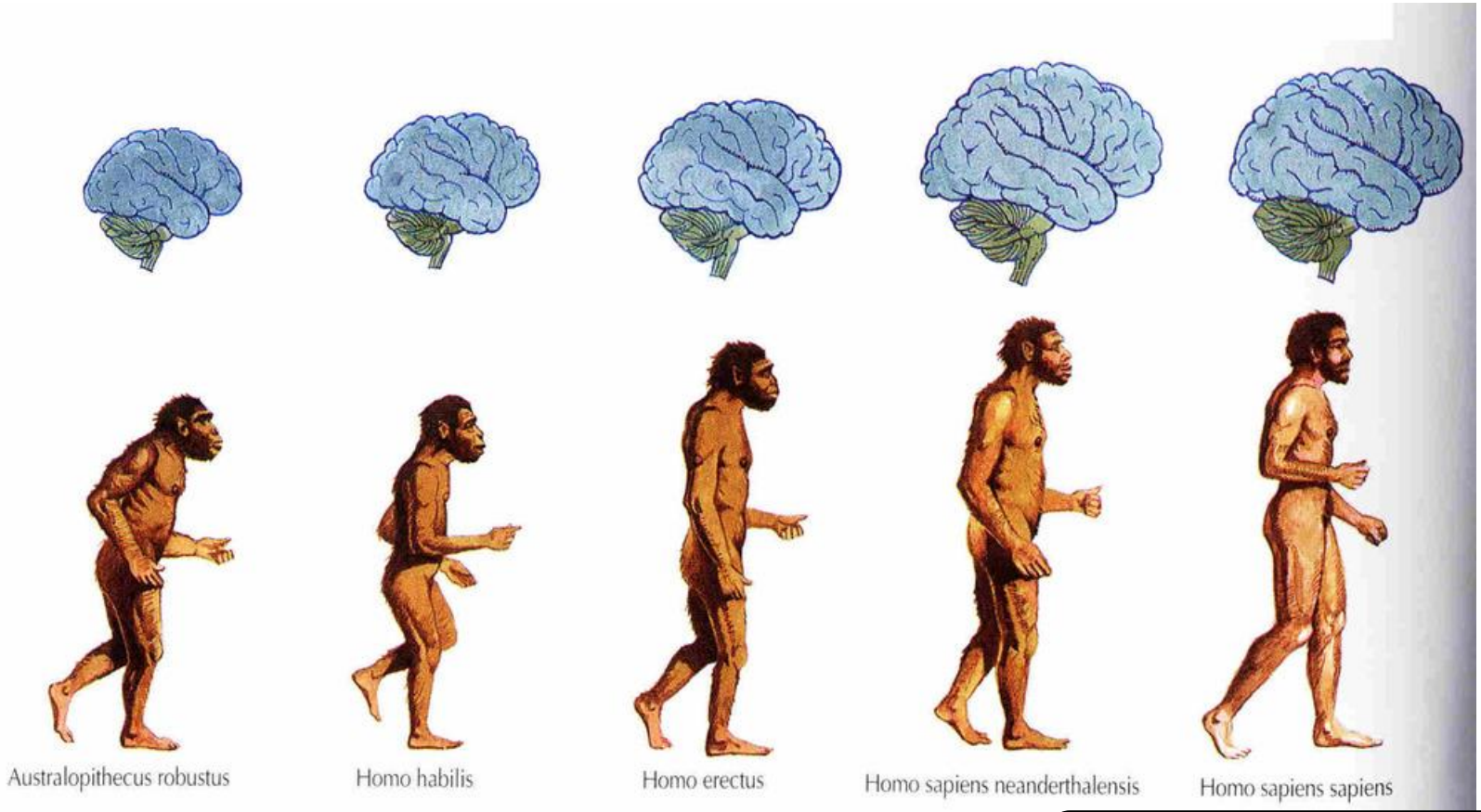
Southern African ancient genomes estimate modern human divergence to 350,000 to 260,000 years ago

Carina M. Schlebusch et al.

