

The elephant in the room: mapping the footsteps of historic elephants with big game hunting collections

Abstract

This paper examines the artefacts of big game hunting in natural history collections of the late 19th and early 20th centuries. A contextual object biography approach is utilised to analyse the life histories of these specimens through the use of archival and isotopic evidence. Emphasis is placed on the example of an elephant shot on Mt Elgon, Kenya in 1902, parts of which were preserved and shipped to England for curation and display in the Powell-Cotton Museum in Kent. The results of isotopic analyses on some of the remains reveal a life history that has implications for developing conservation strategies for modern elephant populations in the region and contribute baseline data critical for interpreting the isotopic signatures of ancient ivory believed to have been exported from eastern Africa.

Keywords

Elephant ivory; big game hunting; East Africa; bioarchaeology; object biography

Introduction

Ivory is not immediately associated with its anatomical definition—as a tooth, an animal tissue, a complex network of living cells that store nutrients from an elephant’s diet and habitat creating a blueprint of its life. Ivory is more often thought of as the valuable cultural resource that it also is, traded amongst people worldwide for thousands of years—wielded as a symbol of power, welded into a decoration of status, carved as an object of beauty and even symbolised as a colour of purity. Yet, ivory has been collected both for its properties as a blank canvas for art or manufacture, and for its identity as an animal tooth, a spectacular specimen of an organism.

The complex ways in which it is possible to think about ivory, and by extension elephants, frames the approach to the research presented in this paper. This paper explores how ivory and other tissues from East African elephants that were collected originally as natural history specimens by big game hunters in the late 19th and early 20th centuries, can be explored in new ways. These hunts left vast assemblages of East African elephant ivory, hides, tail hair and bones

in natural history collections throughout Europe and North America. These assemblages have a layered contextual history in the politics and environment of how they were collected, but also tell a story about how people interacted with and interpreted elephants as artefacts of big game hunting in the colonial period of East African history. Yet each elephant specimen can also be investigated in terms of its life history as part of an elephant. By taking a bioarchaeological approach combined with an object biography perspective, it is possible to investigate the chemical properties of these specimens to open a window onto the life of the animal. The research presented in this paper develops this approach by outlining the social and cultural context in which these collections were assembled in the late 19th and early 20th centuries. A case study from one particular ‘big game hunting’ collection demonstrates the possibilities of using multiple lines of evidence – archival, archaeological, and isotopic – to trace the journey of an East African elephant from a savanna to a glass case and ultimately through my own research to a written text via test-tubes and other laboratory paraphernalia. The tracing of this journey arguably has multiple implications for a range of disciplines, including the archaeology of the 19th century ivory caravan trade.

An object-centred approach to big game hunting collections

Over the last few decades, object biography or life history approaches (Schiffer 1972; Kopytoff 1986; Appadurai 1986; Hoskins 1998; Gosden and Marshall 1999; Schiffer and Miller 1999; Hurcombe 2007; Joy 2009) have made a substantial impact on the analysis and understanding of material culture. Although the practice of archaeology naturally places importance on the role of material culture, the object biography approach offers a way to specifically highlight the many layers of meaning bound within an object – thereby reminding us that the production, consumption and life history of the object occurs within the various cultural contexts of interactions with people. There have been several important contributions developing this approach with reference to different archaeological time frames and contexts (Dobres 1995; Holtorf 1998; Saunders 1999; Gilchrist 2000; Hurcombe 2007; Joy 2009). These studies have primarily focused on objects and people; however, many of the artefacts that archaeologists encounter were once living organisms with their own life history. According to Kopytoff (1986), objects experience birth when they are produced, life cycles in their use, and finally death when they cease to be utilised. Arguably, however, the birth of an object made from animal tissue such

as ivory begins much sooner while still part of the animal from which it was derived. Put another way, part of its materiality stems from its existence as a living network of cells, attached to an organism whose life history, in turn, is amenable for study through the application of bioarchaeological techniques such as isotope analysis.

