Extinctions and Introduced Pathogens: What might rats and mammoths have in common?

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One can observe population declines caused by disease that are currently in progress. For example, the widespread decline of amphibians has been linked to the spread of a Chytrid fungus. In rare cases, extinction by disease has been observed as in the case of very rare Partula snails. It becomes much more difficult to analyze extinction events in general, and those caused by disease in particular, if they occurred in the past. While it is commonly accepted that disease can cause severe population declines and extinction in amphibians and mollusks, this acceptance has not extended as readily to mammals. We have used a well defined historical extinction event to attempt to address the potential for disease to cause extinction in mammals (Wyatt et al. 2008). At the beginning of the 20th century, within a 10 year period, the two endemic rat species of Christmas Island (Indian Ocean) went extinct. Besides the incredibly short time from onset of decline to full extinction, a key aspect of this example was that just prior to the collapse of the species; black rats were introduced accidentally to the island via a cargo shipment. It has been argued that the disappearance of the endemic rats ca. AD 1900 may have been partly or wholly caused by a pathogenic trypanosome carried by fleas hosted on black rats (*Rattus rattus*) from the cargo shipment. However, until recently no decisive evidence for this scenario had ever been provided. Using ancient DNA methods we have demonstrated that the endemic rats were indeed unique species that have been eradicated. Endemic rat remains were collected after the introduction of black rats were shown to contain rat specific trypanosome DNA sequences whereas rats that pre-dated the arrival of black rats were negative. The black rats from this time periods were also positive for trypanosome sequences suggesting they were a plausible reservoir for the infectious agent. The data suggests the putative infectious agent coincides with the arrival of black rats and was indeed present during the severe decline that resulted a few years later in the complete eradication of endemic rats on Christmas Island. Thus, our results are consistent with an extinction event with disease as an important contributing factor. Most mammoths also went extinct in a short time frame relatively speaking at the end of the Pleistocene roughly 10,000 years ago. In fact, most of the megafaunal species disappeared from Eurasia through the Americas. However, many large mammals survived. Several mitochondrial DNA studies suggest that the survivors also suffered population crashes at the time that mammoths were disappearing. Was something like Christmas Island occurring but on a wider scale? The new available mammoth genome will provide the resources for answering at least part of this question.