3.325	0.00634171	4.06068
Mixe	America	0.005752	3.05527	0.00536758	3.13379
Mixtec	America	0.00491685	2.70694	0.00534292	3.38178
Pima	America	0.00587814	3.00055	0.00674086	3.86248
Wayuu	America	0.0047155	1.73693	0.00406557	1.72637
Zapotec	America	0.00567177	3.03781	0.00588349	3.56508
Algonquin	America	0.00341791	2.10024	0.00359057	2.51794
Chipewyan	America	0.00476624	3.06588	0.00459867	3.35761
Cree	America	0.00326052	2.35353	0.00399524	3.16568
Ojibwa	America	0.00295479	2.1697	0.00405415	3.34406
Chane	America	0.00501931	1.95521	0.00483637	2.06794
Chilote	America	0.00413504	2.61033	0.00437527	3.13003
Guarani	America	0.00765614	3.88535	0.00805691	4.45616
Inga	America	0.00756856	3.39662	0.00787352	3.92312
Karitiana	America	0.00658685	3.29439	0.00782881	4.21389
Piapoco	America	0.00437142	2.02264	0.00553827	2.91193
Quechua	America	0.00629271	3.41472	0.00747954	4.58026
Surui	America	0.00764527	3.38808	0.00587283	2.89066
Ticuna	America	0.00839289	3.27438	0.00926771	3.83763
Kalmyk	Central Asia	0.00449149	2.75855	0.00378622	2.72755
Kyrgyz	Central Asia	0.00335323	2.22386	0.00323688	2.65414
Tajik_Pomiri	Central Asia	0.000552145	0.528045	0.00143518	1.58415
Turkmen	Central Asia	0.00165259	1.4982	0.00252873	2.64956
Uzbek	Central Asia	0.00345197	3.15598	0.0033855	3.55886
Tubalar	Siberia	0.00371812	2.78705	0.00354145	3.10848
Ulchi	Siberia	0.00551125	3.01392	0.00466307	3.11411
Aleut	Siberia	0.0024954	2.06782	0.00291119	2.66344
Altaian	Siberia	0.00472344	2.98713	0.00435998	3.28925
Chukchi	Siberia	0.00722322	3.98002	0.00572292	3.67359
Dolgan	Siberia	0.0046463	2.27193	0.00325963	1.95252
Eskimo	Siberia	0.00669728	3.66117	0.00645787	4.16728
Even	Siberia	0.00330756	2.28224	0.00357582	2.949
Itelmen	Siberia	0.0059248	2.95508	0.00412718	2.42011
Koryak	Siberia	0.00613465	3.05767	0.00470671	2.75689
Mansi	Siberia	0.00361749	2.5565	0.00382578	3.19162
Nganasan	Siberia	0.00579826	2.92769	0.00543281	3.1507
Selkup	Siberia	0.00341876	2.27007	0.00433584	3.36862

