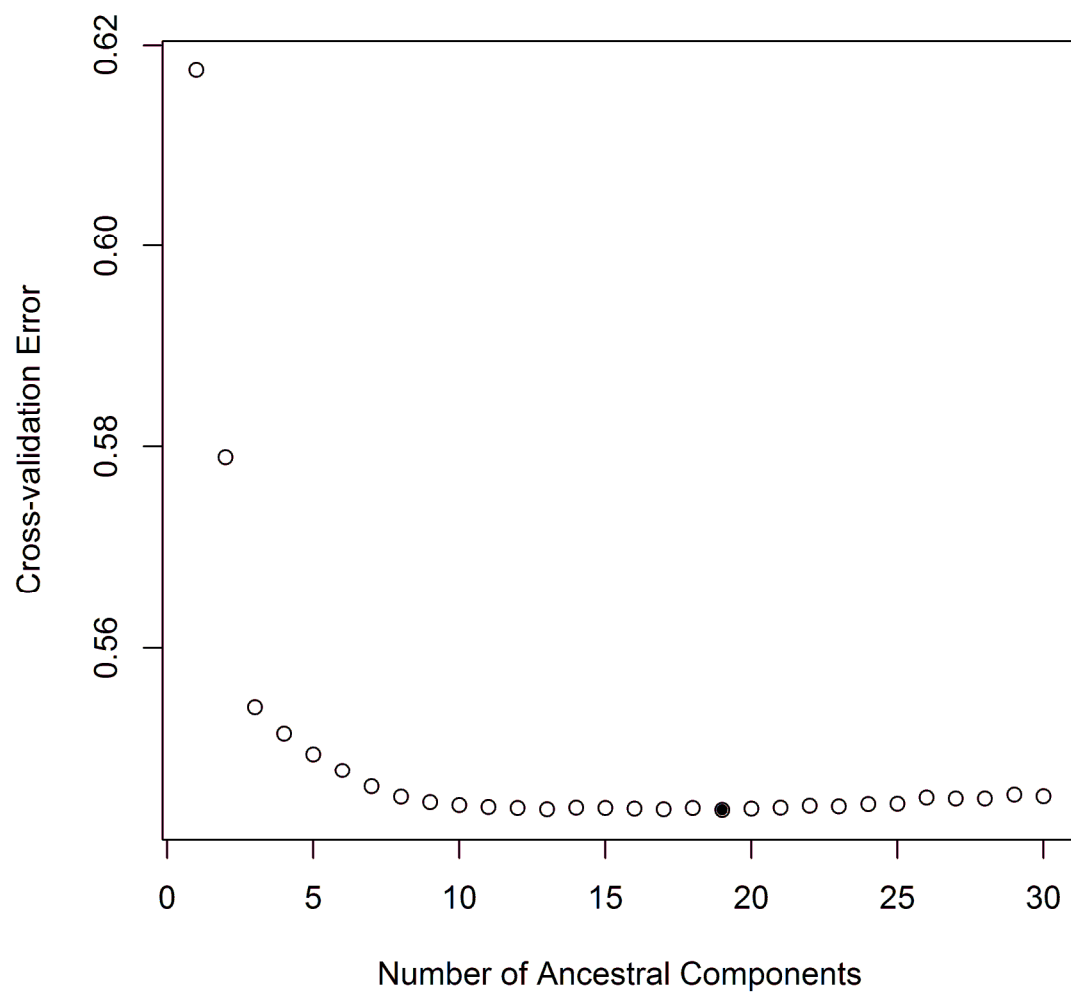


**Genome-wide genotype and sequence-based reconstruction of the 140,000 year history of  
modern human ancestry**

