Tracing the Road Down Under

SYDNEY, AUSTRALIA—Fifty human-origins researchers gathered here at the University of New South Wales from 29 to 30 September. The genetic, archaeological, and environmental data they presented sketches a new picture of the colonization of Australia by both humans and canines.

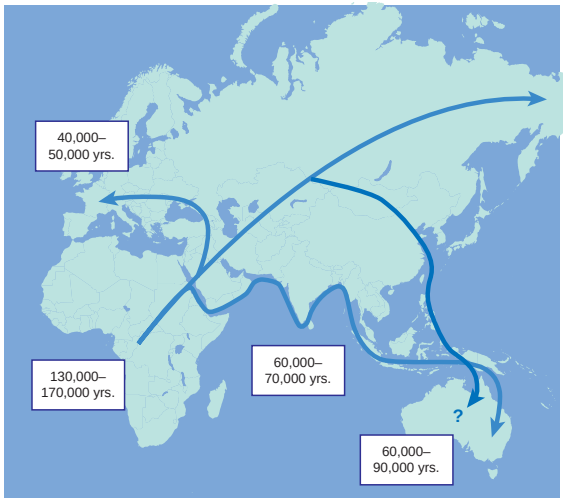
For millions of years, Australia was chiefly a marsupial playground, home to killer kangaroos, giant wombats, and tigerlike carnivores—but not to people. Humans and their commensals finally arrived sometime in the last 100,000 years or so, but researchers have argued heatedly over exactly when. Most experts plump for about 40,000 years ago, whereas a splinter group argues for an early arrival at least 60,000 years ago, probably from several parts of Asia.

At the meeting, researchers presented new genetic and paleoecological evidence that has the warring parties edging a bit closer to agreement. This emerging view sees early Australians arriving on the continent perhaps as much as 60,000 years ago and reaching widespread occupation 15,000 years later. Like immigrants today, settlers may have come via two routes, one along the coast of Arabia, India, and south Asia and another down from China and central Asia. "This work sounds exciting," says Chris Stringer, head of the human origins group at the Natural History Museum in London. "Such an age [for colonization] would not surprise me."

The sharp disagreement about when humans arrived in Australia stems from the wide range of dates yielded by different techniques, sometimes for the same bit of bone. For example, the age of Australia's oldest known human remains, a skeleton known as "Mungo Man," has been set by various techniques at between 40,000 and 68,000 years, with the most recent work pointing to 42,000 years. Dating expert Ed Rhodes of Australian National University in Canberra plotted all the dates from fossils and artifacts associated with early Australians and concludes that, based on the very limited existing data, the "best fit" is that people first arrived 45,000 to 48,000 years ago. "It may be earlier, but there's not enough data" to be certain, he said in Sydney.

The paleoecological data, however, fit a scenario of even earlier arrival, with widespread occupation by 45,000 years ago, according to paleoecologist Peter Kershaw of Monash University in Melbourne. He analyzed data from seven deep land and marine cores from in and around Australia, which offer a continuous, 300,000-year record of pollen and charcoal. Charcoal peaks are associated with fires, and Kershaw spotted two, at 45,000 and 130,000 years ago. He attributes the 45,000-year peak to widespread human activity. "The earlier peak is most easily explained by climate change, but an early arrival is possible," he says.

Genetic evidence presented in Sydney also tends to support an early arrival, as well as providing clues to the routes taken. Molecular anthropologist Sheila van Holst Pellekaan, of the University of New South Wales and Sydney University, and Oxford University population geneticist Rosalind Harding compared mitochondrial DNA (mtDNA) from 188 Aboriginal people from remote parts of Australia to 61 mtDNA samples from people around the world. According to van Holst Pellekaan, preliminary analysis reveals three "very ancient" sets of mutations, called haplogroups, that are distinctive to Australia. Some variations within one haplogroup are shared by people living along a geographic line from southern India and southeast Asia, thus suggesting a migration route. Likewise, some variations within the other haplogroups are shared predominantly with people along a line originating in China and Indonesia. The findings imply a two-pronged entry, although that needs confirmation, says van Holst Pellekaan.



Road map. Mitochondrial DNA data suggest these routes and times for human expansion out of Africa.

As for timing, "Sheila wouldn't put a date on it, but I will," says Harding. She argues that the steadily ticking "molecular clock" traditionally used by geneticists is unrealistic and produces ages that are too young. Instead, Harding uses random mutation rates, which she claims more accurately reflect the natural world. Assuming two different rates, Harding concludes that the ancient haplogroups arose either 60,000 or 90,000 years ago, suggesting an arrival in Australia well before 40,000 years ago.

Other researchers also turned up some evidence for a route through India. Geneticist Rodney Scott of the University of Newcastle and John Hunter Hospital in New South Wales and his colleagues compared differences in genes coding for cytokines—cells that regulate an inflammatory response to infection—in 118 Aborigines from Australia's Northern Territory, 262 Britons and European Australians, and 32 Bangladeshi. They found that the genotypes rare in Aborigines were common in Britons and European Australians, and vice versa, with the Bangladeshi results in the middle. "The results suggest a gene flow across the Indian subcontinent towards Australia," concludes Scott, although he adds that the work is preliminary and must be confirmed.

Molecular anthropologist John Mitchell of La Trobe University in Melbourne, who has tracked human migration through the Y chromosome, says the findings presented in Sydney make sense in terms of both timing and route. "This is definitely what the Y chromosome data show," says Mitchell, referring to work he published in 1999 in *Human Biology*. Despite the lingering disparity over dates, he says, "overall, a pattern is clearly emerging."

On the Trail of the First Dingo

Australia's national dog, the dingo, is famous for its wolflike howls and wild ways. But new genetic work suggests that all of today's feral hounds are descendants of an ordinary domestic pooch from the islands of Southeast Asia. And although dingoes have spread across the continent, their ancestors arrived Down Under in a single introduction roughly 5000 years ago, says molecular biologist and geneticist Alan Wilton of the University of New South Wales in Sydney.

"The founding event was small," says

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