Genetic analysis finds that modern humans evolved from southern Africa's Bushmen

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A team of Stanford University scientists, using the largest-ever genetic analysis of remote tribal people, have determined that the human family tree is rooted in one of the world's most marginal and primitive people - the Bushmen of southern Africa.

This startling conclusion challenges the long-held assumption of our origins in the East African highlands of Ethiopia and Sudan in East Africa, suggested by "stones and bones" fossil evidence.

And it links us to a people who today live on the flat, dry and scrubby edge of the Kalahari Desert - and the outer fringes of society. Speaking in an extraordinary language of tonal clicks, their numbers have dwindled, over time and they languish at the bottom of Africa's caste social system.

"We have to recognize our origins in a kind of hunter-gatherer group that most people today would say (is) much more primitive than we are," said Stanford biology professor Marcus Feldman. "They don't use metal. They live in the toughest kind of environment, with very little water. Their hunting tools are minimal; they have a very-low calorie diet."

But Feldman, who led the team with geneticist Brenna Henn, went on to say, "But they are total geniuses in the bush." Further, he explained, "over tens of thousands of years, we lost the skills they have, that they teach their children. We developed a totally different set of values - with evolution through agriculture - that bypassed these people."

To explore the origins of human evolution, the Stanford research team looked inward, at human DNA.

Africans are the most genetically diverse people in the world. But over time, as different populations emigrated from their homeland - splintering into smaller populations within Asia, Europe and the Americas - they carried away only small portions of available diversity.

As a result, older original populations have greater genetic diversity, while newer populations have far less. This fact forms the basis of elegant computer-based statistical analyses in the burgeoning field of population genetics.

Many other teams have used genetics to track human migrations around the globe - but there has been little study of different populations within Africa. The complete genomes of five southern Africans, including Archibishop Desmond Tutu, were sequenced in February.

So the Stanford team expanded the collection, obtaining saliva specimens from 95 members of the Hadza and Sandawe tribes of Tanzania and the click-speaking Khomani Bushmen of South Africa. Each sample, stored in a small thimble-sized device, held vast amounts of DNA. They also genotyped 650,000 individual variations, or "single nucleotide polymorphisms," in the populations.

The team compared this DNA with 21 samples from more-extensively studied tribal peoples such as the Maasai of Kenya and Tanzania, and the Yoruba of western Africa. The DNA was also compared with that of a group from Tuscany in Italy, for contrast.

They found that the greatest genetic variation was seen in the Bushmen - suggesting that this population is most likely to be the original population from which all other African populations emerged. Specifically, the

DNA of Bushman showed four times more diversity in regions governing immune function.

Based on genetic analysis, the team calculated that these first human populations of Homo sapiens Bushmen date back about 200,000 years, said Feldman. The study was published in Monday's issue of the *Proceedings of the National Academy of Sciences*.

Did modern humans originate in this desperate desert environment? The study does not definitively prove that, because Bushmen once had a far larger geographic range than they do today.

Several thousand years ago, as the more affluent cattle-herding Bantu populations expanded, many Bushmen perished or fled to the sub-Saharan desert. What the Stanford scientists tested were the members of remnant populations - the survivors.

"Bushmen could have been more ubiquitous in Africa. We don't know. We don't have any idea what the original range was," said Feldman. "We can't tell that they evolved 'in situ,'" in that exact place.

If so, the findings don't necessarily contradict conclusions reached by University of California, Berkeley's Tim White after his recent discovery of three fossils in Ethiopia, widely believed to be the likely immediate ancestors of anatomically modern humans.

"They could have been related - we have no way to say that they were, or were not, Bushmen," said Feldman. "If we could get DNA from those 160,000-year-old skulls - that would be the clincher. We can't do that yet."

But because the Stanford team found that genetic diversity wanes in populations residing in the northeast of Africa, they believe that

contemporary Ethiopians represent more recently evolved populations.

The genetic pattern they detected is consistent with histories of human migration that describe an exodus from eastern Africa into the Middle East, then settlement throughout Asia, Europe and the Americas.

The Stanford team recently revisited the southern African Bushmen who participated in the study, and took height and skin color measurements from the people whose DNA they had analyzed. They hope to collaborate with South African scholars to see if they can find the key genes that govern these traits.

Finally, they hope to expand their study of human variation in other early human populations.

"We don't know very much about Australian Aboriginals, indigenous Americans or even South Asian people, who comprise nearly a sixth of the world's population," Feldman said.