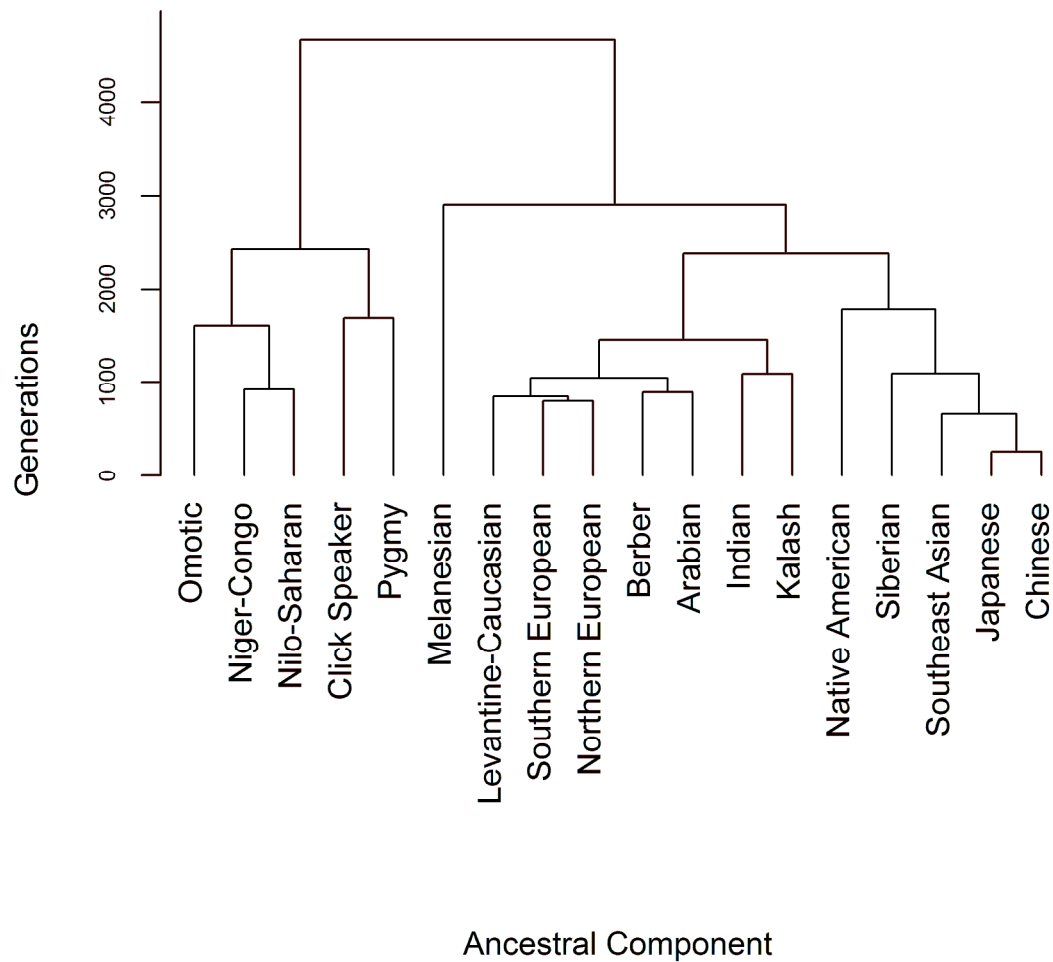
**Daniel Shriner, Fasil Tekola-Ayele, Adebowale Adeyemo, Charles N. Rotimi\***

