Proposal for Isotopic analysis and Radiocarbon dating of Early Iron Age faunal material from Letaba 6 and Letaba 7 - University of Pretoria MA Project

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I. Introduction

This application is for a sampling permit[1] for faunal material from Le6 and Le7, Early Iron Age sites in the Letaba district of the Kruger National Park. The collections from these sites belong to and are housed at the University of Pretoria, and this research is part of a Masters of Arts in Archaeology from the University of Pretoria.

This project explores the human-animal relationship through the zooarchaeological analysis of site-specific foodways during the Early Iron Age (EIA), identified as 200 to 900 AD in southern Africa (e.g. Huffman 2007). This research investigates patterns of animal exploitation in the Kruger National Park (KNP) during the EIA, using the faunal assemblages from the sites of Letaba 6 and Letaba 7.

The EIA in southern Africa marks both the introduction and florescence of multiple modes of subsistence (e.g. Huffman 2007; Voigt 1986), with the introduction of domestic species to the region occurring along side continued hunting and foraging practices. Rather than clear cut adoption or wide spread use of either domestic or wild species, the EIA is marked by a wide range of animal use (e.g. Voigt 1986). Sites fall all the way across the spectrum, with some assemblages absolutely dominated by domesticates, others wholly wild, and some as varying mixtures of the two (ibid.). And yet, the causes or motivating factors behind such variety are still unclear (ibid.), with explanations ranging from the purely environmental to socio-political or economic drivers.

In order to explore this diversity in use more closely, this project focuses on the animal use patterns (as seen through the faunal remains) at two EIA sites located in the KNP. These two sites, Le6 & Le7, fall far on the wild side of the spectrum. Their assemblages are dominated by wild species with few domesticates present. Previous work carried out on faunal exploitation during the EIA produced a KNP-wide categorisation of hunting-reliant subsistence strategies (Plug 1988). Within that homogenised regional classification, fine scale patterns of processing, procurement, and environmental conditions will be identified at Le6 and Le7 in order to explore the potential socio-economic implications of animal use at a site level in the KNP during the first millennium AD.

II. Problem Identification : Why so wild?

As stated above, previous work was focused on a regional level study subsistence habits (e.g. Plug 1988, 1989a, 1989b), and firmly established the overwhelmingly wild composition of EIA assemblages within

[1] Note: a second, separate permit application was already accepted for the faunal teeth for the oxygen analyses.

the KNP. This project aims to explore why there may have been such a focus on the wild fauna at Le6 and Le7.

In order to address this question and identify the facets of the Human-Animal relationship beyond pure subsistence, the two main factors of animal use must both be addressed: the social and the environmental. As both socio-cultural drivers and environmental conditions shape food habits and animal use, it is essential to identify environmental parameters if one also wishes to address the social aspects that guide food use and faunal choices.

The social aspects of foodways will be explored by identifying the manner in which food was procured, prepared, shared, and disposed. This will be done through traditional zooarchaeology identification of species and skeletal elements, supplemented by detailed analysis of the taphonomy (butchering, burning, weathering, etc) present on these remains. However, the broader conditions within which those food choices were being made must be identified so as to clarify which choices were social motivated versus those driven by ecological factors.

The isotopic analyses will be the main method employed for establishing these key environmental parameters. Previous hypotheses have suggested environmental conditions may have been a predominant driver of wild use, and proscriptive factor for domestic presence in the KNP (e.g. Plug 1988, 1989a; Voigt 1986). However, in her examination of species utilised and procurement choices, Plug (1988: 359) found no signs of famine food (i.e. species only used out of necessity) nor signs of a degraded environment or other forms of resource depression (ibid.). The stable isotopic record preserved in an animal's bones and teeth have long been identified as useful proxy for reconstructing both an animal's dietary choices and the broader environmental and climatic conditions (e.g. Balasse & Ambrose 2005; Hedges et al. 2004; van der Merwe 1982; West et al. 2006). Therefore, carbon, nitrogen, and oxygen isotopes will be utilised as another route for clarifying the environmental conditions present during the occupation of Le6 and Le7 and so offer insight on the wild use at these sites.

Finally, although the original researcher identified Le6 and Le7 as representing at least three occupation events (with occupation beginning at Le7, then shifting to Le6, then back to Le7), only the latter two have radiocarbon dates, with one apiece (Meyer 1986: 223). More dating is needed not only to clarify the relationship not only between the sites and their placement within the EIA, but also to elucidate the features within the sites themselves. Both sites are characterised by a variety of ash pits, ash heaps, and surfaces scatters that together make for amorphous, dispersed sites (e.g. Meyer 1984: Plug 1988). Further dating[2] will clarify if these various features were created during longer term residences, or if they may be the remnants of repeated seasonal re-use of the same location.