楊茂榮
陳柏佑



When does anatomically modern humans appears?

anatomically（解剖學上的）
modern humans

When does Anatomically modern humans appears?

In archeology,
we find some early fully modern human remains and determinate the age of the remain by Half-life determination.
(半衰期測定)

In genetics,
we try to calculate the distance between modern humans and estimate the deepest split time (which means their common ancestor) by mutation rate.

The earliest modern human remain – Omo remains

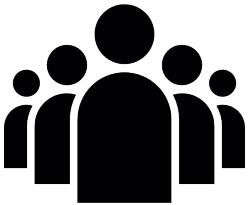
The Oldest Fossil (化石) Remains of Anatomically Modern Humans.

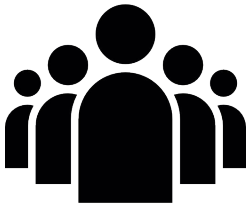
It is estimated to be there about 195,000 years ago. Was discovered between 1967 and 1974 at the Omo Kibish sites near the Omo River, Ethiopia.

Estimation by Genetics

Intuition of Estimation by Genetics

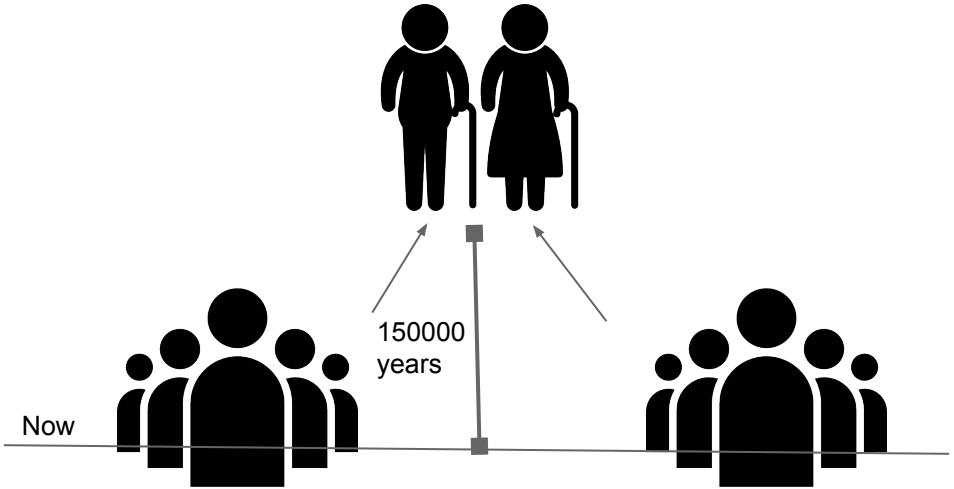
1. Find 2 groups of modern humans, both of them have obvious modern human features.





