The Neolithic

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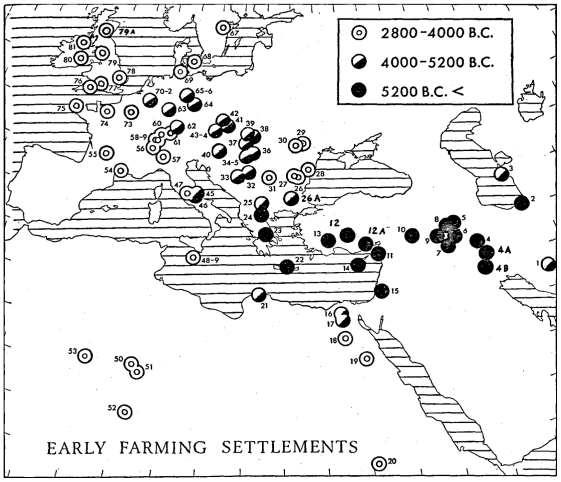
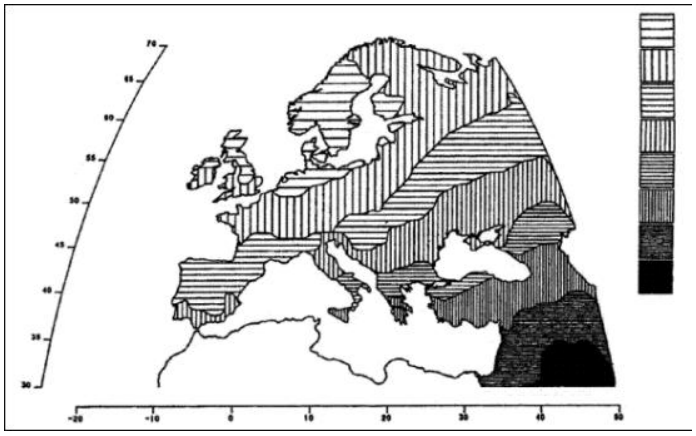
Spread of farming across Europe



(Grahame Clark, 1965, *Proc. Prehist. Soc.*)

Major axis of genetic variation in Europe



95 genes (Cavalli-Sforza, 1994, p. 292)

Movement of people or of technology?

Local hunter-gatherers contributed less than 30% in the original settlements. This finding leads us to reject a predominantly cultural transmission of agriculture.

(Lounès Chikhi et al. 2002)

Both mitochondrial DNA and Y chromosome analyses have indicated a contribution of Neolithic Near Eastern lineages to the gene pool of modern Europeans of around a quarter or less. This suggests that dispersals bringing the Neolithic to Europe may have been demographically minor.

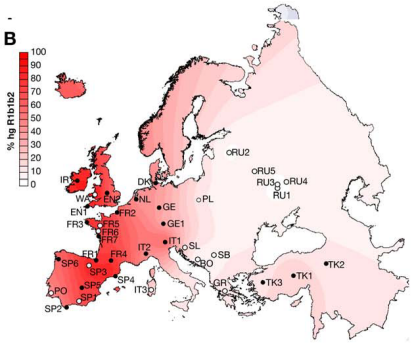
(Martin Richards 2003)

Argument for cultural diffusion

We have already seen that it took thousands of years for farming to reach northern and western Europe.

In addition, many genetic loci exhibit a cline in allele frequency from SE Europe to NW Europe. For example, the Y haplogroup R1b1b2 . . .

Y haplogroup R1b1b2 most common in Ireland: Mesolithic origin?