III. Research Aims

To establish these environmental and temporal parameters, the research aims of this project are:

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[2] Given the dearth of charcoal collected from the sites, collagen will be used for dating.

- To identify any evidence of dietary stress in the herbivores present as a proxy environmental stress (as seen through dietary switching and diet quality of various grazing strategists).
- To identify signs of seasonal use among the migratory, territorial, and domestic species present to explore the possibility seasonal use of these sites.
- To establish the nature of occupation at these sites, be it longer-term single use residences or repeated short reoccupations during a period of time.

Analysis of the carbon and nitrogen isotopes will be used to address the first point: looking at diet composition and quality as a check on local ecological conditions. Remains from a variety of herbivores with known dietary preferences (i.e. preferentially grazers, browsers, or mixed feeders) will be used [see Appendix A]. If these animals underwent dietary stress and/or were forced into unusual grazing patterns (e.g. forced to browse when they are preferentially grazers), the vegetation change will manifest in the isotopic signature recorded in their bones and teeth (e.g. Codron et al. 2009). This could be a sign of impoverished environmental conditions, which in turn would have restricted over all animal use choices and would locally counter Plug's (1988) interpretation of a plentiful environment. On the other hand, is only the domestic species show signs of dietary stress, it would indicate an environment hostile only to the domesticates. Or, all species may display the expected vegetative signals [carbon] with signs of quality grazing [nitrogen] it would indicate perfectly favourable conditions for all herbivores during the occupation periods at these sites.

Oxygen isotopes will be used to look for the seasonal signals of the second point. If one or both of these sites were only seasonally inhabited, all the animals would be expected to have the same oxygen isotope signal captured in their remains. On the other hand, if the habitation spanned multiple seasons, the remains would be expected show a wider variety of seasonal signals. Further more, by looking at migratory versus territorial species one can explore the potential seasonal focus on certain types of species. The migratory species are expected to have the same seasonal signals (as they are only seasonally present in that region), but if it differs from the territorial species it could indicate a focus on the migratory species while they were present, and use of the local territorial species during the rest of the year.

Additional dating will address the third point. As mentioned above, one radiocarbon date is available for both Le6 and Le7b, Le7a remains undated apart from a relative chronology based on pottery typologies and other site characteristics (e.g. Meyer 1986: 296; Plug 1989a: 63). As the pit and ash heap features that characterise these sites potentially do not offer great time depth in themselves, a variety of them will be selected in order to explore the diachronic nature of these features, but also to test the contemporaneity of features within the sites and occupations. A few of the pits will also be dated twice, so as to test the theory that they mark relatively brief disposal periods (e.g. Maggs & Michael 1976). Further radiocarbon dating will also help clarify the sites' placement in the broader spectrum of EIA. Given the dearth of charcoal recovered from these excavations, bone collagen will be used for the dating.

IV. Research Sites & Collections Employed

First identified by Andrie Meyer (1986) as part of a park-wide archaeological survey of the KNP, Le6 and Le7 are both open-air sites, located a few hundred metres apart on the southern bank of the Letaba River. Excavated in the 1970s and 80s (Meyer 1984; Plug 1988), the material belongs to and has been housed at the University of Pretoria ever since. While Plug (1988) used faunal material from these sites as part of her Doctoral work, the material employed for this project is all previously unanalysed. Given the features from whence this assemblage comes (e.g. ash pits and ash heaps), the material is phenomenally preserved, making it exemplary for the taphonomic elements of this study. [See the methodology section and appendix A below for details on the specific samples intended for use in the proposed isotopic analyses and collagen dating.]

Moreover, the KNP origin of the material is advantageous for the isotopic intentions of the project. As yet, there has been no isotopic research on archaeological material from the KNP. However, isotopic studies in the KNP have included grassland studies (e.g. Codron et al. 2009, 2007, 2005), exploration of anthropogenic versus climatic influences on the riverine forests (e.g. Gillson & Ekblom 2009), and paleoanthropological research (e.g. Sponheimer et al. 2005). This means there is a solid database on the background floral isotopic composition of the region, which will be an essential aid in interpreting the isotopic signals in the sampled bones and teeth.