By investigating the multiple aspects of an artefact's human and animal life history in this way, the relationships created between people and animals in the past is exposed in a way that gives equal attention to the animal that created the object as well as the people who interacted with it (Mullin 1999; Ingold 2000; Mullin 2002; Haraway 2008; Ingold 2012). As Ingold (2012) has discussed, the importance of understanding material culture through the lens of both humanistic and science-based approaches and especially the 'ecology of materials', move our consideration of the materiality of objects beyond that of their relationship with humans to also their relationship with other living organisms. In much the same way, the big game hunting collections discussed in this paper provide both a means to understand the interplay between humans and animals within the context of a specific place and time, but also to understand the life of a particular elephant before it became enmeshed in a sphere of collection and identification.

Collecting East African elephants in the late 19th and early 20th centuries

The primary interest and value of East African elephants throughout most of the 19th century was as bearers of valuable raw material—ivory. Elephant ivory was exported from East Africa at an astonishing rate during the last decades of the 19th century (Beachey 1967; Sheriff 1987) for manufacturing items such as piano keys, cutlery handles, and billiard balls – fuelled by an escalating desire for consumer items and symbols of distinction among the growing middle class in Europe and North America (Briggs 1988; Richards 1990). The exotic nature of this material and its ease of working meant that by the late 19th century, it became the Victorian version of modern plastic in its almost ubiquitous use in the manufacture of everyday items. As Maskell (1906, 1179) remarked, it was 'used for such prosaic things as billiard balls, paper knives, cutlery handles, and toilet objects, and other objects of utility which we are accustomed to see in shop windows'. The ready availability of ivory as a raw material for transforming into these objects was the result of a highly organised and profitable caravan trade that employed porters,

hunters, traders, and others across East Africa to extract, exchange, and move this ivory from the interior regions to the coast for export (Sheriff 1987; Håkansson 2004; Rockel 2006). The scale of extraction and the associated trade had profound economic and ecological consequences for East African communities, landscapes, and elephants (Håkansson 2004; Prestholdt 2008). From the 1840s, East African elephant ivory truly became a global commodity, enmeshed within the lives of all the people who interacted with this material whether they were located thousands of miles away from the source of exploitation, or had been responsible for dispatching the animals that bore it, or played some other role along the chain that linked these different worlds (Coutu 2011, 10-42).

However, ivory's desirable status began to change during the first half of the 20th century, as remarkable shifts in the worldview of Western societies and political bodies occurred, prompting efforts aimed at conserving nature and curtailing the destruction of natural resources. Romantic ideals of a pristine landscape began to be championed, eventually taking root within international conservation bodies. International treaties, such as The Convention for the Preservation of Wild Animals, Birds and Fish in Africa (1900) and the Agreement for the Protection of the Fauna and Flora of Africa (1933), were drawn up specifically with the goal of protecting Africa's wildlife (Mackenzie 1988; Carruthers *et al.* 2008). Setting aside land for conservation also came to the forefront of policy meetings, as at the London Convention for the Protection of Fauna and Flora in 1933 (Steinhart 1994, 59; Neumann 1998, 123). These international initiatives both raised alarm over the growing number of threats to wildlife and the urgent need for conservation measures, while also providing the platform for controlling access to the fauna and flora of these designated landscapes in a manner that restricted the privilege of hunting to only those licensed to do so by the colonial governments of the day (Mackenzie 1988; Steinhart 2006). In short, the creation of national parks across the region resulted in major land reforms, the exclusion of local populations and their criminalisation as 'poachers' (Steinhart 2006). These newly created wildlife sanctuaries were governed by colonial administrators who, influenced by the socio-political ethos of the time, sought to establish control over the natural resources of the colonies in the name of preserving them for posterity (Barringer 1998; Brockington 2002; Steinhart 2006).

