Ancient invaders transformed Britain, but not its DNA

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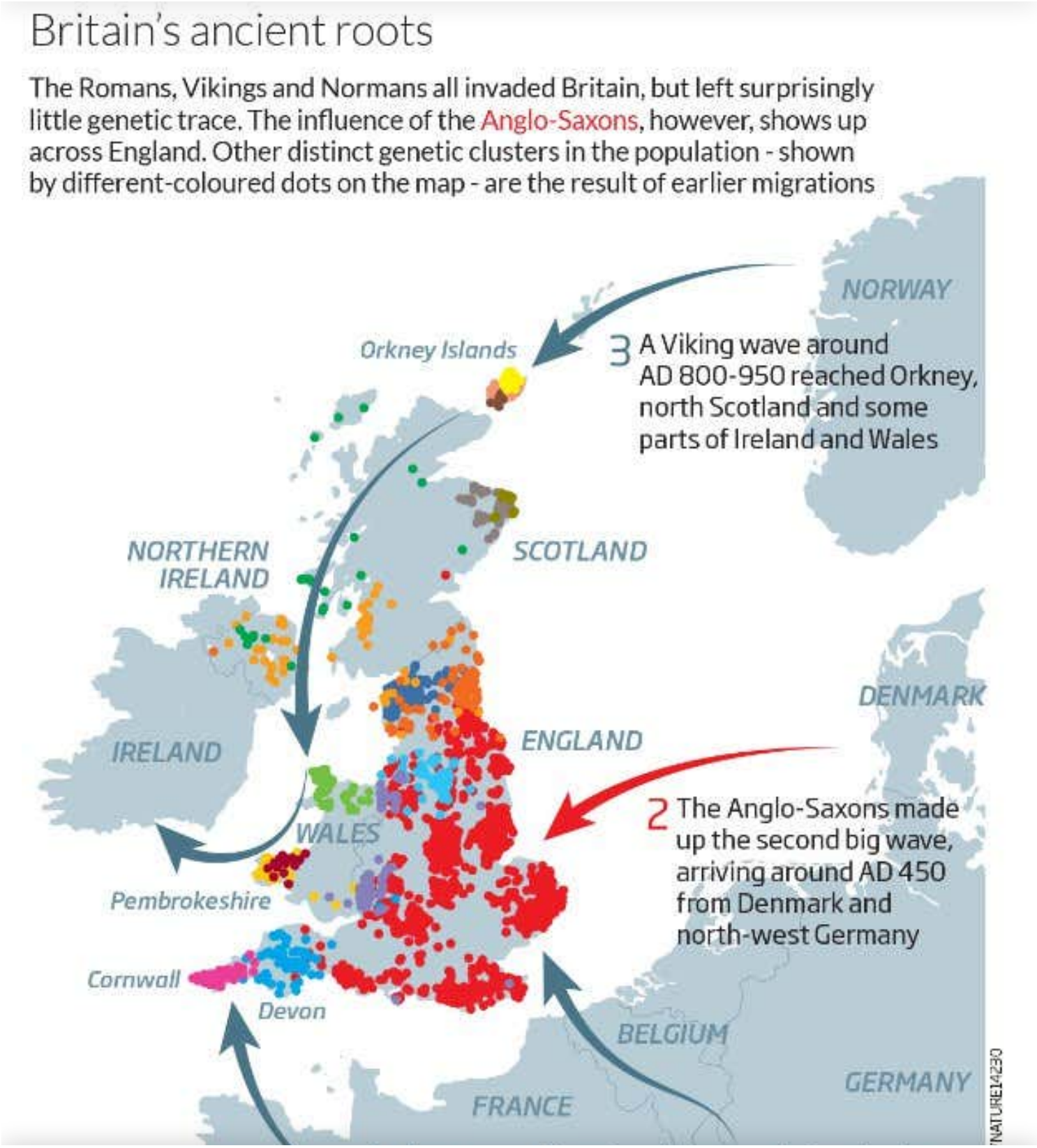
By **Andy Coghlan**

THEY came, they saw, they conquered. But while the Romans, Vikings and Normans ruled Britain for many years, none left their genetic calling cards behind in the DNA of today's mainland Caucasian population. That's the message from the most comprehensive analysis yet of the genetic make-up of the white British population.

