A Taste of Tiwanaku

Daily Life in an Ancient Andean Urban Center as Seen through Cuisine

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ABSTRACT

This dissertation explores issues of identity at Tiwanaku, the urban cosmopolitan capital of an ancient Andean polity. This is done through an in-depth investigation of domestic culinary practices within the non-elite neighbourhood of Mollo Kontu. Recent research on the creation and maintenance of Tiwanaku socio-political relations has emphasized the importance of communal feasting events as the process through which residents were integrated into a broad Tiwanaku inclusive state identity. In particular, the consumption of maize beer (*chicha*), and the use of attractive ceramic paraphernalia attached to *chicha* production and consumption, are viewed as key aspects of the consensual integration to the Tiwanaku lifestyle. Results from my investigation of everyday culinary practices suggest that this Tiwanaku state inclusive identity was not as universally accepted as previously suggested.

A detailed analysis of faunal remains from selected domestic contexts is presented and integrated with ceramic, paleoethnobotanical, ichtyoarchaeological, and bioarchaeological results, to illustrate the *chaîne opératoire* of cuisine at Mollo Kontu. I demonstrate that its residents managed their own camelid herds for meat production and consumption, independently from the Tiwanaku state. Their presence represents the exploitation of a shared food preference rather than an epiphenomenon of the residents' economic and political situation. Mollo Kontu daily cuisine emphasized and valued the ingestion of local resources, especially domesticated camelids, in contrast to the Tiwanaku state identity manifested in the commensal consumption of beer

made of non-local maize. This suggests both an independence from the state, and the reinforcement of a local highland identity through the ingestion of locally produced staples, in an increasingly cosmopolitan urban context. Combined with isotopic results which showed Mollo Kontu residents consumed little maize, I argue that Mollo Kontu residents did not fully embrace the pluri-ethnic nature of the Tiwanaku state; in their daily lives they embraced their local roots through their culinary practices.

RÉSUMÉ

Cette dissertation explore des phénomènes identitaires ayant cours à Tiwanaku, capitale urbaine et cosmopolitaine d'une ancienne unité politique andine, grâce à l'étude approfondie des pratiques culinaires domestiques associées au quartier non-élite de Mollo Kontu. Des recherches récentes sur la création et le maintien des relations socio-politiques à Tiwanaku insistent sur le rôle stratégique des festins communautaires dans l'intégration des résidents à l'intérieur d'une même identité étatique Tiwanaku, vaste et inclusive. Plus particulièrement, la consommation de bière de maïs (*chicha*) et l'utilisation de céramiques d'une grande qualité esthétique pour la production et la consommation de *chicha* sont vues comme jouant un rôle clé dans l'intégration consensuelle des résidents à l'intérieur d'un mode de vie Tiwanaku. Les résultats de mon étude des pratiques culinaires quotidiennes (à Mollo Kontu) indiquent toutefois que cette identité étatique Tiwanaku n'était pas universellement acceptée, contrairement à ce que les études antérieures suggéraient.

Une analyse détaillée des restes fauniques provenant d'une sélection de contextes domestiques est présentée et combinée à des résultats obtenus à partir de vestiges céramiques, paléobotaniques, ichtyologiques et bioarchéologiques afin d'illustrer la chaîne opératoire des pratiques culinaires à Mollu Kontu. Je démontre que les résidents de ce quartier géraient leurs propres troupeaux de camélidés à des fins de production et de consommation, et ce indépendemment de l'état de Tiwanaku. Je soutiens que l'existence de ces

troupeaux n'est pas qu'un épiphénomène résultant de la situation socioéconomique des résidents, mais bien le reflet d'une préférence culinaire partagée. La cuisine quotidienne de Mollo Kontu favorisait et mettait en valeur l'ingestion de ressources locales, notamment celle de camélidés domestiques, et contrastait en cela avec l'identité étatique Tiwanaku qui se manifestait par la consommation commensale de bière produite à partir de maïs, une ressource non-locale. Ceci suggère à la fois une indépendance face à l'état et le l'existence d'une identié locale associée aux hautes-terres et renforcée par l'ingestion de produits du terroir, dans un contexte urbain de plus en plus cosmopolitain. Sur la base de ces données, combinées à des résultats d'analyse isotopique démontrant que les résidents de Mollo Kontu consommaient très peu de maïs, je soutiens que ceux-ci n'adhéraient pas complétement au caractère multi-ethnique de l'état de Tiwanaku; dans leur vie quotidienne ils célébraient leurs racines locales par le biais de leurs pratiques culinaires.