Supplementary Figures 1–6

Supplementary Tables 1–2

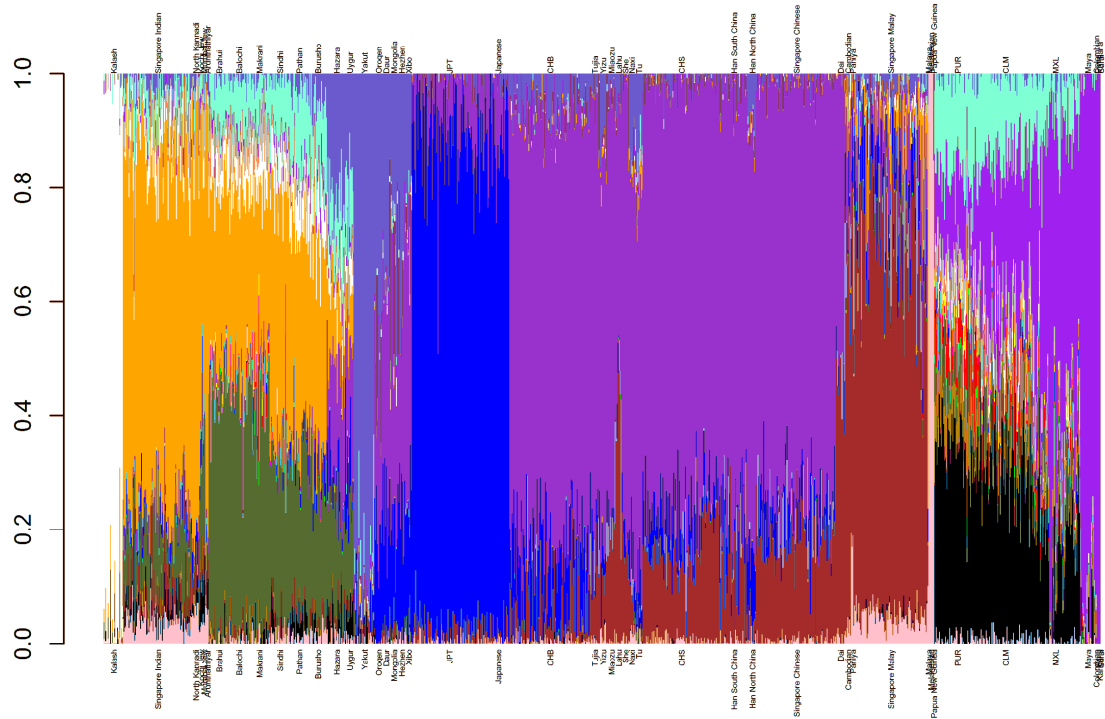


Supplementary Figure 1. Cross-validation error as a function of the number of ancestral components. Cross-validation error reached a minimum at 19 ancestral components, shown as a filled circle.

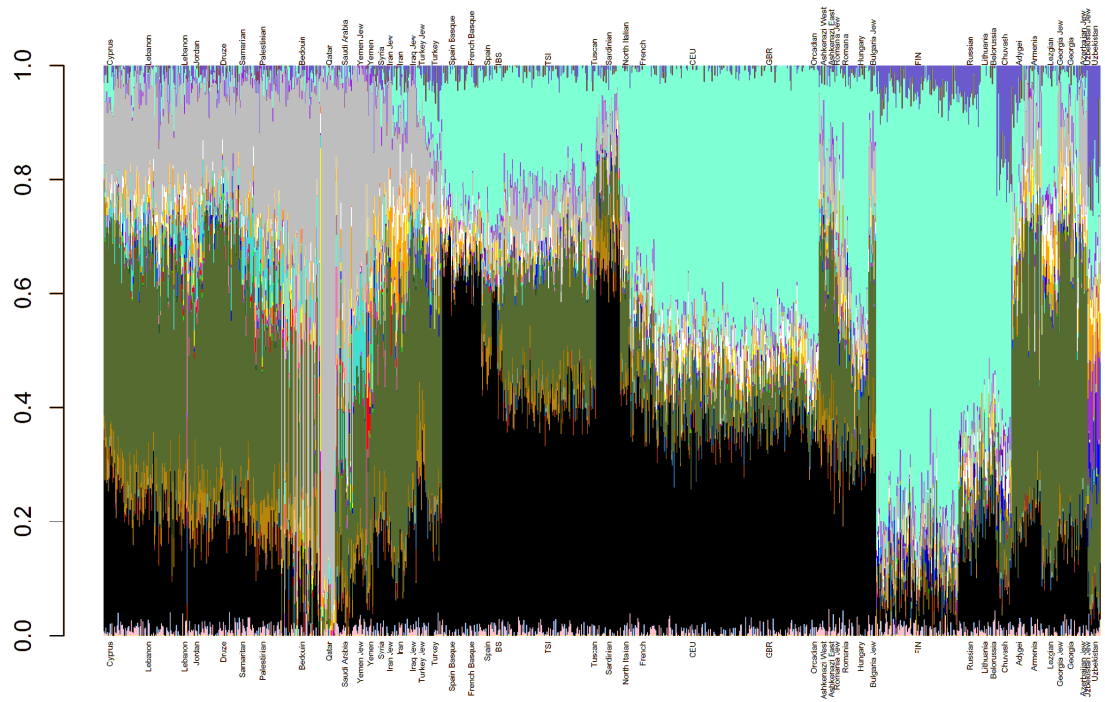


Supplementary Figure 2. Dendrogram of ancestral components by generations since divergence. The plot was drawn using hierarchical cluster analysis with complete linkage. The Lowland East Cushitic ancestral component was omitted, leading to the appearance of one Out-of-Africa migration giving rise to Eurasian peoples.