In East Africa, elephants were under particular scrutiny in terms of how they were hunted due to the immense pressure that had been placed on elephant populations during the second half of the 19th century as a result of the ivory trade. Two, often competing, reasons were at play: the commercial value of ivory versus the aesthetic presence and conservation of the elephant in its natural habitat (Parker 1979, 122). These reasons also influenced the formation of national parks, as the impetus for gazetting was to set aside land for the controlled hunting of game, as this brought in revenue from hunting licenses, but also meant that wildlife could be conserved (Rodgers and Lobo 1980; Steinhart 1994). These measures increased the value of ivory as a protected material, and ivory was increasingly obtained illegally as it was difficult to control hunting which had been practiced for centuries before (Parker 1973). These early protectionist measures therefore set the stage for the way that elephants are conserved and the sale of ivory is regulated even today (Blignaut, de Wit and Barnes 2008).

Although the creation and regulation of parks in East Africa varied between colonies, many of the policies were hugely unjust, both for indigenous inhabitants and customary users of the lands now set aside for wildlife (Derman 1995; Neumann 1998; Brockington 2002; Cowan 2005; Steinhart 2006; Cernea and Schmidt-Soltau 2006; Shetler 2007). For example, there was no provision for issuing hunting licenses to local hunters, effectively making any form of hunting by Africans illegal. As Pullan (1988, 34) notes, ‘Traditional forms of hunting were banned in order to raise money from gun licenses and in an attempt to enforce the European hunting ethic.’ This ethic acknowledged rather ironically that African wildlife was decreasing in numbers, yet used this to justify hunting in order to preserve the animals for future research, in case of extinction (MacKenzie 1989, 150-151; Steinhart 2006). For example, former U.S. President Theodore Roosevelt, on the subject of his East African hunt in 1909 to collect specimens for the National Museum of Natural History noted, ‘... our large mammals are disappearing more rapidly than the smaller ones, and in the districts where they are now rare special efforts should be made to obtain and preserve specimens before their extinction’ (Roosevelt and Heller 1914, 747). Big game hunting was therefore not necessarily antithetical to conservation practice as it was being developed at the time, though there were certainly critics. Roosevelt’s East African hunting trip, for instance, received considerable public attention and much jeering in the American press, largely because he was seen to have used his power and global stature as a former U.S. president

to facilitate a leisure hunting safari under the guise of scientific collecting (Shaw 1910; Tobias 2011, 89).

Big game hunting was also a lucrative business, as hunters in East Africa supplied animal specimens to museum collections all over the world. One taxidermist based in Arusha, Tanzania, for example, was granted licenses by the Game Department of Tanganyika in 1921 to collect specimens for museums in the US, Europe, and South Africa (Tanzania National Archives, Customs and Trade File No. 10199, 31). Rather than relying on resident big game hunters, however, many of the larger museums in Europe and North America paid hunters and zoologists to travel abroad on hunting expeditions to collect specimens for the explicit purpose of establishing natural history collections across the world (Roosevelt and Heller 1914; Thompson 2010). Former U.S. President Theodore Roosevelt's East African expedition for the American National Museum of Natural History cost over \$100,000, (which today would amount to the purchasing power of well over \$2,000,000) and successfully obtained 23,151 specimens of birds, fish, plants, insects, and shells and 5,013 mammals including eight elephants (Roosevelt 1910; Roosevelt and Heller 1914, 778; O'Toole 2005). Most of these expeditions employed trained taxidermists and zoologists to preserve the specimens in the field, but also relied on the local knowledge and skills of African men and women to transport, lead, survey, hunt, and porter the preserved and pickled specimens for export (Figure 1) (Powell-Cotton 1904; Hobley 1929; Roosevelt 1920; Dawson 1923).