Tlingit	Siberia	0.00385827	2.35117	0.00445452	3.1475
Tuvanian	Siberia	0.00484627	2.92386	0.00519342	3.76426
Yakut	Siberia	0.00430018	2.51221	0.004234	2.96631
Yukagir	Siberia	0.00531142	3.29136	0.00434402	3.24241
Xibo	East Asia	0.00510087	2.64083	0.00428168	2.72191
Cambodian	East Asia	0.00480147	2.68388	0.0039179	2.50687
Dai	East Asia	0.005262	2.81552	0.00513897	3.35167
Daur	East Asia	0.00568646	3.11635	0.00560727	3.74355
Han	East Asia	0.00495835	2.70493	0.00448149	3.00425
Han_NChina	East Asia	0.00513866	2.69533	0.00396195	2.54804
Hezhen	East Asia	0.00410171	2.19364	0.00380048	2.37757
Japanese	East Asia	0.00445593	2.42011	0.0039259	2.62932
Kinh	East Asia	0.00584752	2.98655	0.00538866	3.33297
Korean	East Asia	0.0044352	2.27145	0.00392049	2.3587
Lahu	East Asia	0.00512461	2.6195	0.00572098	3.6038
Miao	East Asia	0.00599281	3.06897	0.00500603	3.19618
Mongola	East Asia	0.00328262	1.77319	0.00338387	2.20418
Naxi	East Asia	0.00323792	1.71797	0.00398875	2.46691
Oroqen	East Asia	0.00498253	2.71475	0.0036874	2.36806
She	East Asia	0.00529373	2.73412	0.00461504	2.95989
Thai	East Asia	0.00561097	3.19897	0.00492492	3.35817
Tu	East Asia	0.00420324	2.30003	0.00444207	2.93037
Tujia	East Asia	0.00613524	3.1158	0.00518579	3.27072
Uygur	East Asia	0.00198918	1.60412	0.00213755	2.03437
Yi	East Asia	0.00547795	2.86579	0.00529508	3.37195
Ami	East Asia	0.00565569	2.87729	0.00479741	2.93491
Atayal	East Asia	0.00585268	2.87854	0.00471682	2.77524
Borneo	East Asia	0.0061369	3.1149	0.0055888	3.42882
Semende	East Asia	0.00704653	3.49931	0.00602322	3.55359
Mamanwa	East Asia	0.0123167	6.59416	0.0163348	10.1031
Australian	Oceania	0.0272718	8.57693	0.0382337	12.6046
Bougainville	Oceania	0.02475	8.71467	0.0332587	12.5823
Choiseul	Oceania	0.0181727	7.23221	0.0267402	11.4545
Gela	Oceania	0.0190554	7.85405	0.0246942	10.9533
Isabel	Oceania	0.0148888	6.52675	0.0202626	9.87201
Kolombangara	Oceania	0.0191344	7.76951	0.0246368	10.9056
Makira	Oceania	0.01838	7.7516	0.0245911	11.3447
Malaita	Oceania	0.018949	7.90896	0.0242183	10.5719
New_Guinea	Oceania	0.0270994	9.12256	0.0383311	13.0724
Ontong_Java	Oceania	0.0123219	5.94223	0.0161963	8.53926
Papuan	Oceania	0.0240472	8.83088	0.0338723	12.7282
Ranongga	Oceania	0.0169999	6.73689	0.0236631	10.1724
RenBel	Oceania	0.0122018	5.53253	0.0134219	6.85455
Russell	Oceania	0.0182795	7.24791	0.0245052	10.4177

Santa_Cruz	Oceania	0.0248267	8.99604	0.0337085	12.8569
Savo	Oceania	0.0193718	7.91406	0.0250535	10.9694
Tikopia	Oceania	0.0116368	5.22349	0.0153103	7.79193
Tongan	Oceania	0.011057	5.2166	0.0117895	6.29913
Vella_Lavella	Oceania	0.0200786	7.90191	0.0265223	11.4415
Bengali	South Asia	0.00245897	1.80571	0.00268206	2.2135
Balochi	South Asia	-0.000701985	-0.782533	0.000208284	0.271057
Brahui	South Asia	-0.000168224	-0.171206	0.000737734	0.88433
Burusho	South Asia	0.00104818	1.10133	0.00206653	2.45138
GujaratiA	South Asia	0.00024821	0.192169	0.00075845	0.643199
GujaratiB	South Asia	0.000249215	0.187538	0.00173418	1.49323
GujaratiC	South Asia	0.00184462	1.31043	0.00207006	1.65486
GujaratiD	South Asia	0.00206003	1.43988	0.00276332	2.16368
Hazara	South Asia	0.0019354	1.51528	0.00242988	2.245
Kalash	South Asia	5.62E-05	0.0500881	0.000631432	0.630337
Kharia	South Asia	0.00388438	2.46146	0.00534866	3.9163
Kusunda	South Asia	0.0041205	2.3395	0.00438097	2.89026
Lodhi	South Asia	0.00132816	1.0136	0.00291791	2.59425
Makrani	South Asia	-0.00012384	-0.134554	0.00108029	1.37866
Mala	South Asia	0.00283812	2.14096	0.00352956	3.03696
Onge	South Asia	0.00640251	3.02734	0.00528425	2.81071
Pathan	South Asia	0.000358011	0.403034	0.00151379	1.89172
Punjabi	South Asia	0.001061	0.825519	0.00220053	1.89477
Sindhi	South Asia	0.000571881	0.560093	0.00184129	2.04613
Tiwari	South Asia	0.00115799	1.10369	0.00208327	2.20532
Vishwabrahmin	South Asia	0.00302711	2.22717	0.00420248	3.52604
Cochin_Jew	South Asia	-0.000707713	-0.536855	-0.000617467	-0.537841