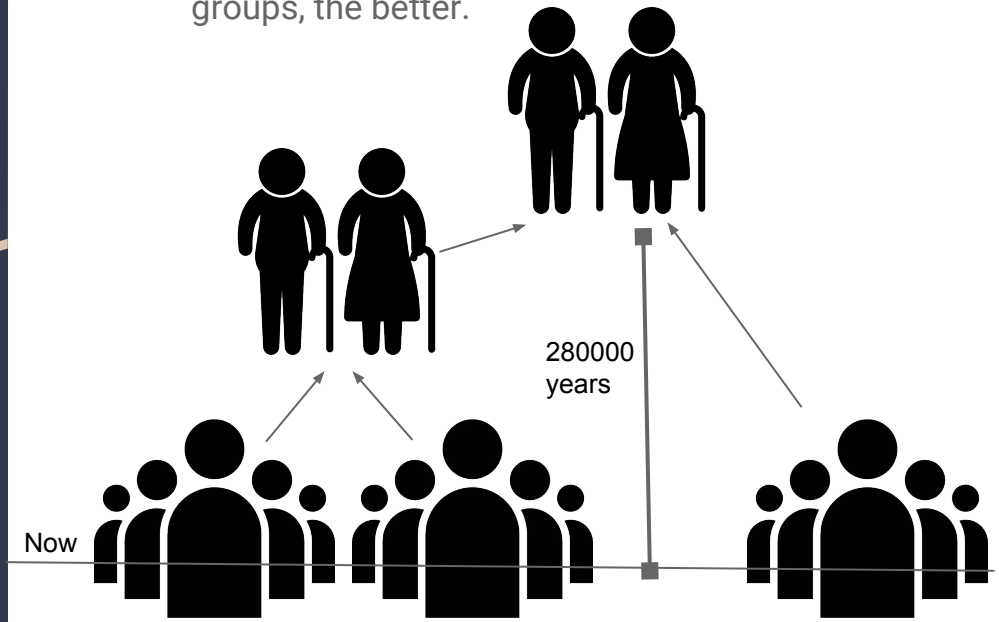
Intuition of Estimation by Genetics

1. Find 2 groups of modern humans, both of them have obvious modern human features.
2. Estimate the age of their common ancestor, the ancestor must have modern human features already.



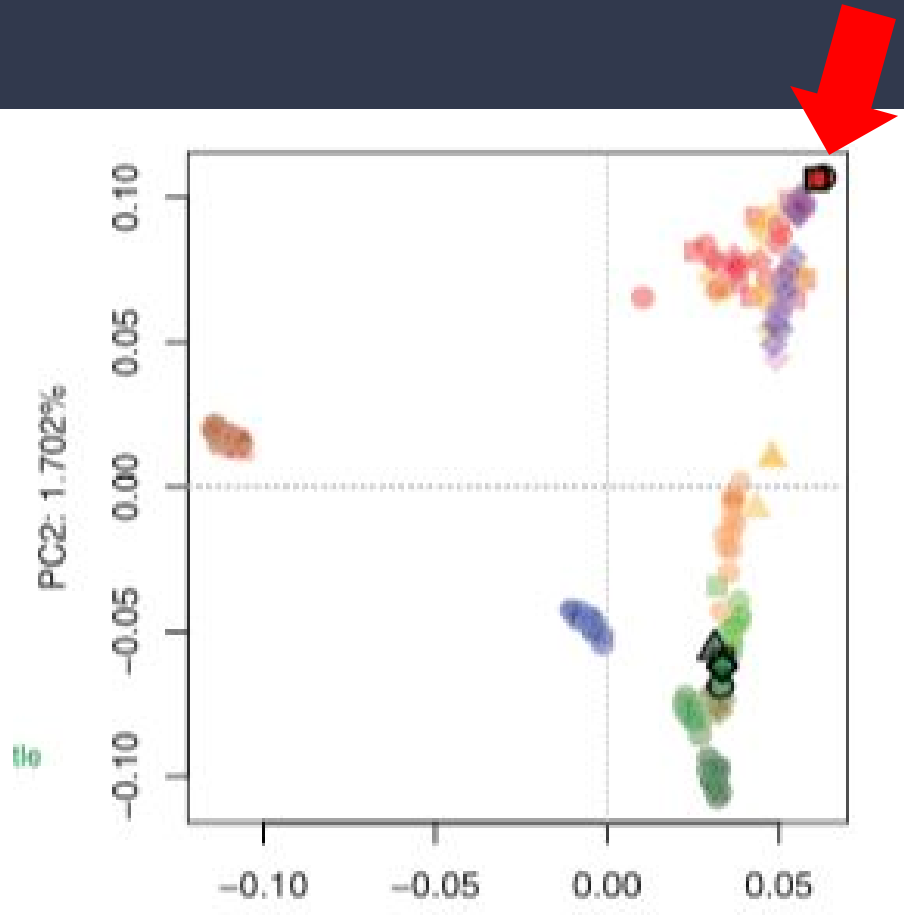
Intuition of Estimation by Genetics

1. Find 2 groups of modern humans, both of them have obvious modern human features.
2. Estimate the age of their common ancestor, the ancestor must have modern human features already.
3. The farther distance between two picked groups, the better.