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CHAPTER 1: INTRODUCTION

This dissertation investigates how identity was embodied and expressed at the neighbourhood level through everyday culinary practices at the pre-Inka urban capital of Tiwanaku, Bolivia (ca. A.D. 500-1100). Tiwanaku was both an early urban center, and the seat of an influential state which spanned Bolivia, southern Peru, and northern Chile. At its height, this site attracted thousands of individuals from varied backgrounds into this urban phenomenon, a new type of social organization in the area. Residents and visitors were joined together by a widely shared ideology embodied in Tiwanaku monuments and material culture, and rooted in communal feasting and festivals. Yet throughout its history, Tiwanaku's population remained heterogeneous on many levels. I explore this urban heterogeneity through an investigation of cuisine within the residential neighbourhood of Mollo Kontu. In particular, I use a social zooarchaeology approach to illuminate the "human scale of animal use" (Marciniak 2005: 4) by tracing camelid use at Mollo Kontu, from the animals' life on pasture lands to their ultimate discard as meal remnants within the domestic garbage pits of Mollo Kontu. Such an approach differs from standard zooarchaeological research only in its interpretative stance; that is, this approach investigates issues beyond economy, into the territory of everyday social practices. This investigation, supported by paleoethnobotanical, bioarchaeological and ceramic analyses, suggests that culinary practices at Mollo Kontu were used to express and internalize a distinctly *local* identity framed partly in reaction to city- and state-wide pluri-ethnic influences.

Cities are challenging objects of study due to their scope and complexity. Previous archaeological research at the site focuses largely on macro-scale levels of analyses, from understanding Tiwanaku's broader political economy (Janusek and Kolata 2004; A. Webster 1993; Webster and Janusek 2003; Wright *et al.* 2003), cosmological beliefs (Kolata 1986, 1993, 2003c, 2004), and the cosmopolitanism of its society (Blom 2005; Janusek 2002, 2003b, 2004a, 2004b; Couture 2004, 2007; Couture and Sampeck 2003; Rivera 2003), to its attraction as a capital for residents as well as pilgrims (Isbell and Vranich 2004; Janusek 2008, 2009; Vranich 1999, 2006). Research on Tiwanaku also benefits from studies of its expansive periphery (e.g. Albaraccin-Jordan 2003; Anderson 2009; Bermann 1994, 2003; Burkholder 1997; Goldstein 1989, 2000, 2003, 2005; Isbell and Burkholder 2002; Knudson 2004; Mathews 2003; Park 2001; Stanish 2003). Through these studies, we gain invaluable insight into Tiwanaku's social, economic, ritual, and political organization. Building on these investigations, I adopt a micro-scale approach to the study of Mollo Kontu's food remains to inquire into the daily life of Tiwanaku's residents. That is, I take into account that a large portion of the archaeological record is built from a collection of the small scale, routine actions – filleting meat, cleaning out pots, collecting herbs, flavouring broth, eating by the fire, spitting bones out, keeping scraps for domestic animals, breaking plates. This approach emphasizes routine culinary practices and complements a recent focus on the importance of feasting at the site (e.g. Berryman 2010; Goldstein 2003). If Tiwanaku's broad identity was embodied through feasting events, the identity of Mollo Kontu's residents was expressed through mundane culinary practices.

Recent studies on Tiwanaku's socio-political organization stress feasting as an integral process through which Tiwanaku's political and ritual authority was harnessed, negotiated, and established (e.g. Alconini 1993; Anderson 2009; Berryman 2010; Couture 2007; Goldstein 2003; Janusek 2008). In particular, the increased importance and eventual dominance of Tiwanaku in its sphere of influence is linked to "commensal politics" (Dietler 2001: 68); that is, the negotiation of power relations that happened within communal feasting events. Central to these feasts was the production and consumption of copious quantities of *chicha*, a locally brewed beer typically made from non-local maize.

The introduction and widespread adoption of chicha at Tiwanaku's inception is inferred from three lines of evidence: the sudden and sustained distribution and consumption of maize imported from the lowlands as seen through paleoethnobotanical and bioarchaeological analyses (e.g. Berryman 2010; Bruno and Ramos 2009; Wright *et al.* 2003); the early colonization of maize-growing areas (see Goldstein 2000, 2003); and the widespread adoption of paraphernalia analogous to those used in later Inka times for the production and consumption of maize beer. This chicha complex is identified within the current Tiwanaku discourse as a dominant facet of an inclusive Tiwanaku state identity. As such, it is used as an indicator of a broadly shared 'Tiwanaku identity' within the context of the present dissertation. Maize kernels and cobs are distributed throughout the urban center, along with jars and tumblers used for the production and consumption of beer. Though these items are not exclusive to those of higher status, maize beer consumption is generally conceptualized as a crucial aspect of feasting events orchestrated by Tiwanaku elites.

Feasting, often envisioned as a ritual practice involving the communal consumption of food and drinks (following Dietler 2001: 65), is a particularly powerful mechanism to explain increased status differentiation, as well as the formation of early Andean states. The popularity of this concept within Andean research is linked to its applicability to Inka feasting practices as documented within ethnohistorical accounts. Colonial accounts of pre-Conquest practices suggest pan-Andean traditions of reciprocity and "institutionalized hospitality" (Murra 1968: 130). The definition of reciprocity and hospitality promoted particularly by John V. Murra (1956, 1968, 1975 [1972], 1985), in which the help or hospitality provided by an individual or a household is repaid through a delayed reciprocal action, does not explicitly explain how this continuous exchange of service or food and drinks began, or how it evolved into a state redistributive system. The reciprocal debt is simply 'in place.' The study of feasting events, on the other hand, integrates reciprocity and hospitality into discussions concerning long-term social changes and the creation and maintenance of status differentiation.