1 Note: f_4N and f_4D stand for $f_4(San, Neanderthal; French, X)$ and $f_4(San, Denisovan; French, X)$,
2 respectively. Weighted Block Jackknife (block size of 5 cM) was used to correct LD among SNPs and estimate
3 standard deviations. For these tests, we interpreted $|Z\text{-score}| \geq 2$ as significant evidence of admixture.

4

1 **Table S4.** Contribution from Neanderthals and Denisovans to EE/NA populations, as
 2 measured by f_4 statistics

Population	Region	f_4	Zscore
Aymara	America	-0.0113568	-6.17014
Bolivian	America	-0.0123691	-7.11404
Cabecar	America	-0.0113053	-5.94349
Kaqchikel	America	-0.012164	-6.82797
Mayan	America	-0.0120483	-7.32535
Mixe	America	-0.0129999	-7.38354
Mixtec	America	-0.0121864	-7.22184
Pima	America	-0.0117528	-6.71457
Wayuu	America	-0.013253	-6.00994
Zapotec	America	-0.0124035	-7.42641
Algonquin	America	-0.0124589	-7.89778
Chipewyan	America	-0.0128063	-8.47909
Cree	America	-0.011891	-7.75182
Ojibwa	America	-0.0115282	-7.47247
Saqqaq	America	-0.0134751	-5.7708
Chane	America	-0.0128538	-5.92277
Chilote	America	-0.0123856	-7.4309
Guarani	America	-0.0122123	-7.05136
Inga	America	-0.0123019	-6.27561
Karitiana	America	-0.0113823	-6.15503
Piapoco	America	-0.0114452	-6.03002
Quechua	America	-0.0114341	-6.93151
Surui	America	-0.0143843	-7.26167
Ticuna	America	-0.0117534	-5.16065
Xibo	East Asia	-0.0134463	-8.15697
Cambodian	East Asia	-0.0135107	-8.25725
Dai	East Asia	-0.0127525	-7.55208
Daur	East Asia	-0.0127072	-7.73905
Han	East Asia	-0.0131057	-8.2157
Han_NChina	East Asia	-0.0138054	-8.53546
Hezhen	East Asia	-0.0129278	-7.92603
Japanese	East Asia	-0.0131582	-8.12795
Kinh	East Asia	-0.0130924	-7.72175
Korean	East Asia	-0.0131474	-7.83961
Lahu	East Asia	-0.0120411	-7.16691
Miao	East Asia	-0.0136233	-7.9163
Mongola	East Asia	-0.0125219	-8.01112
Naxi	East Asia	-0.0118823	-7.29218
Oroqen	East Asia	-0.0139253	-8.42937
She	East Asia	-0.0133051	-7.94785