Khoe-San

Genetic studies identified modern southern African Khoe-San populations as carrying more unique variants and more divergent lineages than other living groups.



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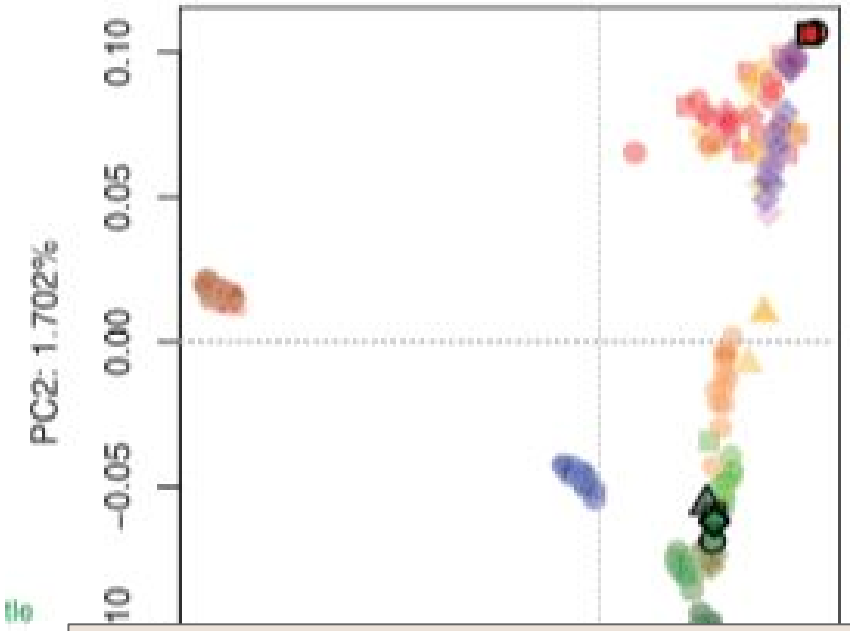


PCA of ancient southern Africans and a global comparative data set.

Modern Bantu-language-speaking group

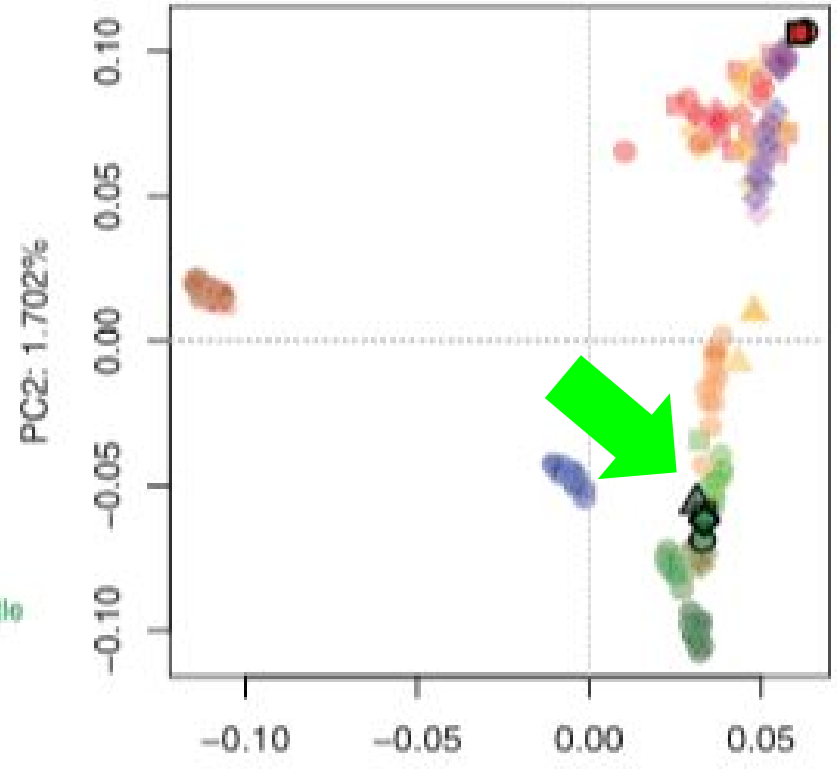
They origin from Nigeria and Cameroon, and start to migrate at around 3000 years ago.