The enduring legacies of these expeditions are the vast collections of zoological specimens found in natural history museums across Europe and North America. The establishment of these collections emerged from a Victorian mindset that was fascinated with the exotic, natural world, but most importantly sought to identify and categorise it (Barringer 1998; Neumann 1998, 21-25; Prestholdt 2008, 151-155). As Yanni (2005, 3) notes, these collections were places where 'the objects of nature were captured, stuffed, pinned down and categorized...'. Yet their creation ultimately meant that animals had to be killed on a fairly large scale (MacKenzie 1988, 36). In the late 19th century, contemporary writers voiced their concerns about the killing of large herds of elephants for the ivory trade, yet simultaneously, museums around the globe showcased the hunted tusks of elephants as a marvel of the natural world (MacKenzie 1988, 150). These

contradictory representations are summarised by Flynn (1998, 188): ‘At once the fruit of colonial adventurism, an international trade commodity, art medium, industrial raw material...ivory was at that time open to a wide variety of appropriations and interpretations.’

Although there are inherent complexities with the ethos behind the formation of these collections, they are interesting as case studies for understanding Victorian perceptions of ivory shifting from its use as a raw material to being re-contextualised as part of an elephant—in its ‘natural’ context attached to its skull with its hair, teeth, bones, and skin. The unique properties of ivory – being culturally valuable and collected, but also being identified as a biological specimen – are exposed in natural history collections and by the manner in which they were assembled. As Gosden and Marshall (1999, 176) note, relationships between people and objects change over time. Big game hunting, framed within the colonial experience, led to a break in the biography of the object, a ‘radical resetting of meaning’ (Gosden and Marshall 1999, 176) as objects from the colonial world became alienated from their culture and placed into a museum, a new context of meaning. On this note, Barringer (1998, 12) describes collections in Britain as a ‘cultural formation’, as the objects were taken away from the periphery of the Empire, brought to the centre of the Empire in London, and finally their meanings reconstructed in a new space created by the Victorian museum display.

Multiple lines of evidence create elephant life histories

Objects in big game hunting collections thus have richly layered life histories that have the potential to be re-examined in an archaeological framework. Archaeological approaches to artefact biographies often forget the biography of the animals (where the artefacts are derived from animal tissue), yet using big game hunting collections, it is possible to create object histories that begin with the animal through chemical analysis of its tissue. By using a multi-isotope approach ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{18}\text{O}$, $^{87}\text{Sr}/^{86}\text{Sr}$) to analyse the tissues of elephant specimens in big game hunting collections, such as ivory, hair, bone, and skin, it is possible to understand the diet, habitat, and geographic provenance of these elephants (Coutu 2011). Big game hunters often recorded how, when, and where each specimen was hunted, preserved, and displayed. This information allows specimens to be traced to a place and date of origin which means that the isotopic information about the elephant’s diet, movement, and habitat can be referenced to a

specific East African habitat and time period. Additionally, these archival records provide a social and ecological dimension to the skeleton, by describing people that were encountered and the range of plants and animals in these landscapes, which builds a contextual understanding of each elephant skeleton in its historic habitat. These data therefore not only allow us to generate individual life histories of the elephants but also help us to understand the habitats, hunters, and local people who interacted with elephants for their ivory in the late 19th and early 20th centuries.

In the following section, one example of such an object life history is outlined through the analysis of the carbon ($\delta^{13}\text{C}$) and strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) isotope ratios measured in the tail hair of an elephant skeleton from the big game hunting collection of the Powell-Cotton museum. Ultimately, by building a collective understanding of several elephant life histories contextualised in this way, it is argued that this approach has potential for unravelling the impact of historic elephant hunting and the ivory trade in East Africa.

Mapping the footsteps of the elephant from Mt Elgon with archival and isotopic analysis

One of the most impressive big game hunting collections housed within a Victorian museum display is curated by the Powell-Cotton museum at Quex Park, Kent, England. Powell-Cotton (b. 1866, d. 1940) spent more than 26 years in Africa on 25 separate expeditions during his life (Nicklin 1981; Powell-Cotton Museum 2008). He officially opened his museum to the public in 1896 and the museum—consisting of 6,000 mammal specimens and 18,000 artefacts—remains more-or-less as Powell-Cotton formed it, including eight dioramas of 500 game animals set in their natural habitats, relics of the Victorian art of taxidermy (Yanni 2005, 30). What makes his collection unique, however, is the meticulous detail with which he archived the material he collected. He photographed the places he visited and kept detailed diary entries for each day of his expedition, noting the weather, the people he encountered, what game he hunted, and the topography and vegetation of the landscape. This archive contextualises the elephant skeletons in the collection, making it possible to tell life histories such as the following elephant from Mt Elgon, Kenya.