Thai	East Asia	-0.0133096	-8.39116
Tu	East Asia	-0.0123944	-7.84026
Tujia	East Asia	-0.0135744	-8.17807
Yi	East Asia	-0.012814	-7.75979
Ami	East Asia	-0.0134913	-7.88516
Atayal	East Asia	-0.0137697	-7.87468
Borneo	East Asia	-0.0131807	-7.88718
Mamanwa	East Asia	-0.00861153	-5.40503
Semende	East Asia	-0.0136523	-8.0916
Abkhasian	West Eurasia	-0.0116847	-8.14947
Adygei	West Eurasia	-0.0130862	-9.30735
Balkar	West Eurasia	-0.0119961	-8.27538
Balochi	West Eurasia	-0.0117241	-8.94501
BedouinA	West Eurasia	-0.0105699	-8.66895
Chechen	West Eurasia	-0.0114145	-7.9253
Druze	West Eurasia	-0.0110122	-8.32917
Egyptian	West Eurasia	-0.00952254	-8.04347
Georgian	West Eurasia	-0.0127099	-8.79379
Iranian	West Eurasia	-0.0119381	-8.62838
Jordanian	West Eurasia	-0.0119378	-9.14616
Kumyk	West Eurasia	-0.0114202	-7.94278
Lebanese	West Eurasia	-0.00970762	-7.06883
Lezgin	West Eurasia	-0.0114489	-7.96432
Nogai	West Eurasia	-0.0120184	-8.30905
North_Ossetian	West Eurasia	-0.012407	-8.8656
Palestinian	West Eurasia	-0.0111138	-9.14775
Saudi	West Eurasia	-0.0102548	-7.77089
Syrian	West Eurasia	-0.0105918	-7.93587
Turkish	West Eurasia	-0.0118317	-9.08823
Ukrainian	West Eurasia	-0.0123904	-8.32331
Yemen	West Eurasia	-0.0113953	-8.99184
Albanian	West Eurasia	-0.0127503	-8.743
Armenian	West Eurasia	-0.0116677	-8.54457
Basque	West Eurasia	-0.0117103	-8.36297
Belarusian	West Eurasia	-0.01283	-8.84929
Bergamo	West Eurasia	-0.0119658	-8.58631
Bulgarian	West Eurasia	-0.0129029	-8.88617
Canary_Islanders	West Eurasia	-0.0105437	-6.07032
Croatian	West Eurasia	-0.0124387	-8.60522
Cypriot	West Eurasia	-0.0116234	-8.16788
Czech	West Eurasia	-0.012375	-8.53252
English	West Eurasia	-0.0114766	-7.98421
Estonian	West Eurasia	-0.0119931	-8.25819
Finnish	West Eurasia	-0.0125811	-8.1898

French	West Eurasia	-0.012637	-9.12932
French_South	West Eurasia	-0.013257	-9.12003
Greek	West Eurasia	-0.0124989	-8.97866
Hungarian	West Eurasia	-0.0127752	-9.10429
Icelandic	West Eurasia	-0.0116692	-8.08453
Italian_South	West Eurasia	-0.0136957	-6.75313
Lithuanian	West Eurasia	-0.0110556	-7.44027
Maltese	West Eurasia	-0.0123417	-8.87798
Mordovian	West Eurasia	-0.0125008	-8.35767
Norwegian	West Eurasia	-0.0120939	-8.36283
Orcadian	West Eurasia	-0.0124117	-8.53772
Russian	West Eurasia	-0.0126979	-8.8858
Sardinian	West Eurasia	-0.0124578	-9.02438
Scottish	West Eurasia	-0.0135426	-8.9247
Sicilian	West Eurasia	-0.0118435	-8.51804
Spanish	West Eurasia	-0.0120409	-8.92177
Spanish_North	West Eurasia	-0.0135086	-8.92892
Tuscan	West Eurasia	-0.0121682	-8.34075
Chuvash	West Eurasia	-0.0123536	-8.51697
Kalmyk	West Eurasia	-0.0133364	-8.52945
Ashkenazi_Jew	West Eurasia	-0.012016	-8.11608
Georgian_Jew	West Eurasia	-0.0117257	-8.26931
Iranian_Jew	West Eurasia	-0.0116292	-7.97906
Iraqi_Jew	West Eurasia	-0.0118089	-8.33779
Tunisian_Jew	West Eurasia	-0.0119151	-8.52024
Yemenite_Jew	West Eurasia	-0.0110517	-8.13456
Australian	Oceania	-0.00170086	-0.769969
Bougainville	Oceania	-0.00413514	-2.01453
Choiseul	Oceania	-0.00407141	-2.16222
Gela	Oceania	-0.00699756	-3.76137
Isabel	Oceania	-0.00726135	-4.10566
Kolombangara	Oceania	-0.007147	-3.92329
Makira	Oceania	-0.00643346	-3.53737
Malaita	Oceania	-0.0073684	-3.96113
New_Guinea	Oceania	-0.00143952	-0.657141
Ontong_Java	Oceania	-0.00876281	-5.05376
Papuan	Oceania	-0.00283172	-1.42011
Ranongga	Oceania	-0.00597764	-3.10412
RenBel	Oceania	-0.0114189	-6.29225
Russell	Oceania	-0.00640745	-3.1968
Santa_Cruz	Oceania	-0.00376423	-1.89609
Savo	Oceania	-0.00696929	-3.72357
Tikopia	Oceania	-0.00894591	-4.92779
Tongan	Oceania	-0.0118957	-6.78871