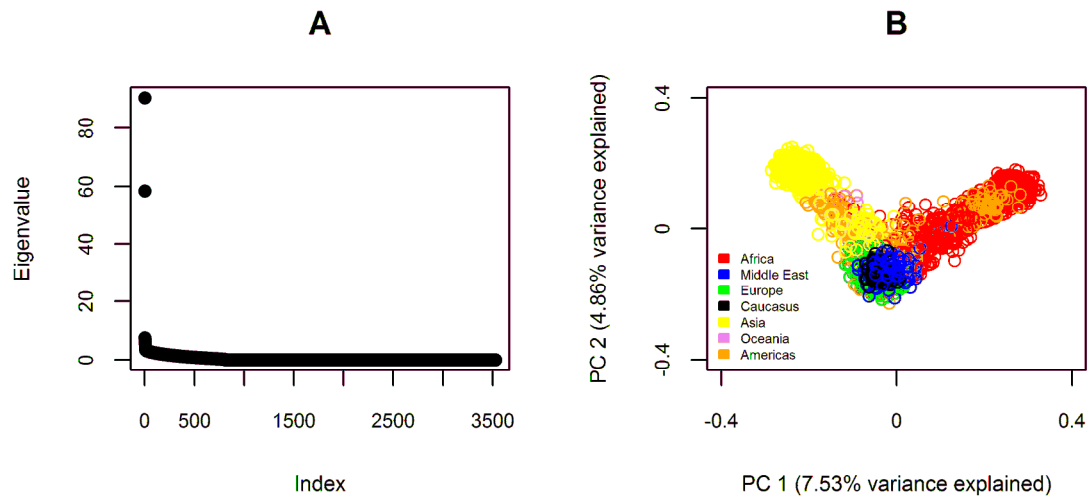




Supplementary Figure 4. Expanded view of the 19 ancestral components for the samples from the Americas, Asia, and Oceania. See the legend for Fig. 2 for the labeling scheme.



Supplementary Figure 5. Expanded view of the 19 ancestral components for the samples from the Caucasus, Europe and the Middle East. See the legend for Fig. 2 for the labeling scheme.



Supplementary Figure 6. Principal components analysis of the global data set. (A) Scree plot of all eigenvalues. (B) Scatter plot of the first two dimensions.

Supplementary Table 1. Average percentages of ancestral components by sample.