V. Research Methodology

Unburnt teeth and (compact) bones have been selected from a variety of wild migratory grazers (wildebeest, zebra, and buffalo), territorial browsers (giraffe, kudu, and duiker), territorial grazers (sable, roan, and waterbuck), mixed feeders (impala and eland), and domestic species from Le6 and Le7 [See Appendix A for details]. With their varying ecological niches, the various grazing and browsing strategies of these species together give a more complete picture of the environmental conditions at the time. The variety of migratory and territorial species, with their seasonally variable (migratory) or constant (territorial) presence, allows for the exploration of the possibility seasonally distinctive use strategies.

47 teeth have been selected for use: 22 from Le6 and 25 from Le7. As it is an archaeological assemblage, the samples available are restricted by the materials recovered. Therefore, multiple species from each type are being used to achieve the most balanced coverage possible for these categories on both sites. In features with multiple individuals present, only teeth known to be from different individuals were selected (e.g. six right lower 2nd molars will be used for the wildebeest in Le7/F4/e2).

106 bones have been selected for use: 46 from Le6 and 60 from Le7. The selection of the bones followed the same protocol as for the teeth above.

As covered above, oxygen isotopic analyses will be carried out on the teeth of these species to explore the possibility of seasonal use at these sites, with the collagen from the bones used to explore the environmental conditions through grazing habits and diet quality via carbon and nitrogen isotopes.

These analyses will be carried out by myself, under the guidance of and using the stable isotope facilities in the Mammal Research Institute at the University of Pretoria.

For the oxygen, carbon, and nitrogen isotope analyses a drill will be used to procure powdered samples of enamel and compact bone. For the teeth, the surface of 1 lobe of each tooth selected for sampling will be sequentially drilled. With the bones a 5g sample will be obtained from a section of compact bone. The resultant samples will prepared using the methods laid down in the literature (Ambrose 1990; Balasse et al. 2003; Blumenthal et al. 2014; De Niro & Weiner 1998; Emery et al. 2000; Zazzo et al. 2012). Again, all other zooarchaeological and taphonomic information will be recorded before any sampling takes place.

For the collagen dating, samples of compact bone will be selected from within the non-identifiable bone flake material. As with the isotopic samples, all information (weight, taphonomy, etc) has been recorded for these selected pieces. Samples will be taken from the Le6 features Le6.26, Le6.27, Le6.28, Le6.29, Le6.30, and Le6.31, and the Le7 features: Le7.30, Le7.32, Le7.33, and one each from levels 2, 3, and 4 in Le7/F4/e2. In total, 7 from Le6 (out of 445 total non-identifiable bone flakes), and 6 from Le7 (out of 2,054 flakes).

VI. Research Work plan

The timeframe for the research, subject to the permit's approval, is November 2014 through February 2015.

- The samples for the collagen dating will be sent out as soon as SAHRA approval is received.
- The oxygen isotopic will be carried out on the selected teeth [separate permit application approved] during December 2014 at the Stable Isotope Laboratory at the University of Pretoria, under the supervision of Grant Hall.
- The carbon and nitrogen isotopic analyses of select bones will also be carried out at the Stable Isotope Laboratory at the University of Pretoria over 2 weeks in January or February 2015.

VII. Preparation and Relevant Research Experience

The faunal material in question is housed at the University of Pretoria and I have obtained departmental permission and ethical clearance for this project. I have completely replaced the deteriorating packaging and re-curated the collection, including doing the utmost to track down and remedy missing labelling and documentation.

The main zooarchaeological analyses are already underway, with all the information (including weights, osteometric measurements, taphonomy, photographs, etc) already captured and recorded for the samples selected for these destructive analyses (see Appendix B for catalogue numbers). All data pertaining to the analyses will be included in the final Masters dissertation, as well as a full report, which will comply with heritage legislation and a copy will be lodged with the South African Heritage

Resources Agency (SAHRA). Faunal material will be inventoried and returned to the new packaging according to conventional guidelines, which includes continued storage at the University of Pretoria.

I gained the relevant experience for this zooarchaeological project through various past project. First, through my BA/Honours at Yale University on the faunal analysis of material from a MIA site in Limpopo (Antonites 2012; Grody 2012), as well as by assisting in the faunal analysis of material from other sites in the Limpopo Province (A.R. Antonites, Yale University), from historical sites in the Northwest Province (J. Jordaan, University of Pretoria), and other Iron Age sites in the Kruger Park (G. Jordaan, University of Pretoria).

Additionally, I attended the Stable Light Isotope Course offered by the Stable Light Isotope Laboratory at the University of Cape Town in June 2013. All isotopic work will be carried out by myself, under the guidance and supervision of Grant Hall at the Stable Isotope Laboratory of the Mammal Research Institute at the the University of Pretoria.