Vella_Lavella	Oceania	-0.00619917	-3.29251
Aleut	Siberia	-0.0122087	-7.88472
Altaian	Siberia	-0.0129901	-8.25945
Chukchi	Siberia	-0.0141254	-8.62916
Dolgan	Siberia	-0.0140169	-7.80672
Eskimo	Siberia	-0.012859	-7.69417
Even	Siberia	-0.0123609	-7.94565
Itelmen	Siberia	-0.0144184	-8.12758
Koryak	Siberia	-0.014047	-8.22844
Mansi	Siberia	-0.0124248	-7.78388
Nganasan	Siberia	-0.0129817	-7.4184
Selkup	Siberia	-0.0117082	-7.54102
Tubalar	Siberia	-0.0128086	-8.55665
Tuvinian	Siberia	-0.0122805	-7.5059
Ulchi	Siberia	-0.0134762	-8.27474
Yakut	Siberia	-0.0126828	-7.79545
Yukagir	Siberia	-0.013593	-8.93147
Tlingit	Siberia	-0.0120285	-7.45217
Hazara	Central Asia	-0.0121362	-8.43054
Kyrgyz	Central Asia	-0.0127431	-8.26805
Tajik_Pomiri	Central Asia	-0.0117521	-8.38948
Turkmen	Central Asia	-0.0117556	-8.24613
Uygur	Central Asia	-0.0124826	-8.69796
Uzbek	Central Asia	-0.0126931	-8.80867
Bengali	South Asia	-0.0124116	-8.65175
Brahui	South Asia	-0.0117316	-8.84525
Burusho	South Asia	-0.0116154	-8.39052
GujaratiA	South Asia	-0.0121207	-8.33293
Kalash	South Asia	-0.0120513	-8.16289
Kharia	South Asia	-0.0111161	-7.61859
Kusunda	South Asia	-0.0123753	-7.64658
Lodhi	South Asia	-0.0110348	-7.92198
Makrani	South Asia	-0.0114286	-9.07434
Mala	South Asia	-0.0119417	-8.55961
Onge	South Asia	-0.0137441	-7.91119
Pathan	South Asia	-0.0114744	-8.55508
Punjabi	South Asia	-0.0114895	-7.67388
Sindhi	South Asia	-0.0113607	-8.5113
Tiwari	South Asia	-0.0117085	-8.73025
Vishwabrahmin	South Asia	-0.0114583	-8.13037
Cochin_Jew	South Asia	-0.012539	-8.65825

1 Note: We computed the value of $f_4(Yoruba, X; Neanderthal, Denisovan)$. Weighted Block Jackknife (block
 2 size of 5 cM) was used to estimate standard deviations. An excess of allele sharing with Denisovan yields positive
 3 values while an excess with Neanderthal yields negative values.

1 **Table S5.** Genetic affinity of EE/NA populations with New Guineans and
 2 Australians.

Population	Region	f_4	Zscore
Aymara	America	-0.000785737	-0.386815
Bolivian	America	-5.21E-05	-0.0272089
Cabecar	America	-0.00127859	-0.575843
Kaqchikel	America	-0.000526751	-0.263213
Mayan	America	-0.000826238	-0.462707
Mixe	America	-0.000212424	-0.107201
Mixtec	America	0.000499114	0.259937
Pima	America	0.00149914	0.749923
Zapotec	America	0.00123898	0.655582
Algonquin	America	0.00260927	1.45921
Chipewyan	America	0.00192564	1.11258
Cree	America	0.00140592	0.804392
Ojibwa	America	0.00188398	1.17199
Chilote	America	0.00289384	1.64472
Guarani	America	0.000957188	0.487047
Inga	America	-0.00226077	-1.05582
Karitiana	America	-0.0014192	-0.669221
Piapoco	America	0.000123469	0.0591158
Quechua	America	0.000777798	0.410668
Surui	America	-0.0029972	-1.2922
Ticuna	America	-0.00142008	-0.530124
Kalmyk	Central Asia	0.00128024	0.789235
Kyrgyz	Central Asia	0.0016012	1.02886
Turkmen	Central Asia	0.00188986	1.28262
Uzbek	Central Asia	0.00106518	0.758476
Tubalar	Siberia	0.000528495	0.341376
Ulchi	Siberia	0.0017784	1.04411
Altaian	Siberia	0.00148443	0.898508
Chukchi	Siberia	0.00204021	1.18434
Dolgan	Siberia	0.00257933	1.44473
Eskimo	Siberia	0.000641111	0.368333
Even	Siberia	0.000827268	0.514633
Itelmen	Siberia	0.00188349	1.02502
Koryak	Siberia	0.00209552	1.13464
Mansi	Siberia	0.0017999	1.12985
Nganasan	Siberia	0.00153285	0.838453
Selkup	Siberia	0.000361015	0.220014
Tlingit	Siberia	0.00172224	1.01126
Tuvanian	Siberia	0.000457009	0.266018
Yakut	Siberia	0.00141006	0.853411