Sample	Arabian	Berber	Chinese	Click Speaker	Indian	Japanese	Kalash	Levantine-Caucasian	Lowland East Cushitic	Melanesian	Native American	Niger-Congo	Nilo-Saharan	Northern European	Omoti	Pygmy	Siberian	Southeast Asian	Southern European	Undefined
!Xun	0	0	0	74.7	0	0	0	0	0	0	0	13.7	0	0	0	6.4	0	0	0	5.2
!Xun2	0	0	0	74.8	0	0	0	0	0	0	0	14	0	0	0	7.8	0	0	0	3.4
/Gui and //Gana	0	0	0	72.6	0	0	0	0	0	0	0	23.1	0	0	0	0	0	0	0	4.3
#Khomani	0	0	0	68.1	3.3	0	0	0	0	0	0	7.5	0	4.7	0	0	0	0	3.5	12.9
Adygei	0	0	0	0	0	0	5.8	43.9	0	0	0	0	0	18.7	0	0	5.4	0	15.7	10.5
Afar	10.5	0	0	0	0	0	0	0	43.8	0	0	0	18	0	7.7	0	0	0	0	20.0
Algeria	11.6	38	0	0	0	0	0	5.6	6.7	0	0	8.3	0	0	0	0	0	0	14.4	15.4
amaXhosa	0	0	0	24.2	0	0	0	0	0	0	0	61.3	4.8	0	0	4.4	0	0	0	5.3
Amhara	15.5	0	0	0	0	0	0	0	37.3	0	0	0	14.2	0	14.6	0	0	0	0	18.4
Angolan !Xun	0	0	0	74.2	0	0	0	0	0	0	0	15.3	0	0	0	9.3	0	0	0	1.2
Anuak	0	0	0	0	0	0	0	0	0	0	0	8.8	78.3	0	7.1	0	0	0	0	5.8
AriBlacksmith	0	0	0	0	0	0	0	0	0	0	0	0	0	0	94.9	0	0	0	0	5.1
AriCultivator	0	0	0	0	0	0	0	0	15.8	0	0	0	10.5	0	63.7	0	0	0	0	10.0
Armenia	10.6	0	0	0	0	0	0	44.4	0	0	0	0	0	8.8	0	0	0	0	20.9	15.3
Arunthathiyar	0	0	0	0	75.5	0	0	0	0	6	0	0	0	0	0	0	0	0	0	18.5
AshkenaziE	11.2	6.6	0	0	0	0	0	29.5	0	0	0	0	0	13.8	0	0	0	0	29	9.9
AshkenaziW	9.4	5.8	0	0	0	0	0	26.7	0	0	0	0	0	12.7	0	0	0	0	33	12.4
ASW	0	0	0	0	0	0	0	0	0	0	3	62.1	0	8.4	0	4.5	0	0	6.2	15.8
AzerbaijanJ	17.3	0	0	0	0	0	0	45.3	0	0	0	0	0	0	0	0	0	0	19.7	17.7
Balochi	0	0	0	0	33.1	0	5.6	40.2	0	0	0	1.5	0	9.2	0	0	0	0	0	10.4
Bamoun	0	0	0	0	0	0	0	0	0	0	0	77.6	7	0	0	9.1	0	0	0	6.3
BantuKenya	0	0	0	0	0	0	0	0	0	0	0	55.3	24.4	0	0	8.4	0	0	0	11.9
BantuSouthAfrica	0	0	0	22.1	0	0	0	0	0	0	0	64.5	5.6	0	0	5.4	0	0	0	2.4
Basters	0	0	0	31.4	7.2	0	0	0	0	0	0	0	0	20.5	0	0	0	0	17.5	23.4
Bedouin	50.8	5.1	0	0	0	0	0	16.4	0	0	0	0	3.8	0	0	0	0	0	7.9	16.0
Belorussia	0	0	0	0	0	0	0	7.7	0	0	0	0	0	56.5	0	0	0	0	22.1	13.7
BiakaPygmy	0	0	0	0	0	0	0	0	0	0	0	21.6	0	0	0	77.9	0	0	0	0.5
Brahui	0	0	0	0	31.7	0	5.9	42.1	0	0	0	1.2	0	8.1	0	0	0	0	0	11.0
Brong	0	0	0	0	0	0	0	0	0	0	0	84.9	0	0	0	0	0	0	0	15.1
Bulala	0	0	0	0	0	0	0	0	4.4	0	0	30.7	58.8	0	0	0	0	0	0	6.1
BulgariaJ	12	6.2	0	0	0	0	0	26.7	0	0	0	0	0	11.2	0	0	0	0	31.2	12.7