Mt Elgon is an extinct volcano straddling the border of eastern Uganda and western Kenya. It is an area of incredible biodiversity as well as human population diversity, as people inhabited the

region to take advantage of these natural resources for diverse subsistence strategies such as agriculture, pastoralism, and hunting. The landscape surrounding Mt Elgon was inhabited by several diverse groups of people at the time Powell-Cotton travelled through (including Bukusu, Nandi, Teso, Pokot, and Maasai) and the fertile slopes of the mountain provided an ideal space for agriculture (Médard 2010; Sassen et al. 2013). These communities also had high levels of interaction with travellers from the coast, due to it being one of the routes along which long distance caravans passed. In fact, Powell-Cotton remarks that Nandi groups had a fierce reputation for their hostility to passing caravans and thus he was happy to negotiate a peaceful passing through their villages (Powell-Cotton 1904, 244). Interaction between Mt Elgon communities and outside travellers expanded substantially in 1901 when the railway line built by the colonial government from Mombasa at the coast ran through Kitale on the southern part of the mountain (Sassen et al. 2013). Due to this railway expansion, by 1912, coffee was introduced as a cash crop by the colonial government, which would have a lasting effect on land use policies, deforestation, and land claims in the region from the mid-20th century onward (Sassen et al. 2013). The inhabitants of Mt Elgon, therefore, had high levels of interaction with people travelling from the coast by the early 20th century, including colonial settlers, hunters, and Swahili traders – ivory being one of the key items of trade. Powell-Cotton describes multiple Swahili trading posts on the flanks of Mt Elgon, in which Greek, Arab, and Indian traders operated (Powell-Cotton 1904, 270, 295). He also describes Nandi elephant hunters, and that ivory was collected as payment for government taxes which were collected by Swahili tax collectors sent from the coast (Powell-Cotton 1904, 262). Like many East African communities along the major caravan routes in the late 19th century, the people of Mt Elgon sought new economic opportunities in supplying and trading with long-distance caravans from the coast by hunting elephants for their ivory (Kusimba and Kusimba 2005). The presence of Powell-Cotton's expedition is thus likely to have occasioned limited concern to the local populace at the time.

While based near Mt. Elgon, Powell-Cotton shot several wild animals for his collection. Among these, his diary indicates that a male elephant with one tusk weighing 79 pounds was killed on 8th December, 1902 on the eastern slopes of the mountain (Powell-Cotton 1902, 26). The elephant was skinned, de-fleshed, and dried in the sun by accompanying attendants of the expedition (Powell-Cotton 1902, see Figure 2). Following this, the bones, skin, and tusk of the

elephant were carried by porters to the nearest posting station in Nairobi and then onto Mombasa, Kenya. From there, the skeleton was shipped by boat back to Powell-Cotton's home in England, although the notes in his diary confirm that the tusk was stolen en route, so what remains of this particular elephant are the skin, hair, and bones (Powell-Cotton 1902). The maps and diary entries of Powell-Cotton in the days leading up to the hunt of this elephant indicate that most of the elephant herds inhabited the thick forest on the northern slopes of the mountain, but this particular elephant was shot in long grass on the eastern slope of the mountain. The beauty of this narrative account is that the isotopic record of the skeleton should provide similar information, just from a different source – from the elephant's tail hair. The tail hair, similar to ivory, grows incrementally and once formed, does not undergo remodelling (as bone does) and therefore remains inert, capturing the information about that elephant's diet and movement during the growth phase of the hair. Thus, by analysing carbon ($\delta^{13}\text{C}$) and strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) isotope ratios in small increments (1 cm) of the tail hair (following protocols by Codron et al. 2013), it is possible to measure small changes in historic diet over the length of time that the tail hair was growing. Growth rates were calculated for the historic elephants by using modern elephant tail hair growth rates. In their study of over 50 adult male and female elephants from East Africa, Wittemyer, Cerling, and Hamilton (2009, 10) found that the average growth rate for adult male elephants is 0.56 ± 0.08 mm per day, meaning that 1 cm of hair reflects approximately 18 days.