Yukagir	Siberia	0.00133165	0.813767
Xibo	East Asia	0.00118664	0.688472
Cambodian	East Asia	-0.000948265	-0.572967
Dai	East Asia	-0.000974977	-0.569941
Daur	East Asia	0.00123902	0.736565
Han	East Asia	-0.000170255	-0.102856
Han_NChina	East Asia	-0.000528713	-0.316984
Hezhen	East Asia	0.000476965	0.279418
Japanese	East Asia	0.000891427	0.53743
Kinh	East Asia	-0.000482928	-0.279248
Korean	East Asia	0.000712585	0.405167
Lahu	East Asia	-0.00148382	-0.879844
Miao	East Asia	0.0002751	0.155482
Mongola	East Asia	-0.000732019	-0.435802
Naxi	East Asia	0.000767063	0.429103
Oroqen	East Asia	0.00134608	0.777567
She	East Asia	-0.000220156	-0.127331
Thai	East Asia	-0.0010863	-0.674188
Tu	East Asia	0.000785474	0.475262
Tujia	East Asia	5.16E-05	0.0303204
Yi	East Asia	-0.00022672	-0.126796
Ami	East Asia	0.000198484	0.112919
Atayal	East Asia	-0.00111366	-0.619895
Borneo	East Asia	-0.00172608	-1.02057
Mamanwa	East Asia	-0.00346479	-2.13711
Semende	East Asia	-0.00088986	-0.527028
Hazara	South Asia	0.000996639	0.660642
Kharia	South Asia	0.00104571	0.66734
Kusunda	South Asia	0.000770568	0.46811
Mala	South Asia	0.00196905	1.33881
Onge	South Asia	-0.00130388	-0.671311
Vishwabrahmin	South Asia	0.00154133	1.05551
Bougainville	Oceania	-0.0162316	-8.07864
Choiseul	Oceania	-0.0130027	-7.06624
Gela	Oceania	-0.0197012	-10.7974
Isabel	Oceania	-0.00944564	-5.44678
Kolombangara	Oceania	-0.0122022	-6.6586
Makira	Oceania	-0.0269032	-15.3172
Malaita	Oceania	-0.0195023	-10.4345
Ontong_Java	Oceania	-0.0181257	-10.0548
Papuan	Oceania	-0.0792317	-39.7834
Ranongga	Oceania	-0.0122975	-6.78325
RenBel	Oceania	-0.013556	-6.95393
Russell	Oceania	-0.0164172	-7.86517

Santa_Cruz	Oceania	-0.0393444	-19.6526
Savo	Oceania	-0.0224406	-12.4621
Tikopia	Oceania	-0.0160977	-8.75951
Tongan	Oceania	-0.0136881	-7.61813
Vella_Lavella	Oceania	-0.0115974	-6.495

1 Note: We computed $f_4(Yoruba, X; NewGuinean, Australian)$ for each EE/NA population. Closer genetic
 2 affinity with New Guineans will yield negative f_4 statistics, while closer affinities with Australians will yield
 3 positive statistics. A weighted Block Jackknife (block size of 5 cM) was used to correct LD among SNPs and
 4 estimate standard deviations. We interpreted $|Z\text{-score}| \geq 2$ (bold) as a significant difference of affinity with New
 5 Guinean vs. Australian.