They reach South Africa at around 1700 years ago.

Modern Bantu-language-speaking group

Nowadays, They distributed across Central Africa and South Africa.

Their gene is very different from Khoe-Sans.

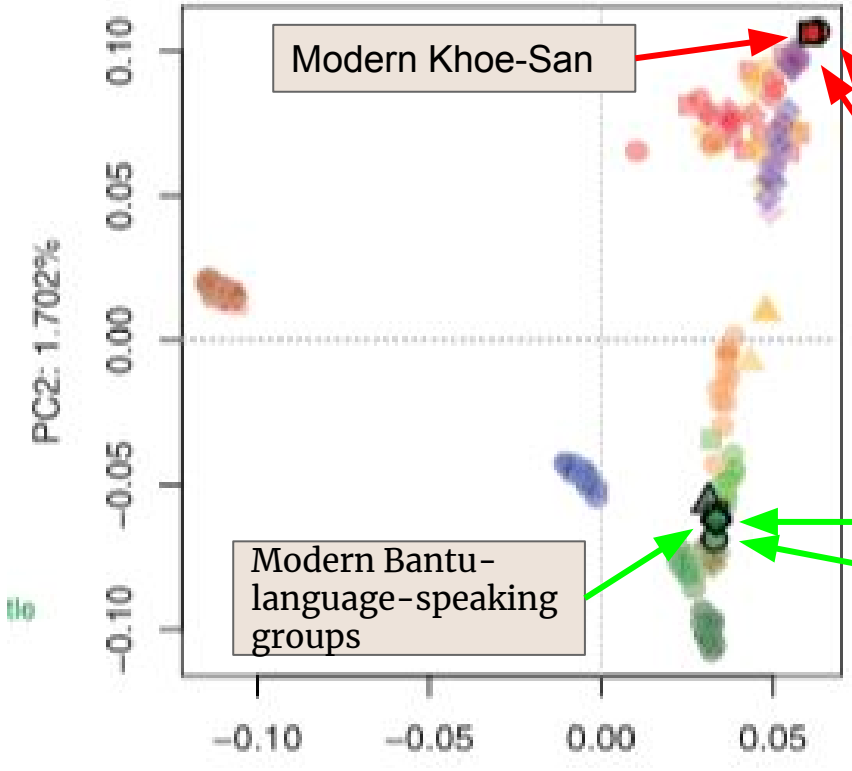


Middle Stone Age sites in KwaZulu-Natal, South Africa

The author studied:
3 stone age hunters / gatherers, about 2000 years old.
4 iron age farmers, about 300~500 years old.

Sample	Calibrated date B.P. (2 SD)
Ballito Bay A	1986–1831*
Ballito Bay B	2149–1932
Doonside	2296–1910*
Champagne Castle	448–282
Eland Cave	533–453
Mfongosi	448–308
Newcastle	508–327