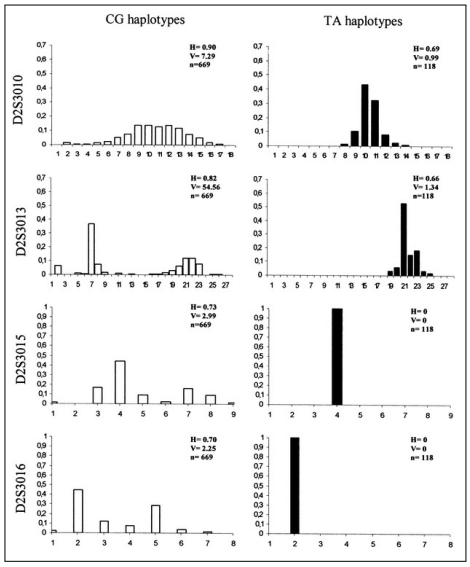
Haplogroup frequency is high in W Europe.

If this was a Mesolithic haplogroup, then very little Middle Eastern DNA reached W Europe.

But is this haplogroup really Mesolithic? To find out, Barlaresque et al (2000) measured the age of this haplotype in different parts of Europe.

Variance at microsatellite loci increases with age

- Microsatellite: a short DNA sequence repeated several times, adjacent on chromosome
  Example:
  ATTC ATTC ATTC ATTC (4 copies)
  ATTC ATTC ATTC ATTC ATTC ATTC (6 copies)
- High mutation rate.
- Variance among chromosomes increases with time.

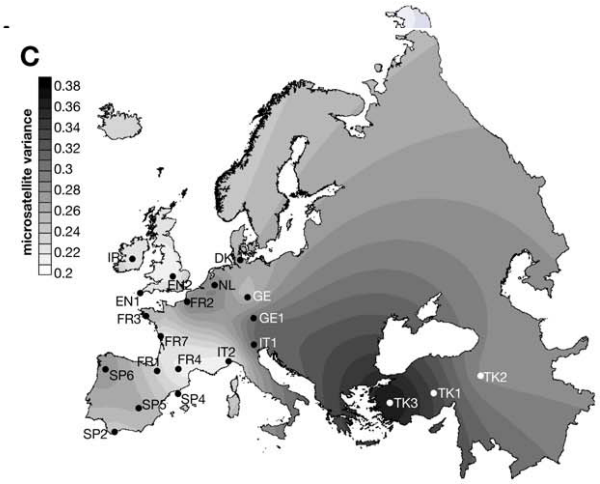


Microsatellite variation measures age

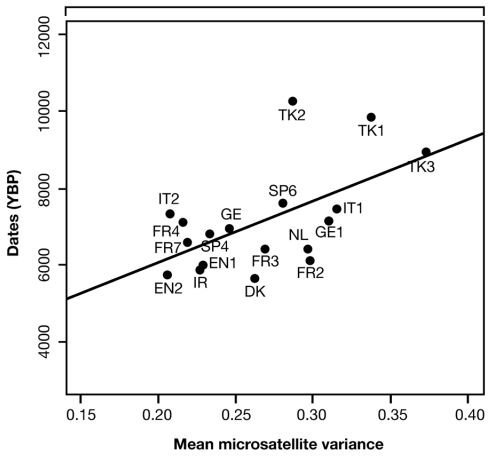
- Rows are different microsatellites
- CG haplotype is old
- TA haplotype is younger: about 10,000 years

(Coelho et al 2005)

On Y haplogroup R1b1b2, microsatellite variation is greatest in Turkey



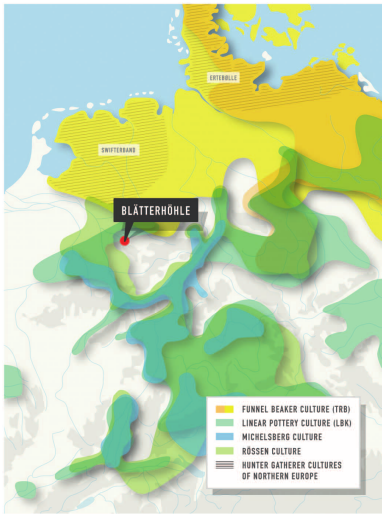
Microsatellite variance vs. earliest Neolithic dates



The R1b1b2 haplogroup is old where the Neolithic arrived early but young where it arrived late.