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9 **Table S6.** $R_D(X)$ ratios using different reference populations.

Population	Region	Yoruba-French		Yoruba-Sardinian		Shua-French	
		$R_D(X)$	SE	$R_D(X)$	SE	$R_D(X)$	SE
Aymara	America	1.20	0.27	1.14	0.22	1.13	0.16
Bolivian	America	1.03	0.16	1.01	0.14	1.03	0.12
Cabecar	America	1.22	0.30	1.15	0.24	1.15	0.19
Kaqchikel	America	1.08	0.27	1.04	0.21	1.05	0.16
Mayan	America	1.12	0.28	1.06	0.21	1.07	0.14
Mixe	America	0.94	0.21	0.93	0.18	0.96	0.14
Mixtec	America	1.09	0.27	1.04	0.21	1.05	0.16
Pima	America	1.13	0.22	1.09	0.19	1.09	0.14
Zapotec	America	1.04	0.21	1.01	0.18	1.02	0.14
Algonquin	America	1.05	0.32	1.00	0.23	1.03	0.19
Chipewyan	America	0.96	0.23	0.94	0.18	0.98	0.15
Cree	America	1.22	0.35	1.12	0.25	1.13	0.20
Ojibwa	America	1.37	0.44	1.21	0.28	1.21	0.22
Chilote	America	1.07	0.36	1.01	0.25	1.04	0.19
Guarani	America	1.06	0.21	1.03	0.17	1.04	0.14
Inga	America	1.04	0.22	1.02	0.19	1.03	0.15
Karitiana	America	1.22	0.30	1.15	0.23	1.12	0.15
Piapoco	America	1.28	0.48	1.18	0.33	1.16	0.24
Quechua	America	1.18	0.22	1.12	0.18	1.13	0.15
Surui	America	0.75	0.21	0.77	0.18	0.83	0.14
Ticuna	America	1.11	0.26	1.07	0.22	1.09	0.21
Kalmyk	Central Asia	0.87	0.18	0.87	0.15	0.91	0.13
Kyrgyz	Central Asia	0.97	0.27	0.94	0.20	0.98	0.18
Turkmen	Central Asia	1.52	0.74	1.22	0.32	1.31	0.38
Uzbek	Central Asia	0.98	0.21	0.95	0.16	0.99	0.15
Tubalar	Siberia	0.96	0.23	0.93	0.17	0.97	0.15
Ulchi	Siberia	0.86	0.18	0.87	0.15	0.90	0.13