Middle Stone Age sites in KwaZulu-Natal, South Africa



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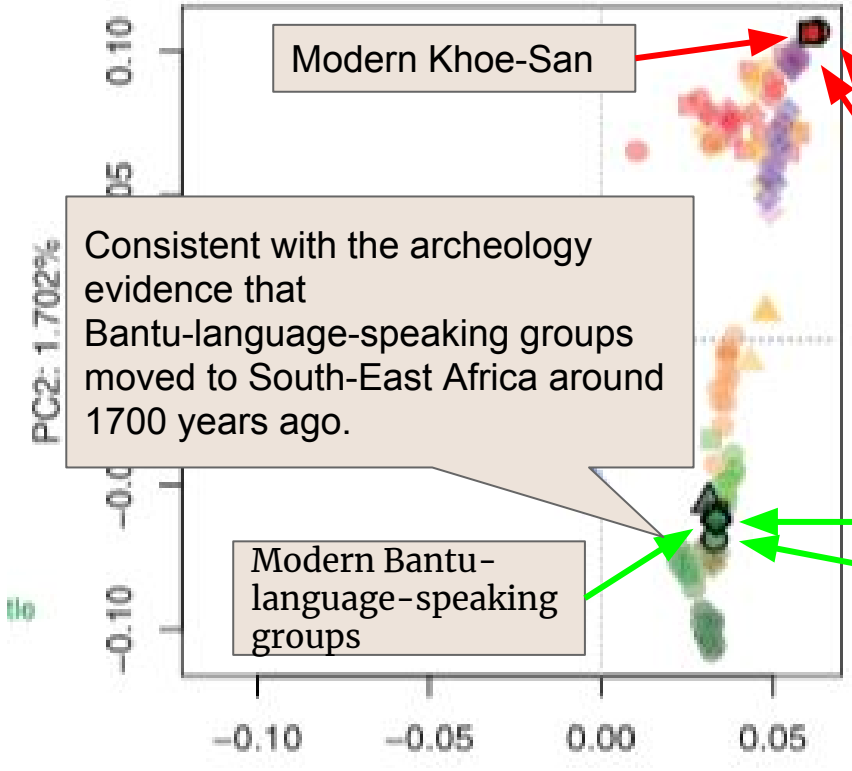

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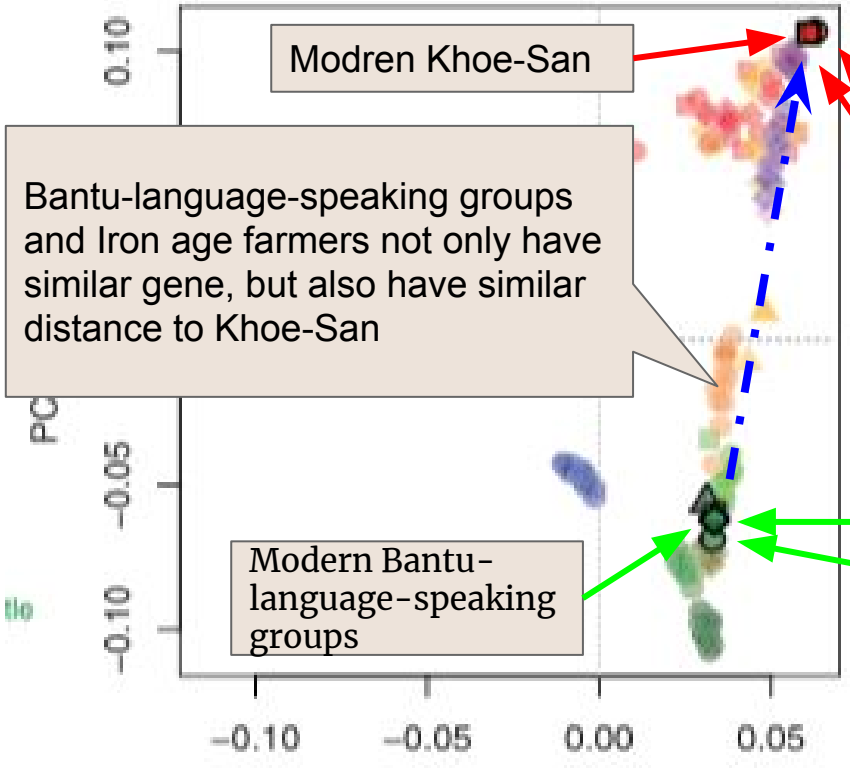