VIII. Conclusions [/Project Relevance]

The integration of procurement, taphonomy, and isotopic data will allow for the human-animal relationship to be questioned beyond pure subsistence choices. In establishing a finely scaled view of both the social and environmental parameters of animal use at Le6 and Le7, this study aims to understand faunal use beyond regional classifications of homogenous wild-reliance. Instead, it will consider the broader social or economic implications of animal use at a local level within the context of the great, and as yet unexplained, variation expressed in southern African EIA faunal patterns.

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Appendix A: Breakdown of bones selected for sampling:

Le6	**Species**	**Number of bones to be sampled**	**Total number in assemblage**
Migratory Grazers:	*Equus burchelli* (zebra)	11	32
	Connochaetes taurinus (blue wildebeest)	5	13
	Syncerus caffer (buffalo)	9	12
Mixed Feeder:	*Aepyceros melampus* (impala)	2	15
Territorial Grazer:	*Taurotragus oryx* (eland)	3	3
Territorial Browser	*Giraffa camelopardalis* (giraffe)	6	10
	Sylvicapra grimmia (duiker)	1	1
Domesticate:	*Bos taurus* (cow)	2	3
	Bovini sp.	8	28
Total		46	117

Le7	**Species**	**Number of compact bones to be sampled**	**Total number in assemblage**
Migratory Grazers:	*Equus burchelli* (zebra)	9	39
	Connochaetes taurinus (blue wildebeest)	15	103
	Syncerus caffer (buffalo)	4	12
Mixed Feeder:	*Aepyceros melampus* (impala)	2	8
Territorial Grazer:	*Hippotragus niger* (sable)	3	10
	Kobus ellipsiprymnus (waterbuck)	8	17
	Taurotragus oryx (eland)	5	8
Territorial Browser	*Giraffa camelopardalis* (giraffe)	3	7
	Sylvicapra grimmia (duiker)	2	11
	Tragelaphus strepsiceros (kudu)	2	4
Domesticate:	*Bos taurus* (cow)	2	2
	Bovini sp.	1	8
	Ovicaprine	1	3
Total		60	232

Appendix B: List of bone samples selected for carbon/nitrogen isotope analysis:

Feature	Catalogue	Species
Le6.27	Le6/F564	*Aepyceros melampus*
Le6.29	Le6/F788	*Aepyceros melampus*
Le6.26	Le6/F331	*Bos taurus, cf.*
Le6.27	Le6/F539	*Bos taurus, cf.*
Le6.31	Le6/F1221	*Bovini sp.*
Le6.27	Le6/F525/01	*Bovini sp.*
Le6.28.2	Le6/F647	*Bovini sp.*
Le6.28.2	Le6/F669	*Bovini sp.*
Le6.29	Le6/F792	*Bovini sp.*
Le6.29	Le6/F794	*Bovini sp.*
Le6.31	Le6/F891	*Bovini sp.*
Le6.31	Le6/F979	*Bovini sp.*
Le6.26	Le6/F134	*Syncerus caffer*
Le6.26	Le6/F329	*Syncerus caffer*
Le6.26	Le6/F330	*Syncerus caffer*
Le6.26	Le6/F354	*Syncerus caffer*
Le6.25	Le6/F43	*Syncerus caffer*
Le6.25	Le6/F44	*Syncerus caffer*
Le6.25	Le6/F45	*Syncerus caffer*
Le6.31	Le6/F939/01	*Syncerus caffer*
Le6.26	Le6/F428	*Syncerus caffer*
Le6.31	Le6/F1232	*Connochaetes taurinus*
Le6.26	Le6/F357	*Connochaetes taurinus*
Le6.28	Le6/F607	*Connochaetes taurinus*
Le6.29	Le6/F789	*Connochaetes taurinus*
Le6.29	Le6/F796	*Connochaetes taurinus*
Le6.31	Le6/F1250	*Equus burchelli*
Le6.26	Le6/F379	*Equus burchelli*
Le6.27	Le6/F538	*Equus burchelli*
Le6.28.2	Le6/F679	*Equus burchelli*
Le6.29	Le6/F707	*Equus burchelli*
Le6.29	Le6/F803	*Equus burchelli*
Le6.29	Le6/F807	*Equus burchelli*
Le6.30	Le6/F847	*Equus burchelli*
Le6.26	Le6/F371	*Equus burchelli, cf.*
Le6.26	Le6/F380	*Equus burchelli, cf.*
Le6.27	Le6/F567	*Equus burchelli, cf.*
Le6.31	Le6/F1207	*Giraffa camelopardalis*
Le6.31	Le6/F1227	*Giraffa camelopardalis*
Le6.26	Le6/F309	*Giraffa camelopardalis*
Le6.29	Le6/F784	*Giraffa camelopardalis*