This suggests that R1b1b2 is a Neolithic marker and was not inherited from the earlier Mesolithic inhabitants of Europe.

The Blätterhöhle site in Germany



Proved beyond doubt that the Neolithic was a movement of people.

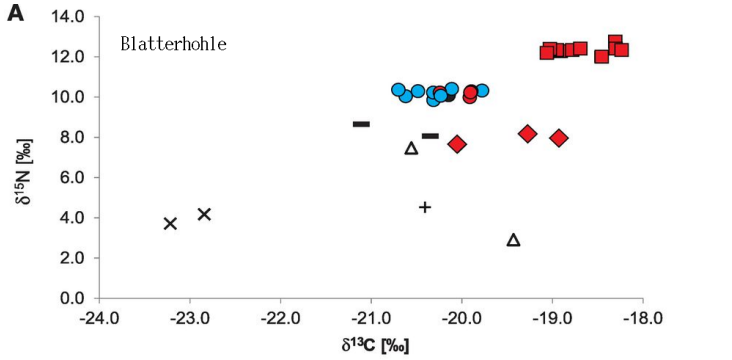
Skeletal remains from Mesolithic and Neolithic occupations.

mitochondrial DNA

isotopic data (tells about diet)

Bolingino et al (2013)

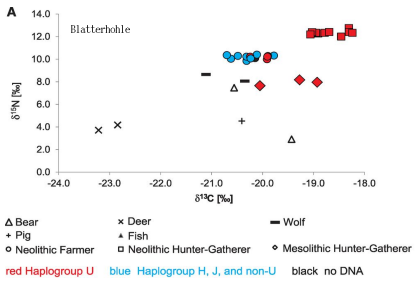
Isotopes (axes) and mtDNA (colors)



Δ Bear × Deer ▬ Wolf
\+ Pig ▲ Fish
○ Neolithic Farmer □ Neolithic Hunter-Gatherer ◇ Mesolithic Hunter-Gatherer

red Haplogroup U blue Haplogroup H, J, and non-U black no DNA

(Bollongino et al, Oct 2013)



Red diamonds: Mesolithic foragers

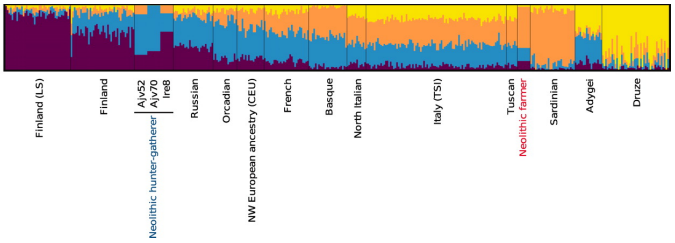
Red squares: Neolithic (aged) fishers with Mesolithic DNA.

Blue and red circles: Neolithic farmers w/ Middle-Eastern DNA.

Foragers and farmers lived side by side, with some gene flow from forager to farmer.

Structure plots

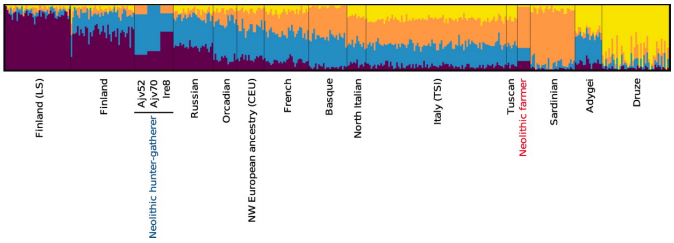
Model each genome as a mixture of K components, where K is chosen by the user. Here, $K = 4$.



(Skoglund et al, 2012)

Each column is a genome. Colors represent components.