Elephants are herbivores and mixed feeders, meaning that they eat both grass and browse. These two types of vegetation (C_4 and C_3 , respectively) are named such due to the two different photosynthetic pathways utilised by each (Tieszen et al. 1979; Tieszen and Imbamba 1980; Tieszen et al. 1989; van der Merwe et al. 1988; Cerling, Harris, and Leakey 1999). The carbon isotope ratios of C_3 and C_4 vegetation are incorporated into its tissues once the elephant has consumed either type, and are distinctly measurable in their ivory, bone or hair (Sternberg, Deniro and Johnson 1984). Because of this, elephants living in closed canopy forests of the interior of East Africa have lower $\delta^{13}\text{C}$ values due to the increased amount of C_3 in their diet, whereas elephants living on mixed or open savannas have higher $\delta^{13}\text{C}$ values due to the increased amount of C_4 in their diet (van der Merwe *et al.* 1988). The carbon isotope value ($\delta^{13}\text{C}$)

measured in elephants from East Africa thus reflects the diet of the individual, but also the density of tree cover in the habitat.

The strontium measured in elephant tissue reflects the strontium that is available to the plants that they eat, through the weathering of the bedrock geology into soil (Sealy et al. 1991; Bentley 2006). Thus, to a large degree, the strontium isotope ratios measured in elephant tissue reflect the strontium composition of the bedrock geology. The isotope ratio measured is a stable isotope of strontium (^{86}Sr) compared to a radiogenic isotope (^{87}Sr), which is produced from the radioactive decay of rubidium (Rb) over time (Herz and Garrison 1998). Thus, lower $^{87}\text{Sr}/^{86}\text{Sr}$ values are found in younger bedrock due to the smaller amount of radioactive decay that has occurred. Because of this, strontium isotope analysis is useful as a geographic provenancing tool when the bedrock geology of a study area is mapped and has significant variability. East Africa is particularly interesting in this regard for its range of geological bedrock formations, from the young volcanics in the Rift Valley to much older basement geology found in the Congo Basin (Simonetti and Bell 1995; Rogers *et al.* 2000). Thus, the $^{87}\text{Sr}/^{86}\text{Sr}$ values measured in the elephant's tissue should reflect to a large extent the geology on which it roamed, and hence variations in $^{87}\text{Sr}/^{86}\text{Sr}$ values can be useful for understanding elephant movement and geographic provenance. The approach has been utilised in modern elephant studies as a way to understand their migration in national parks in the region and elsewhere on the continent (van der Merwe et al. 1990; Vogel, Eglington, and Auret 1990; Koch et al. 1995).

For the male elephant killed on the slopes of Mt Elgon, it is possible to see from the $\delta^{13}\text{C}$ values measured in the tail hair that for most of the year this elephant ate C_3 vegetation (steady $\delta^{13}\text{C}$ values, Figure 2). However, fluctuations in the $\delta^{13}\text{C}$ values record times when the elephant's diet shifted to contain a significant proportion of grass ($\delta^{13}\text{C}$ values increase). Given the description in Powell-Cotton's diary (Powell-Cotton 1902), as well as the current vegetation and topography of this landscape (Figure 2), this matches the vegetation record of this habitat, as this elephant would have had access to both grass and browse.