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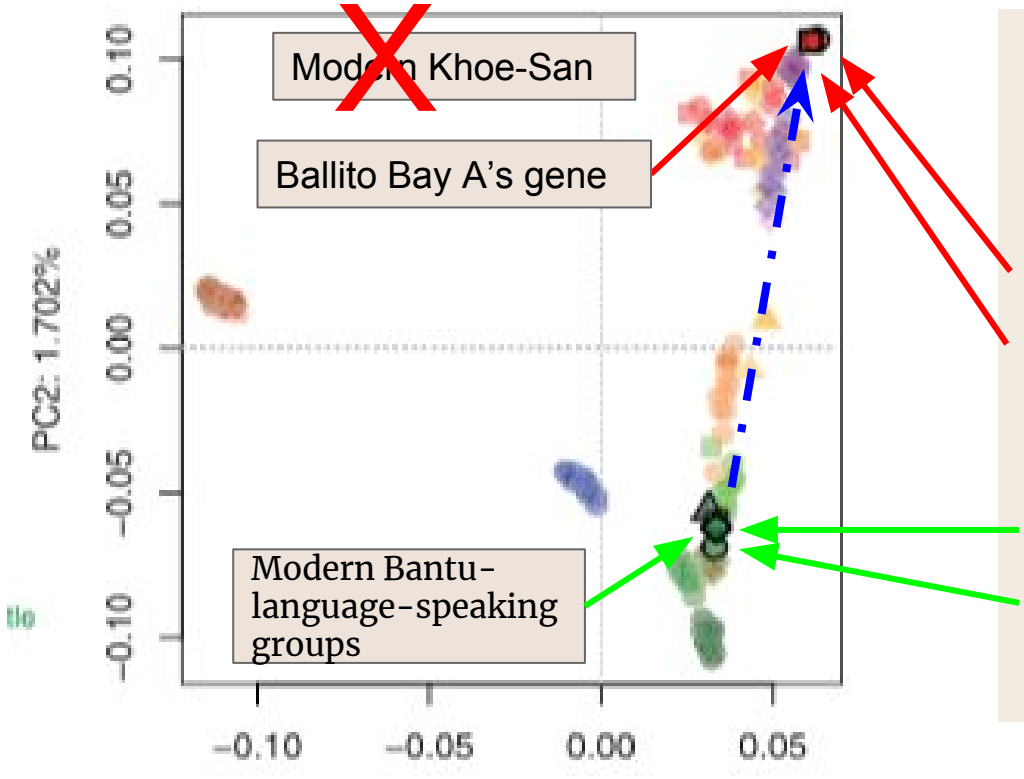
Admixture of Modern Khoe-San

Also by Genetics,
Modern Khoe-San are now know to be mixed with Ju|'hoansi / Nama at around 1500 / 1300 years ago. These people are hordes (遊牧民族) distributed in South Africa. wiki: Ju|'hoan dialect

The admixture would disarrange the estimation of common ancestors.

Middle Stone Age sites in KwaZulu-Natal, South Africa



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High-quality Genome Sequencing

1. Using B. Bay A Boy & Bantu.
2. Assuming 1.25 * 10^-8 mutations per generation.

-> The deepest split time: 285~356ka.

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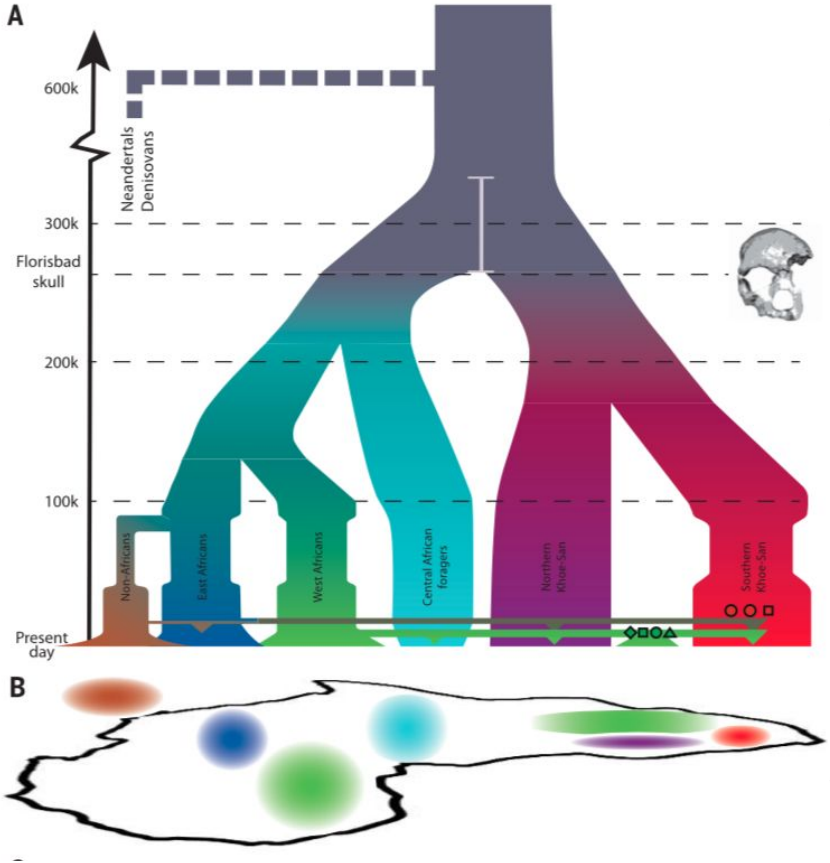
Two plus Two(TT) method