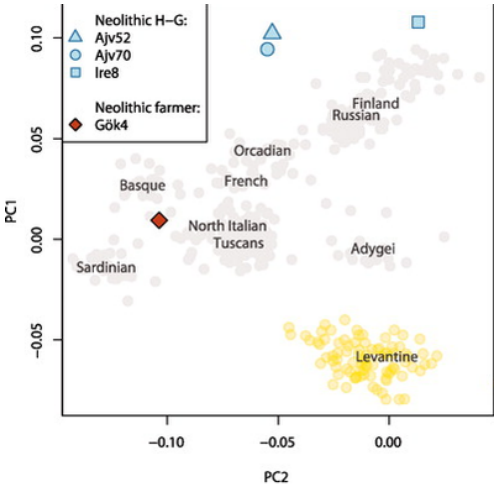
Nuclear genes of Neolithic farmers and foragers



(Skoglund et al, 2012)

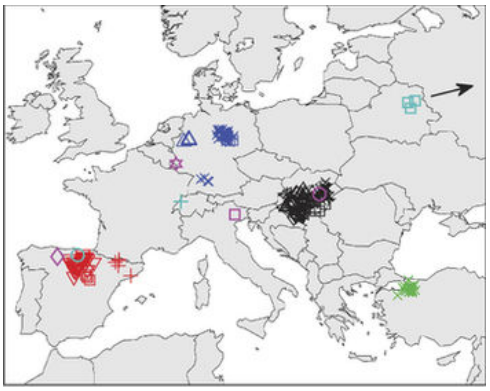
During Neolithic, farmer DNA like modern Sardinians. Forager DNA like modern Finns.

Neolithic farmers and foragers had different DNA



(Skoglund et al, 2012)

Large survey of Neolithic DNA

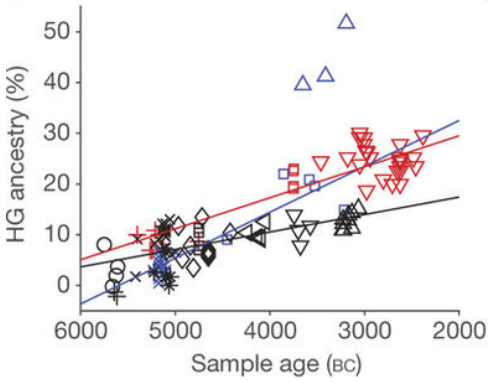


180 genomes from European Neolithic and Chalcolithic

From Hungary, Spain, Germany.

Lipson et al. (2017)