Burusho	0	0	0	0	36	0	8.7	23.4	0	0	0	0	0	12.6	0	0	5	0	0	14.3
Cambodian	0	0	20.3	0	4.9	0	0	0	0	0	0	0	0	0	0	0	0	60.4	0	14.4
CEU	0	0	0	0	0	0	0	8.3	0	0	0	0	0	45.3	0	0	0	0	35	11.4
CHB	0	0	75.4	0	0	10.9	0	0	0	0	0	0	0	0	0	0	5.6	6.1	0	2.0
CHS	0	0	75.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.8	0	8.0
Chuvash	0	0	0	0	0	0	0	9.1	0	0	0	0	0	47.6	0	0	17.3	0	8.6	17.4
CLM	0	0	0	0	0	0	0	0	0	0	27.8	5	0	14.4	0	0	0	0	30.9	21.9
Colombian	0	0	0	0	0	0	0	0	0	0	95.2	0	0	0	0	0	0	0	0	4.8
ColouredColesberg	0	0	0	38.4	3.9	0	0	0	0	0	0	25.2	0	9.4	0	0	0	0	7.8	15.3
ColouredD6	0	0	0	11.8	16.1	0	0	0	0	4	0	13.8	0	13	0	0	0	11.8	9.8	19.7
ColouredEC	0	0	0	25.5	4.8	0	0	0	0	0	0	18.5	0	15.5	0	0	0	5.3	13.2	17.2
ColouredNC	0	0	0	35.5	7.7	0	0	0	0	0	0	5.5	0	15.7	0	0	0	4	12.6	19.0
ColouredWellington	0	0	0	17.1	15.6	0	0	0	0	3.2	0	15.9	0	11.3	0	0	0	6.4	8.3	22.2
Cyprus	15.3	0	0	0	0	0	0	37.2	0	0	0	0	0	0	0	0	0	0	28.5	19.0
Dai	0	0	50.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47.3	0	2.3
Daur	0	0	38.2	0	0	21	0	0	0	0	0	0	0	0	0	0	36.1	0	0	4.7
Druze	17.8	0	0	0	0	0	0	46.2	0	0	0	0	0	0	0	0	0	0	19.4	16.6
Egypt	22.3	11.2	0	0	0	0	0	21.7	12.3	0	0	4.5	0	0	0	0	0	0	15.6	12.4
Egypt2	24.1	10.7	0	0	0	0	0	22	11.7	0	0	5	0	0	0	0	0	0	12.9	13.6
EthiopiaJ	13.6	0	0	0	0	0	0	0	36.2	0	0	0	18.3	0	12.7	0	0	0	0	19.2
EthiopianAmhara	14.7	6	0	0	0	0	0	0	35.6	0	0	0	14.8	0	12.9	0	0	0	0	16.0
EthiopianOromo	5.1	0	0	0	0	0	0	0	39.6	0	0	0	26.1	0	14	0	0	0	0	15.2
EthiopianSomali	0	0	0	0	0	0	0	0	51.9	0	0	0	22	0	8.2	0	0	0	0	17.9
EthiopianTigray	16.3	0	0	0	0	0	0	6.1	37.4	0	0	0	17.8	0	9	0	0	0	0	13.4
Fang	0	0	0	0	0	0	0	0	0	0	0	72.3	6.6	0	0	13.7	0	0	0	7.4
FIN	0	0	0	0	0	0	0	0	0	0	0	0	0	74.6	0	0	4.2	0	6.1	15.1
French	0	0	0	0	0	0	0	10.1	0	0	0	0	0	37.3	0	0	0	0	39.3	13.3
French_Basque	0	0	0	0	0	0	0	0	0	0	0	0	0	24.1	0	0	0	0	63.2	12.7
GBR	0	0	0	0	0	0	0	6.7	0	0	0	0	0	45.9	0	0	0	0	36	11.4
Georgia	7.5	0	0	0	0	0	6.6	50	0	0	0	0	0	11.3	0	0	0	0	16.3	8.3
GeorgiaJ	18.8	0	0	0	4.3	0	0	40.6	0	0	0	0	0	0	0	0	0	0	18.4	17.9
Gumuz	0	0	0	0	0	0	0	0	0	0	0	0	62.6	0	33.7	0	0	0	0	3.7
HanNChina	0	0	72.5	0	0	11.3	0	0	0	0	0	0	0	0	0	0	9	0	0	7.2
HanSChina	0	0	74.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15.7	0	9.5