By measuring another isotope ratio from a different element within the same tail hair, it is possible to have a window into yet another aspect of this elephant's life history. The

measurement from the root of this elephant's tail hair reflects roaming on a much younger geological substrate ($^{87}\text{Sr}/^{86}\text{Sr} = 0.70917$) than the sample measured at the tip of the hair ($^{87}\text{Sr}/^{86}\text{Sr} = 0.72243$), which was approximately two years of growth. The $^{87}\text{Sr}/^{86}\text{Sr}$ value measured in the root of the hair, therefore, reflects the movement of this elephant to a younger geological formation nearer to its time of death. The Mt Elgon region is an area of dispersed and inhomogeneous volcanic geology (Simonetti and Bell 1995), so migrating animals in this region are likely to incorporate strontium in their tissues from different geological substrates. When measuring the bedrock from the alkaline centre of Mt Elgon, Simonetti and Bell (1995) reported low $^{87}\text{Sr}/^{86}\text{Sr}$ values, between 0.70314 and 0.70604. Thus, the sections of tail hair with low $^{87}\text{Sr}/^{86}\text{Sr}$ values (0.70917) indicate that this elephant roamed on volcanic geologies higher up the mountain. Geological base-maps of this landscape indicate that changes in vegetation co-occur with changes in geological bedrock formation (Figure 2). Specifically, more C_4 vegetation occurs in areas of older geological bedrock, whereas higher up the mountain, C_3 vegetation dominates on relatively younger geology. This might then explain the fluctuations in both the $\delta^{13}\text{C}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ values along the tail hair. This journey is not surprising for an elephant living in a montane region, as elephants are known to move up the slopes of mountains to exploit the high quality browse that typically grows in higher altitudes, yet they also exploit fresh grass when it is most nutritious in its primary growing season during periods of high rainfall (Afolayan 1975; Cerling et al. 2009). This corresponds with Powell-Cotton's diary of the time that the elephant was shot, in which he noted particularly heavy rainfall (Powell-Cotton 1904, 291). At the root of the hair near the time of death, there is a spike in C_4 vegetation ($\delta^{13}\text{C}$ values increase) which could reflect this elephant taking advantage of freshly growing grass during the rainy season.

The Mt Elgon elephant is just one of the many individual isotope histories that can be gleaned from analysis of specimens in the Powell-Cotton collection, as well as other big game hunting collections (Coutu 2011). Each of these specimens has a rich documentary and ecological history that is unique in its ability to inform us about elephant populations in the past – but to what aim? The following section describes the benefit of telling elephant biographies through big game hunting collections, and what the contextualisation of these data can mean for understanding the historic interaction between elephants and humans for the ivory trade.

Collective histories: The value of big game hunting collections for understanding the ivory trade

During the late 19th century there was a surge in the demand for East African ivory on a global scale, which would have caused a significant increase in elephant hunting and trading of ivory along caravan routes (Beachey 1967; Spinage 1973). Historical records suggest that elephant herds living closer to the coast were the first to be intensively exploited from ca. 1830 onwards, as they were easily accessible to trading expeditions from coastal ports, but that by the time the demand surged in the late 19th century, these herds would have been hunted out and elephants would have been exploited further into the interior (Thorbahn 1979; Håkansson 2004). An intensification event such as this would have likely had significant impacts on the ecosystem through the removal of thousands of elephants from East African habitats on an annual basis. The ivory trade was part of a social and ecological feedback system involving hunters, traders, consumers, plants, and animals – all dependent on the existence of elephants in the habitat (Håkansson 2007). Thus, in order to understand the impacts that the trade had on these people, elephant populations and local habitats, it is imperative to know where elephants were most intensively exploited for their ivory.

One of the ways to understand this is through documentary sources such as explorer accounts and archival evidence of ivory markets at the coast. But the available estimates of the scale of elephant hunting in these records are primarily based on trade records of ivory exports and these provide little detail of the origin of the ivory (Beachey 1967; Parker 1979; Sheriff 1987; Håkansson 2004). Isotope analysis of individual elephant skeletons, as described for the elephant from Mt Elgon, enables us to characterise where historic elephant ivory originated along the major caravan routes. From this information it becomes possible to refine the available archival records and, potentially, even fill some of the geographical gaps in distribution of written accounts about the intensity of elephant hunting and its impact on elephant herds. Once such information is available, it becomes possible to take the analyses one step further. Provenanced elephant specimens can be used to create a reference of isotope values from elephants living in diverse regions of East Africa which means that it becomes possible to characterise the history of ivory artefacts that do not have a place and date of provenance, such as the thousands of piano keys and cutlery handles made from East African elephant tusks. Big

