

DNA PROVES THE WARRAH WAS A WOLF – AND GOT TO THE FALKLANDS UNAIDED

By Phil Stone

The Falkland Islands hit the headlines at the beginning of November 2009, and for a rather unusual reason. The DNA of the warrah, the extinct Falklands wolf, had been sequenced and the results published in the scientific journal *Current Biology*. The story clearly appealed to the UK Media and most newspapers ran it; typical was ‘How scientists cracked puzzle of the Falklands wolf’ in *The Independent* for November 2nd.

The warrah was first brought to the attention of the scientific world by Charles Darwin, who wrote after his visits in 1833 and 1834: “As far as I am aware there is no other instance in any part of the world, of so small a mass of broken land, distant from a continent, possessing so large a quadruped peculiar to itself.” Then later, when assessing the insularity of his Galapagos mocking birds: “The only fact of a similar kind of which I am aware is the constantly asserted difference between the wolf-like fox of East & West Falkland Islds. If there is the slightest foundation for these remarks the zoology of archipelagoes will be worth examining, for such facts would undermine the stability of species.” Darwin also predicted the warrah’s demise, and sure enough the last one was shot at Shallow Bay, West Falkland in 1876.

Darwin’s erstwhile shipmate on HMS Beagle, Bartholomew Sullivan, later denied that there was any difference between the warrachs from the East and the West. Sullivan lived in the islands for a while so was well placed to judge, but now it’s hard to be sure, because all we have is a handful of skulls and skins in various museums. And to cloud the issue still further, whether those specimens came from the East or the West is commonly not recorded (a notable exception is Darwin’s well-documented collection). Still, it was four of the museum specimens that had been sampled for DNA and for which genes had been sequenced, or rather it was five that had been sampled but only four that had provided sufficiently detailed genetic datasets – hence some numerical confusion in the Media. The results were the outcome of a scientific collaboration (Slater *et al.*, 2009) between experts and laboratories in Los Angeles (USA), Seville (Spain), Uppsala (Sweden), and Adelaide (Australia). The warrah samples were provided by The Natural History Museum, London (UK) (2 samples, one of which was collected by Darwin – Figure 1), The World Museum, Liverpool (UK), The Academy of Natural Sciences, Philadelphia (USA) and the Otago Museum (New Zealand). It was the Otago specimen that gave unsatisfactory analyses.

Before the DNA study was completed it wasn’t even clear whether the warrah was a wolf or a fox – note Darwin’s ‘wolf-like fox’. Though the preserved skulls showed unusual craniodental features, their interpretation was by no means straightforward (Clutton-Brock *et al.*, 1976). So the first important finding from the DNA assessment was that the warrah was indeed a wolf, with a closest living relative in the Maned Wolf of the South American savannah. Not that close though. Molecular dating analyses (the ‘molecular clock’) suggest that the warrah and the maned wolf last shared a common ancestor six million years ago, and that beast lived in North America. The Panama isthmus didn’t form until about 3 million years ago, so only sometime after that did the South American wolf lineages begin to migrate south. The warrah would probably have shared a closer descent with other, but now extinct South

American wolf species, which it survived in the safety of (and lack of competition in) an island refuge.

The other much-debated questions regarding the warrah concern how and when it got to the Falkland Islands, which even allowing for lower sea levels during the last ice age have never been linked with South America by dry land. Darwin and Robert Fitzroy, captain of HMS Beagle, had speculated that the first warrahs might have arrived on an iceberg, but the popular consensus became some form of human intervention, either by accident or design. It was thought possible that Indian canoes from Patagonia, complete with hunting dogs, might have made the trip – though prospects for a successful return journey seem less promising. This idea - human dispersal followed by isolation – has been previously reviewed for *Falkland Island Journal*: in 1972 by Stanley Gorham, and in 1993 by Patrick Armstrong; both thought it the most likely solution. A rather more exotic and fanciful variation on the theme was then offered in a 2002 book by Gavin Menzies, who proposed that in 1423 the Falklands had been visited by a Chinese fleet of ocean-going junks – complete with dogs for hunting and/or consumption, some of whom escaped and were marooned.

All of this preceded the DNA breakthrough of course. The first mention of an attempt to sequence the warrah's genes was in a 2003 *New Scientist* article by Dan Whipple. He discussed the uncertainty around the animal's origin and noted that "... DNA studies of old museum specimens have so far failed to settle the matter." It is not clear to which studies (if any) he was referring, but now the science has caught up with the speculation. The new results from the mitochondrial DNA sequence analysis allow an estimate of the time that has elapsed since the four successfully analysed warrah specimens last shared a common ancestor. That estimate turns out to be about 330 000 years ago! Even allowing for the uncertainties surrounding this kind of work (at 95% confidence the possible range is 70 000 to 640 000 years ago), the warrah population was clearly established long before humans arrived in South America, no earlier than 20 000 years ago. This makes a human-mediated origin for the warrah most unlikely. Instead, the animals probably reached the islands via ice, solid sea-ice or floes, at some point during the last ice age.

With the lower sea level of the ice age it is not inconceivable that a complete, winter ice cover might have extended between the Falklands and the mainland. Indeed, as a one-off event in a particularly severe year it must be highly likely. A wolf might have made a good living out on the sea ice, hunting penguin and perhaps seal. From there, arrival and subsequent isolation on the Falklands is not difficult to envisage. During the last ice age there were particularly intense cold intervals at around 340 000 years ago, 150 000 years ago and about 25 000 years ago; one of these might have created the conditions exploited by the first (and perhaps only) warrahs to make it across, with the earlier options perhaps the most likely.

We'll probably never know if the warrahs on East and West Falkland had indeed begun to diverge. If the 'last common ancestor' date of 330 000 years ago does in fact date the isolation of an original population, there would have been enough time available for that to have happened. On the other hand, the populations could have readily mixed across a sea-free or frozen Falkland Sound as recently as 20 000 years ago and since it's only 5 km across the Sound, either straight across in the north or island-hopping in the south, a determined or fortunate warrah might make it across

anyway. Sadly, we'll probably never have enough material to know for sure. Still, I've no doubt that Charles Darwin would be delighted by the new findings, and it's probably no coincidence that the results were published in 2009, the 200th anniversary of his birth and the 150th anniversary of the publication of his seminal book "Origin of Species".

As well as those museums listed above which provided samples for the DNA study, the following are also known to hold various warrarah specimens:

Nationaal Natuurhistorisch Museum - Naturalis, Leiden, Netherlands.

Naturhistoriska Riksmuseet, Stockholm, Sweden.

Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.

Until very recently no warrarah relics were held in the Falklands. Happily that is no longer the case. During the 2009/2010 summer, ancient *Canidae* bones, including skulls and jaws, were found by Dale Evans on his family's farm at Spring Point, West Falkland. They have now been confirmed (in July 2010) as warrarah remains by Louise Tomsett, a mammal specialist at The Natural History Museum, London, based on distinctive features of the teeth. Dale, a natural history enthusiast, was thirteen when he found the bones but has been collecting specimens since he was three!

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Caption for the accompanying illustration, Figure 1:

Left lateral view of the skull of an adult, male warrarah collected in East Falkland, 1833, by Charles Darwin during the Beagle expedition. Scale in millimetres and centimetres. © The Natural History Museum, London. This was one of the specimens used in the DNA study.

The original final sentence ...

It is a shame that no warrarah relics are currently held in the Falklands – though hopefully it is only a matter of time until more are discovered.

To be replaced by ...

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Alternatively, could leave things as they are and add at the very end ...

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