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Split method	Human-Neandertal (Nean-BBayA)	Human-Neandertal (Nean-San)	Human-Neandertal (Nean-Dinka)	Deep Human (Dinka-BBayA)	Deep Human (Dinka-San)	Deep Human (Mandenka-BBayA)	Deep Human (Mandenka-San)	NKSP-SKSP (San-BBayA)	Out of AFR (Dinka-Sardinian)
G-PhoCS	545 ± 9	534 ± 8	535 ± 9	336 ± 7	282 ± 7	356 ± 7	298 ± 7	185 ± 6	115 ± 6
TT-method	660 ± 33	639 ± 26	632 ± 28	265 ± 5	255 ± 5	256 ± 6	261 ± 5	156 ± 5	76 ± 6

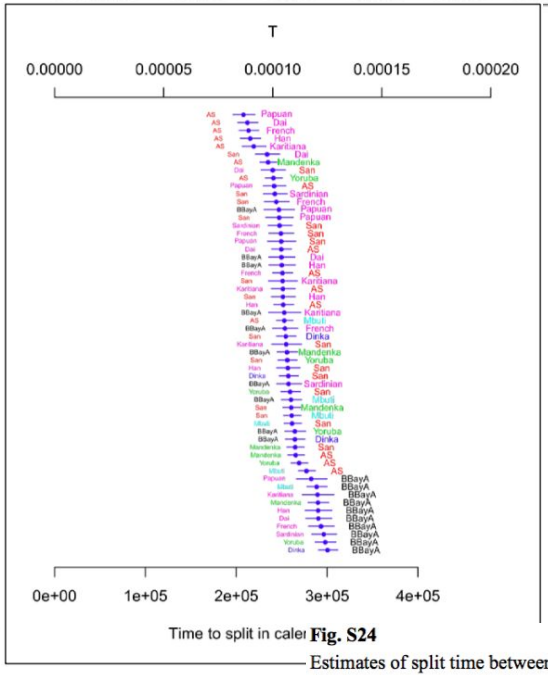

Fig. S24

Estimates of split time between pairs of individuals using the TT method. The populations displayed on top and in larger font are focal populations while the populations below in smaller font are the contrasting populations. We assume a mutation rate of 1.25×10^{-8} per site and generation, and a generation time of 30 years to translate the estimated parameter T to time in calendar years. In the figure, 'BBayA' refers to Ballito Bay A and 'AS' to the modeled admixed modern-day San.

Brief Summary (So far)

1. B. Bay A v.s. Dinka demonstrating the deepest split at >260 ka.
2. Ju|'hoansi v.s. Dinka 258~255 ka.

-> deepest split among modern humans occurred at between 350 and 260 ka
Consistent; with the opening of Middle Stone Age

Conclusion

Archaeological, fossil, and genetic records increasingly point toward a modern human development that includes southern Africa.