Complete mitochondrial genome sequences of ancient New Zealanders

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In a landmark study, University of Otago researchers have achieved the feat of sequencing complete mitochondrial genomes for members of what was likely to be one of the first groups of Polynesians to settle New Zealand and have revealed a surprising degree of genetic variation among these pioneering voyagers.

The Otago researchers' breakthrough means that similar DNA detective work with samples from various modern and ancient Polynesian populations might now be able to clear up competing theories about the pathways of their great migration across the Pacific to New Zealand.

Results from the team's successful mapping of complete mitochondrial genomes of four of the Rangitane iwi (tribe) tupuna (ancestors) who were buried at a large village on Marlborough's Wairau Bar more than 700 years ago will be published online in the prestigious US journal Proceedings of the National Academy of Sciences (*PNAS*).

Study director Professor Lisa Matisoo-Smith explains that mitochondrial DNA (mtDNA) is only inherited through the mother's side and can be used to trace maternal lineages and provide insights into ancient origins and migration routes.

"We found that three of the four individuals had no recent maternal ancestor in common, indicating that these pioneers were not simply from one tight-knit kin group, but instead included families that were not directly maternally related. This gives a fascinating new glimpse into the

social structure of the first New Zealanders and others taking part in the final phases of the great Polynesian migration across the Pacific."

The researchers discovered that the four genomes shared two unique genetic markers found in modern Maori while also featuring several previously unidentified Polynesian genetic markers. Intriguingly, they also discovered that at least one of the settlers carried a genetic mutation associated with insulin resistance, which leads to Type 2 diabetes.

"Overall, our results indicate that there is likely to be significant mtDNA variation among New Zealand's first settlers. However, a lack of genetic diversity has previously been characterised in modern-day Maori and this was thought to reflect uniformity in the founding population.

"It may be rather that later decimation caused by European diseases was an important factor, or perhaps there is actually still much more genetic variation today that remains to be discovered. Possibly, it may have been missed due to most previous work only focusing on a small portion of the mitochondrial genome rather than complete analyses like ours."

Professor Matisoo-Smith and colleagues including ancient DNA analysis expert Dr Michael Knapp used Otago's state-of-the-art ancient DNA research facilities to apply similar techniques that other scientists recently employed to sequence the Neanderthal genome.

"We are very excited to be the first researchers to successfully sequence complete mitochondrial genomes from ancient Polynesian samples. Until the advent of next generation sequencing techniques, the highly degraded state of DNA in human remains of this age has not allowed such genomes to be sequenced," she says.

Now that the researchers have identified several unique genetic markers in New Zealand's founding population, work can begin to obtain and

sequence other ancient and modern DNA samples from Pacific islands and search for these same markers.

"If such research is successful, this may help identify the specific island homelands of the initial canoes that arrived in Aotearoa/New Zealand 700 years ago," she says.

This research is the most recent output from the Wairau Bar Research Group, a collaboration between Otago researchers and Rangitane-ki-Wairau. The Otago research team is led by archaeologist Professor Richard Walter (Department of Anthropology and Archaeology), and biological anthropologists Associate Professor Hallie Buckley and Professor Matisoo-Smith (Department of Anatomy).

Background information

First excavated over 70 years ago, the Wairau Bar site is one of the most important archaeological sites in New Zealand because of its age and the range of material found there.

It is the site of a fourteenth century village occupied by some of the first generations of people who settled New Zealand. The material excavated from the site, most of which is now cared for in the collections at Canterbury Museum, provided the first conclusive evidence that New Zealand was originally settled from East Polynesia.

This discovery was first reported to the New Zealand public in 1950 by the late Dr Roger Duff, Director of Canterbury Museum, in his ground breaking book The Moahunter Period of Maori Culture. The principal evidence for his conclusions was in the artefacts found; however, the site also contained a large number of human burials.

Between 1938 and 1959 a total of 44 graves were excavated from the

site and the grave contents taken to Canterbury Museum for study. For many years Marlborough Iwi (tribe), Rangitane, sought to have the remains repatriated so they could be reburied in the site and an agreement was reached with Canterbury Museum.

The reburial took place in April 2009, following earlier archaeological investigations of the site undertaken in collaboration with Rangitane.

A University of Otago-led multidisciplinary team of scientists have been analysing tooth samples recovered from the koiwi tangata (human remains) of the Rangitane iwi tupuna (ancestors) prior to their reburial. This work includes studies of the diet and health of the tupuna.

A 2009 article about aspects of the archaeological and biological anthropology research can be read here: www.otago.ac.nz/research/hekit … istoryunearthed.html

Of the 19 burials screened for DNA preservation, four provided sufficient sequence data for inclusion in the current study. These included the remains of two young to middle-aged females, a young adult male and a young adult female.

The researchers will now proceed with discussions with Rangitane about further genetic studies based on the samples already processed.

Provided by University of Otago