Altaian	Siberia	0.93	0.20	0.92	0.16	0.95	0.14
Chukchi	Siberia	0.80	0.14	0.81	0.13	0.85	0.11
Dolgan	Siberia	0.76	0.21	0.78	0.18	0.82	0.17
Eskimo	Siberia	0.97	0.18	0.95	0.15	0.98	0.14
Even	Siberia	1.08	0.30	1.02	0.22	1.05	0.19
Itelmen	Siberia	0.71	0.20	0.74	0.17	0.79	0.15
Koryak	Siberia	0.78	0.19	0.80	0.16	0.84	0.14
Mansi	Siberia	1.05	0.23	1.01	0.18	1.03	0.16
Nganasan	Siberia	0.95	0.21	0.94	0.17	0.96	0.16
Selkup	Siberia	1.27	0.38	1.15	0.26	1.17	0.22
Tlingit	Siberia	1.16	0.33	1.08	0.23	1.12	0.25
Tuvinian	Siberia	1.07	0.23	1.03	0.18	1.05	0.16
Yakut	Siberia	0.99	0.23	0.96	0.18	0.99	0.16
Yukagir	Siberia	0.83	0.16	0.84	0.14	0.88	0.12
Xibo	East Asia	0.85	0.21	0.85	0.17	0.90	0.14
Cambodian	East Asia	0.82	0.24	0.83	0.19	0.89	0.14
Dai	East Asia	0.98	0.26	0.95	0.21	0.99	0.16
Daur	East Asia	0.99	0.24	0.96	0.19	0.99	0.15
Han	East Asia	0.90	0.23	0.90	0.19	0.94	0.14
Han_NChina	East Asia	0.79	0.19	0.81	0.16	0.86	0.13
Hezhen	East Asia	0.93	0.29	0.92	0.22	0.96	0.17
Japanese	East Asia	0.87	0.26	0.87	0.20	0.93	0.15
Kinh	East Asia	0.92	0.22	0.91	0.18	0.95	0.14
Korean	East Asia	0.90	0.24	0.89	0.19	0.93	0.16
Lahu	East Asia	1.11	0.29	1.06	0.22	1.08	0.19
Miao	East Asia	0.84	0.19	0.85	0.16	0.89	0.13
Mongola	Siberia	1.03	0.33	0.99	0.24	1.02	0.19
Naxi	East Asia	1.20	0.42	1.11	0.29	1.11	0.21
Oroqen	East Asia	0.76	0.19	0.79	0.16	0.83	0.14
She	East Asia	0.86	0.24	0.87	0.20	0.92	0.15
Thai	East Asia	0.88	0.20	0.88	0.17	0.91	0.14
Tu	East Asia	1.06	0.31	1.01	0.22	1.03	0.17
Tujia	East Asia	0.86	0.17	0.87	0.15	0.91	0.12
Yi	East Asia	0.97	0.21	0.95	0.17	0.98	0.14
Ami	East Asia	0.85	0.21	0.86	0.18	0.90	0.14
Atayal	East Asia	0.80	0.22	0.82	0.18	0.87	0.15
Borneo	East Asia	0.91	0.20	0.91	0.17	0.94	0.14
Mamanwa	East Asia	1.28	0.11	1.25	0.10	1.24	0.09
Semende	East Asia	0.87	0.16	0.87	0.14	0.90	0.12
Australian	Oceania	1.36	0.09	1.34	0.08	1.34	0.08
Bougainville	Oceania	1.30	0.08	1.28	0.08	1.29	0.08
Choiseul	Oceania	1.40	0.11	1.37	0.10	1.38	0.10
Gela	Oceania	1.28	0.10	1.25	0.09	1.25	0.09
Isabel	Oceania	1.31	0.11	1.28	0.11	1.28	0.10

Kolombangara	Oceania	1.26	0.09	1.24	0.09	1.24	0.08
Makira	Oceania	1.29	0.09	1.27	0.09	1.27	0.08
Malaita	Oceania	1.25	0.09	1.23	0.09	1.23	0.08
New_Guinea	Oceania	1.37	0.09	1.35	0.08	1.35	0.08
Ontong_Java	Oceania	1.27	0.14	1.23	0.12	1.24	0.12
Papuan	Oceania	1.37	0.09	1.35	0.08	1.35	0.08
Ranongga	Oceania	1.34	0.11	1.31	0.10	1.32	0.10
RenBel	Oceania	1.10	0.13	1.07	0.11	1.08	0.10
Russell	Oceania	1.30	0.11	1.27	0.10	1.28	0.10
Santa_Cruz	Oceania	1.31	0.08	1.29	0.07	1.30	0.08
Savo	Oceania	1.26	0.09	1.24	0.08	1.25	0.08
Tikopia	Oceania	1.29	0.16	1.25	0.14	1.24	0.12
Tongan	Oceania	1.06	0.13	1.04	0.12	1.05	0.10
Vella_Lavella	Oceania	1.27	0.09	1.25	0.08	1.26	0.08
Hazara	South Asia	1.23	0.48	1.09	0.27	1.13	0.25
Kharia	South Asia	1.34	0.35	1.23	0.24	1.22	0.19
Kusunda	South Asia	1.05	0.23	1.01	0.18	1.04	0.17
Mala	South Asia	1.25	0.43	1.12	0.26	1.14	0.22
Onge	South Asia	0.83	0.21	0.84	0.17	0.88	0.15
Vishwabrahmin	South Asia	1.43	0.48	1.24	0.28	1.24	0.22

1 Note: We computed $R_D(X)$ as the ratio of $f_4(AF, Denisovan; WE, X)$ and $f_4(AF, Neanderthal; WE, X)$ for
 2 each EE/NA which show significant signals of admixture with archaic hominins in formal tests (Table S3). We
 3 repeated the computation using different pairs of AF-WE reference populations. Weighted Block Jackknife (block
 4 size of 5 cM) was used to estimate the standard error.

5