Feature	Catalogue	Species
Le6.29	Le6/F785	*Giraffa camelopardalis*
Le6.31	Le6/F889	*Giraffa camelopardalis*
Le6.25	Le6/F85	*Sylvicapra grimmia*
Le6.26	Le6/F135	*Taurotragus oryx*
Le6.31	Le6/F887	*Taurotragus oryx*
Le6.26	Le6/F158	*Taurotragus oryx, cf.*

Feature	Catalogue	Species
Le7/F4/e2	Le7/F1255	*Aepyceros melampus*
Le7.30	Le7/F1392	*Aepyceros melampus*
Le7/F4/e2	Le7/F1190	*Bovini sp.*
Le7/F4/e2	Le7/F799	*Bos taurus, cf.*
Le7/F4/e2	Le7/F1183	*Bos taurus, cf.*
Le7/F4/e2	Le7/ F1166/01	*Syncerus caffer*
Le7.32	Le7/F1458	*Syncerus caffer*
Le7/F4/e2	Le7/F1537	*Syncerus caffer*
Le7/F4/e2	Le7/F1064	*Syncerus caffer*
Le7/F4/e2	Le7/ F1154/02	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1180	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1181	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1185	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1204	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1207	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1208	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1264	*Connochaetes taurinus*
Le7/F4/e2	Le7/F148	*Connochaetes taurinus*
Le7/F4/e2	Le7/F742	*Connochaetes taurinus*
Le7/F4/e2	Le7/F778	*Connochaetes taurinus*
Le7/F4/e2	Le7/F779	*Connochaetes taurinus*
Le7/F4/e2	Le7/F1209	*Connochaetes taurinus, cf.*
Le7.32	Le7/F1455	*Connochaetes taurinus, cf.*
Le7.33	Le7/F1514	*Connochaetes taurinus, cf.*
Le7.32	Le7/F1053	*Equus burchelli*
Le7/F4/e2	Le7/F1083	*Equus burchelli*
Le7/F4/e2	Le7/F1248	*Equus burchelli*
Le7/F4/e2	Le7/F1249	*Equus burchelli*
Le7/F4/e2	Le7/F1274	*Equus burchelli*
Le7/F4/e2	Le7/F1275	*Equus burchelli*
Le7.30	Le7/F1393	*Equus burchelli*
Le7.32	Le7/F1462	*Equus burchelli*

Feature	Catalogue	Species
Le7/F4/e2	Le7/F794	*Equus burchelli*
Le7/F4/e2	Le7/F1006	*Giraffa camelopardalis*
Le7/F4/e2	Le7/F1529	*Giraffa camelopardalis*
Le7.33	Le7/F1142	*Giraffa camelopardalis, cf.*
Le7/F4/e2	Le7/F1012	*Hippotragus niger*
Le7/F4/e2	Le7/F1016	*Hippotragus niger*
Le7/F4/e2	Le7/F1018	*Hippotragus niger*
Le7.30	Le7/F1040	*Kobus ellipsiprymnus*
Le7.30	Le7/F1041	*Kobus ellipsiprymnus*
Le7.30	Le7/F1042	*Kobus ellipsiprymnus*
Le7/F4/e2	Le7/F1095	*Kobus ellipsiprymnus*
Le7/F4/e2	Le7/F1096	*Kobus ellipsiprymnus*
Le7/F4/e2	Le7/F744	*Kobus ellipsiprymnus*
Le7/F4/e2	Le7/F1066	*Kobus ellipsiprymnus, cf.*
Le7.31	Le7/F1429	*Kobus ellipsiprymnus, cf.*
Le7/F4/e2	Le7/F1071	*Ovicaprine, cf.*
Le7/F4/e2	Le7/F1078	*Sylvicapra grimmia*
Le7/F4/e2	Le7/F768	*Sylvicapra grimmia*
Le7/F4/e2	Le7/F733/01	*Tragelaphus oryx*
Le7.30	Le7/F1049	*Tragelaphus oryx, cf.*
Le7.33	Le7/F1508	*Tragelaphus oryx, cf.*
Le7.33	Le7/F1509	*Tragelaphus oryx, cf.*
Le7/F4/e2	Le7/F662	*Tragelaphus oryx, cf.*
Le7/F4/e2	Le7/F1206	*Tragelaphus strepsiceros*
Le7.30	Le7/F1129	*Tragelaphus strepsiceros, cf.*