MiaoZu	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18.9	0	6.1
MKK	0	0	0	3.7	0	0	0	0	23.4	0	0	12.7	43.1	0	0	0	0	0	0	17.1
Mongolia	0	0	44	0	0	16.5	0	0	0	0	0	0	0	0	0	0	30	0	0	9.5
Morocco	9.8	46.2	0	0	0	0	0	0	6.5	0	0	11.9	0	0	0	0	0	0	10.5	15.1
Morocco_N	9.7	46	0	0	0	0	0	0	5.7	0	0	4.6	0	0	0	0	0	0	14.9	19.1
Morocco_S	0	43.9	0	0	0	0	0	0	6.3	0	0	21.3	0	0	0	0	0	0	8.2	20.3
MoroccoJ	13.6	12.1	0	0	0	0	0	25.2	0	0	0	0	0	7.7	0	0	0	0	29.2	12.2
Mozabite	0	61.1	0	0	0	0	0	0	0	0	0	7.6	0	0	0	0	0	0	0	31.3
MumbaiJ	7.1	0	0	0	40.5	0	0	24.5	0	3.8	0	0	0	0	0	0	0	0	7.9	16.2
MXL	0	0	0	0	0	0	0	5	0	0	51.6	0	0	9.7	0	0	0	0	18.4	15.3
Nama	0	0	0	61.9	0	0	0	0	5.1	0	0	15	0	4	0	0	0	0	0	14.0
Naxi	0	0	67.3	0	0	0	0	0	0	0	0	0	0	0	0	0	13.7	7.5	0	11.5
NorthItalian	6.9	0	0	0	0	0	0	17.2	0	0	0	0	0	23.5	0	0	0	0	42.7	9.7
NorthKannadi	0	0	0	0	74.2	0	0	0	0	6	0	0	0	0	0	0	0	0	0	19.8
Orcadian	0	0	0	0	0	0	4.5	0	0	0	0	0	0	49.1	0	0	0	0	33.1	13.3
Oromo	10.3	0	0	0	0	0	0	0	35	0	0	0	17.7	0	19.7	0	0	0	0	17.3
Oroqen	0	0	29.7	0	0	18.3	0	0	0	0	0	0	0	0	0	0	49.2	0	0	2.8
Palestinian	23.7	5.8	0	0	0	0	0	32.8	7.6	0	0	0	0	0	0	0	0	0	15.8	14.3
Paniya	0	0	0	0	4.8	9.6	0	0	0	18.3	0	0	0	0	0	0	0	55.2	0	12.1
Papuan	0	0	0	0	0	0	0	0	0	92.4	0	0	0	0	0	0	0	7.6	0	0.0
Pathan	0	0	0	0	36.6	0	6.7	28.3	0	0	0	0	0	14	0	0	0	0	0	14.4
Pima	0	0	0	0	0	0	0	0	0	0	98	0	0	0	0	0	0	0	0	2.0
PUR	0	6.3	0	0	0	0	0	0	0	0	14.7	7.9	0	16.8	0	0	0	0	33.2	21.1
Qatari	91.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.5
Romania	5.9	0	0	0	4.1	0	0	21.2	0	0	0	0	0	29.3	0	0	0	0	28.6	10.9
RomaniaJ	10.5	0	0	0	0	0	0	26.1	0	0	0	0	0	15.1	0	0	0	0	32.6	15.7
Russian	0	0	0	0	0	0	0	7	0	0	0	0	0	58.4	0	0	6.1	0	14.9	13.6
Sahrawi	12.2	53.5	0	0	0	0	0	0	8.6	0	0	9.1	0	0	0	0	0	0	0	16.6
Samaritan	23.2	0	0	0	0	0	0	36.7	6.5	0	0	0	0	0	0	0	0	0	23.4	10.2
San	0	0	0	94.8	0	0	0	0	0	0	0	0	0	0	0	5.2	0	0	0	0.0
Sardinian	8.2	6.1	0	0	0	0	0	8.6	0	0	0	0	0	7.8	0	0	0	0	64.1	5.2
SaudiArabia	49	0	0	0	0	0	0	21.9	0	0	0	0	0	0	0	0	0	0	5.4	23.7
SEBantu	0	0	0	24.2	0	0	0	0	0	0	0	62.3	4.7	0	0	4.6	0	0	0	4.2
She	0	0	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.1	0	4.9



Supplementary Table 2. Pairwise  $F_{ST}$  between ancestral components.