Mesolithic ancestry increases with time

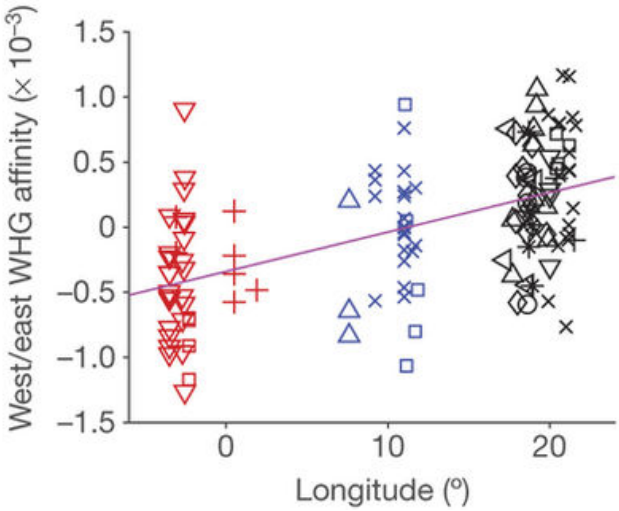


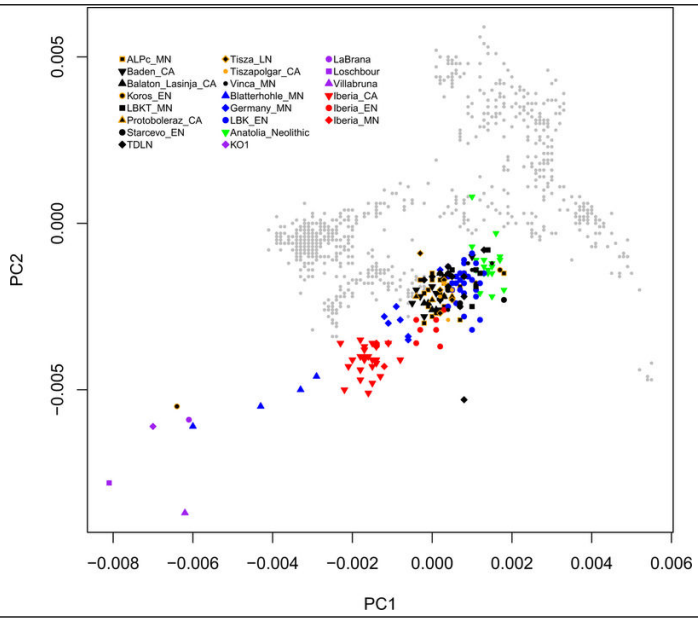
Farmers and foragers co-existed and interbred over millennia.

△ admixture greatest in Germany

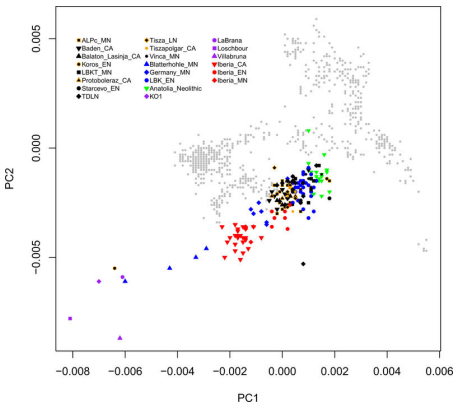
Lipson et al. (2017)

Eastern farmers interbred with eastern foragers





Principal components plot again



Modern Europeans

Anatolian Neolithic

Western hunter-gatherers

Germany

Spain and Portugal

Neolithic populations varied in level of Mesolithic admixture.

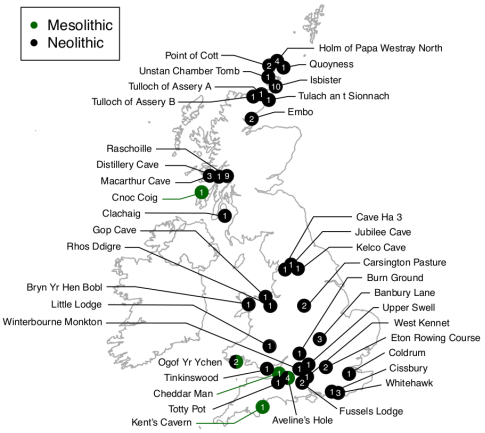
Neolithic Britain

Neolithic arrives in NW Europe ∼7000 years ago.

Doesn't make it to Britain for another 1000 years.

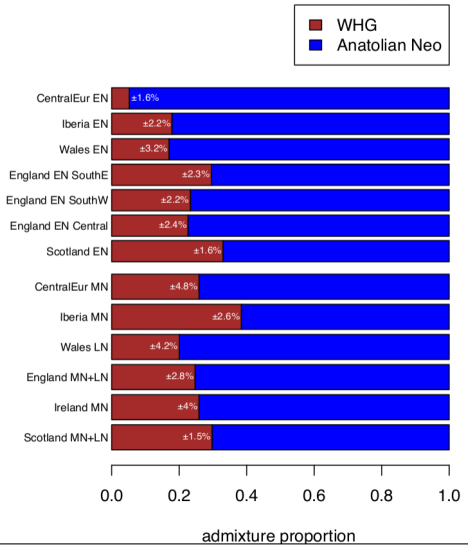
What happened then? A story unlike that of early Neolithic Europe.

Study of Brace et al (2018)



Genome-wide data from 6 Mesolithic and 67 Neolithic Brits, dating from 10.5–4.5 kya.

Mesolithic admixture in Neolithic Britain



WHG fraction doesn't increase with time.

Neolithic Brits didn't interbreed with foragers.