The only invaders that left a lasting legacy are the Anglo-Saxons. As well as giving us the English language, the Anglo-Saxons, whose influx began around AD 450, account for 10 to 40 per cent of the DNA in half of modern-day Britons.

The analysis also springs some surprises. There was no single Celtic population outside the Anglo-Saxon dominated areas, but instead a large number of genetically distinct populations (see map below). The DNA signatures of people in the neighbouring counties of Devon and Cornwall are more different than between northern England and Scotland. And there are also unexpectedly stark differences between inhabitants in the north and south of the Welsh county of Pembrokeshire.



The only appreciable genetic input from the Vikings is in the Orkney Islands, which were part of Norway for 600 years. Viking DNA accounts for 25 per cent of today's Orcadian DNA.

"The only genetic input the Vikings had in the UK is in Orkney, where 25 per cent of DNA is Viking"

The insights come from a study of DNA samples donated by 2039 Caucasian people from around the UK. Each was selected because all four of their grandparents were born within 80 kilometres of each other, allowing the researchers to infer their grandparents' DNA and later link it to a location. Because the grandparents were born on average in 1885, the analysis enabled a genetic snapshot of Caucasian Britain prior to immigrations since then. "Any one person's genome is a random sample of DNA from all four of their grandparents, so it's a way to look back in time," says Peter Donnelly of the Wellcome Trust Centre for Human Genetics in Oxford, UK.

To identify differences between people who have similar genetic make-ups, Donnelly's team searched not just for single genetic alterations, but how common combinations of those alterations were inherited in large chunks of chromosomes. "That's much richer than looking at each genetic difference individually," says Donnelly.

The team found that the genetic profiles of the participants formed 17 distinct clusters. When they mapped this information based on where the participants lived they were surprised to see the clusters mapped almost exactly to geographical location.

The largest cluster accounted for half the participants and occupies almost the whole of eastern and southern England and most of the Midlands. This turned out to be the genetic legacy of the Anglo-Saxon invasions. Even so, at least 60 per cent of the DNA in the cluster had survived from earlier migrants (*Nature*, DOI: 10.1038/nature14230).

In fact, all 17 clusters are dominated by DNA from settlers that arrived prior to the Anglo-Saxons. By comparing the clusters with genomes from modern-day continental Europe, the team was able to piece together the general migration pattern that took place.

The first wave of arrivals crossed by land bridges, when sea levels were so low that Britain was attached to what is now northern Germany. This wave was dominated by people with genomes most similar to modern-day inhabitants of northern Germany and Belgium. In parallel, migrants from the west coast of France were arriving by boat. Traces of the combined DNA

The overall message is that despite their large cultural impact, Britain's main invaders left no genetic stamp of note. "When you study the past through history, linguistics or archaeology, you learn about successful people," says Donnelly. "History is written by the winners, so much of current historical information is from a relatively small subset of people. Genetics, by contrast, is the history of the masses."

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Correction, 19 March 2015: *When this article was first published, a detail on the map was incorrect. This has now been corrected.*

Immigration Britain

What have the Romans done for us?

Before the Romans came, Britain was a highly Balkanised cluster of culturally and genetically isolated tribal enclaves. Starting in AD 43, the Romans dissolved many of these barriers in what is now southern and eastern England – partly through building roads. That same area was subsequently occupied by the Anglo-Saxons from AD 450 onwards. Only in the west and north of Britain did the tribes manage to hold on to their isolation, including genetic isolation from the Anglo-Saxons.

Are some regions of Britain inbred?

No. Although some groups are more genetically distinct, they are only subtly so, with a huge amount of commonality across all British Caucasians. It is easier for differences to accumulate and linger in smaller populations, says Donnelly, whereas they become diluted in larger groups.

Are there any medical implications of the findings?

Identification of regional genetic differences means that any harmless regional variants can be ruled out of screenings for disease-related genes. "It makes it easier to distinguish these genetic red herrings," says Donnelly.

Could you do a global version of this genetic study?

Studies on larger populations may be easier as people would be more dissimilar from each other genetically than in a small country like the UK. But the team says it would be really interesting to study individual countries, and a similar study is already in progress in Spain.

This article appeared in print under the headline "Roman invasion left no genetic legacy"