$F_{ST}$	Arabian	Berber	Chinese	Click Speaker	Indian	Japanese	Kalash	Levantine-Caucasian	Lowland East Cushitic	Melanesian	Native American	Niger-Congo	Nilo-Saharan	Northern European	Omoti	Pygmy	Siberian	Southeast Asian	Southern European
Arabian	0	0.058	0.135	0.205	0.086	0.133	0.088	0.057	0.078	0.184	0.157	0.158	0.153	0.068	0.134	0.187	0.134	0.138	0.056
Berber	0.058	0	0.134	0.187	0.091	0.132	0.094	0.06	0.07	0.18	0.157	0.131	0.129	0.067	0.116	0.166	0.134	0.136	0.054
Chinese	0.135	0.134	0	0.225	0.096	0.018	0.123	0.129	0.146	0.148	0.107	0.179	0.175	0.124	0.164	0.206	0.051	0.039	0.138
Click Speaker	0.205	0.187	0.225	0	0.196	0.224	0.215	0.204	0.161	0.263	0.254	0.101	0.112	0.21	0.117	0.082	0.229	0.225	0.214
Indian	0.086	0.091	0.096	0.196	0	0.093	0.071	0.075	0.105	0.152	0.126	0.148	0.144	0.076	0.132	0.177	0.1	0.096	0.088
Japanese	0.133	0.132	0.018	0.224	0.093	0	0.121	0.127	0.144	0.149	0.103	0.177	0.173	0.121	0.162	0.204	0.046	0.046	0.136
Kalash	0.088	0.094	0.123	0.215	0.071	0.121	0	0.07	0.115	0.176	0.143	0.168	0.164	0.074	0.149	0.196	0.121	0.126	0.086
Levantine-Caucasian	0.057	0.06	0.129	0.204	0.075	0.127	0.07	0	0.086	0.177	0.148	0.157	0.152	0.052	0.134	0.186	0.127	0.131	0.055
Lowland East Cushitic	0.078	0.07	0.146	0.161	0.105	0.144	0.115	0.086	0	0.191	0.172	0.105	0.1	0.101	0.095	0.14	0.147	0.146	0.091
Melanesian	0.184	0.18	0.148	0.263	0.152	0.149	0.176	0.177	0.191	0	0.196	0.219	0.216	0.176	0.207	0.244	0.163	0.153	0.187
Native American	0.157	0.157	0.107	0.254	0.126	0.103	0.143	0.148	0.172	0.196	0	0.207	0.204	0.133	0.193	0.234	0.108	0.122	0.157
Niger-Congo	0.158	0.131	0.179	0.101	0.148	0.177	0.168	0.157	0.105	0.219	0.207	0	0.045	0.163	0.078	0.071	0.183	0.178	0.168
Nilo-Saharan	0.153	0.129	0.175	0.112	0.144	0.173	0.164	0.152	0.1	0.216	0.204	0.045	0	0.159	0.07	0.084	0.179	0.174	0.163
Northern European	0.068	0.067	0.124	0.21	0.076	0.121	0.074	0.052	0.101	0.176	0.133	0.163	0.159	0	0.142	0.191	0.117	0.127	0.052
Omoti	0.134	0.116	0.164	0.117	0.132	0.162	0.149	0.134	0.095	0.207	0.193	0.078	0.07	0.142	0	0.099	0.168	0.164	0.144
Pygmy	0.187	0.166	0.206	0.082	0.177	0.204	0.196	0.186	0.14	0.244	0.234	0.071	0.084	0.191	0.099	0	0.21	0.206	0.196
Siberian	0.134	0.134	0.051	0.229	0.1	0.046	0.121	0.127	0.147	0.163	0.108	0.183	0.179	0.117	0.168	0.21	0	0.076	0.135
Southeast Asian	0.138	0.136	0.039	0.225	0.096	0.046	0.126	0.131	0.146	0.153	0.122	0.178	0.174	0.127	0.164	0.206	0.076	0	0.14
Southern European	0.056	0.054	0.138	0.214	0.088	0.136	0.086	0.055	0.091	0.187	0.157	0.168	0.163	0.052	0.144	0.196	0.135	0.14	0