game hunting collections are perfect for this task because they hold preserved historic specimens with a known date and place of death. Their systematic analysis would facilitate the creation of a reference collection of isotope values for historic elephants along the major caravan routes, against which isotope values of unprovenanced pieces of ivory can be matched. Figure 3 is a map showing Powell-Cotton's hunting trip in East Africa, including locations of the elephants he collected and locations of other elephants from natural history collections which have multiple isotope values ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{18}\text{O}$, $^{87}\text{Sr}/^{86}\text{Sr}$) recorded for each specimen (Coutu 2011). Using the data from these provenanced elephant skeletons in big game hunting collections, it has been possible to differentiate historic East African elephant herds that once lived in interior regions from those that lived in the Rift Valley, for example (Coutu 2011). With enough well dated ivory material, this evidence allows us to begin unravelling historical hypotheses about elephant hunting grounds in a more holistic way that combines archival, isotopic and artefact biography approaches.

These collective elephant histories also provide archaeologists with the ability to characterise archaeological ivory, such as the worked ivory found at the rock shelter site of Kasigau in eastern Kenya (Kusimba 2004). Knowledge of where this ivory was hunted allows us to connect the people at the site with hunters and traders in a wider landscape of diverse cultural groups that were becoming increasingly interdependent as a result of the caravan trade linking these communities. The sourcing of elephant hunting grounds thus fits into a wider research goal to better understand the pathways and networks of the East African caravan trade and its impacts on regional ecologies (Lane 2010). There is great potential for integrating the ivory data with archaeological excavations and surveys emerging in the ongoing study of communities associated and affected by the expansion of long distance caravan trade routes (Wynne-Jones and Croucher 2007; Biginagwa 2009; Walz 2010; Biginagwa 2011). At the same time, the ability to reconstruct past elephant mobility patterns that can be compared with those documented in the same regions for modern elephant herds can provide insights into the adaptive behaviour of elephants in response to human land use changes, and, by extending the temporal range of observational data on elephant mobility (e.g. Croze and Moss 2011), may even be beneficial for the development of migration corridors so as to reduce human-elephant conflict in these landscapes today.

Conclusion

By conceptualising big game hunting collections as assemblages of objects with individual life histories, it is possible to contextualise them in a different way. This approach contributes to the understanding of the interactions between elephants and humans during the 19th century ivory trade in East Africa in terms of provenancing elephant hunting grounds. This work would be impossible without baseline data and the meticulous and georeferenced records of big game hunters. Provenancing studies are often used to elucidate the origin of an object (Henderson et al. 2005; Hull et al. 2008; Sanjuán et al. 2013), which arguably can also be weaved into the story of the object's biography. These studies reveal the source of the artefact in order to understand human action, such as where people migrated on the landscape for access to a raw material. However, by provenancing organic tissues, it is also possible to explore the life of the organism which is intrinsically bound to the artefact, and arguably forms a part of its biography. The isotope analysis thus provides an ecological context for these artefacts as a way of understanding the life histories of the elephants themselves before they were hunted, collected, valued, and re-framed within the context of the museum. Furthermore, analysing these objects in a holistic way enables an exploration of the relationship between people and elephants and emphasises the relevance that big game hunting collections have to modern research questions.

Moreover, 'big game hunting' is once more an issue of public interest and concern in the form of illegal poaching for elephant ivory today. Currently, many African countries struggle to enforce the CITES ban on trade in elephant ivory as poaching is on the rise (Wittemyer et al. 2014). Elephant hunting still happens, just that the actors are different, the direction of trade is different, the use of ivory has changed, and public awareness and reaction is much more global and protectionist in a conservation mindset of the 21st century. Ivory, and our relationship as humans to it, is ever present, ever changing, and thus ever more important to understand with a historical lens.

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