The renewed interest in feasting events and commensal politics in archaeology is partly motivated by a desire on the part of scholars to insert agency into the study of emerging inequalities. By introducing the individual's pursuit of prestige or power into the equation (Dobres and Robb 2000: 8), feasting provides an interpretive framework through which to investigate long-term social change, while acknowledging that some, or all participants, even those not invited to feasts, manipulate the situation within accepted cultural norms in order to consolidate or further their social status. A focus on state-sponsored feasting acknowledges the participants as motivated actors within broader political events orchestrated by those seeking to acquire or maintain their power, but the interpretive goals of archaeologists often remain within the greater narrative of the development of social inequalities. A micro-scale analysis of culinary practices at the residential level highlights a different facet of social life; it enhances our understanding of the residents' identities and motivations, since it is in the arena of daily practice or routine where non-discursive knowledge of how to *be* is constituted and recreated (e.g. Bourdieu 1984; Giddens 1984).

A focus on daily food production, acquisition[1] and consumption at the residential level provides insight into actors' lived lives and identities in a less public, though no less *political* context than communal feasting. Indeed, actors who may not be heard in wider social change movements can express their reactions to the broader world in non-discursive ways through food and cuisine. As Mary Weismantel argues, "Because we can use foods to express metaphorically who we are, and because through these symbols we may be motivated to feel and to act, foods and ways of cooking them may even become symbols that polarize factions and create arenas of conflict" (1988: 10). Therefore, the archaeological examination of food and drink remains at the household level provides insight into prehistoric identity since "[…] it is at the human scale that contradictions and conflicts are worked out, lived through and resolved" (Hodder 2000: 26).

[1] I use 'acquisition' instead of 'distribution' as it places the emphasis on the person or household receiving the items, irrespective of the distribution mode (i.e. exchange framed through kinship relations and reciprocity, independent producer, or state redistribution system).

Current understandings of the plural identities found inTiwanaku's urban population suggest the city was a cosmopolitan center. The use of 'cosmopolitan' by Tiwanaku scholars and in this dissertation is meant as a descriptor of the variegated social composition of the city. This is in contrast to the current usage of that concept in social sciences where it frequently applies to an individual's sense of universal belonging in a globalized world (or an affiliation with being a 'citizen of the world') (see Calhoun 2008). In the case of Tiwanaku, 'cosmopolitan' points to the integrated social diversity of the city but does not suggest that its residents all espoused a sense that their identities lied in their feeling 'at home' within the disparate social contexts of the city and the polity. Groups that lived in bounded neighbourhoods shared common origins, familial ties and/or economic specialization, but identities were distinct between neighborhoods. Although residents within and between neighbourhoods held these distinct identities, they also shared a broader "Tiwanaku" identity. This state identity is suggested by the city's architectural plan (see Chapter 3), by a clearly defined iconographic style, and by the widespread use of Tiwanaku-specific ceramic paraphernalia for the production, storage, serving, and consumption of food and beer (Couture and Sampeck 2003; Goldstein 2003; Janusek 2002, 2003a, 2003b, 2008, 2009).

The variegated social landscape of the site is suggested by the distribution of two types of cranial modification (Blom 2005), the association of certain neighbourhoods with economic specialization (Janusek 2002; Rivera 2003), and diverse local religious practices based on the presence of smaller ceremonial complexes and ritual enclosures outside the civic-ceremonial center (Couture 1993, 2003; Couture *et al.* 2008; Janusek 2008, 2009). Social status distinctions form another level of distinction between neighborhoods; identification of differences in social status are based on distinct construction material, on hygienic practices (notably the presence or absence of canals in residential areas), and on the distribution of certain elite goods such as *escudilla* bowls, most commonly found within the central district of the urban center in elite areas such as the Putuni complex of residences and ritual spaces (Couture and Sampeck 2003), and on the Akapana pyramid (Alconini 1993). These differences suggest an overall “concentric cline of urban social status” (Kolata 2003b: 178) where the further the residence is from the central civic-ceremonial center, the lower the status of the residents.

In Andean research, maize and meat are usually considered “luxury foods” as they were strong social markers in Inka times (see Hastorf 2003a) but the faunal and plant remains from Tiwanaku contexts, including the results presented in this dissertation, suggest that meat and maize consumption was dictated by more complex factors than status distinction. Indeed, recent bioarchaeological research by Carrie-Anne Berryman (2010) on individuals from varied Tiwanaku sectors suggests that consumption of these foodstuffs does not explicitly follow the social status lines delineated within the urban center through other status correlates[2] (see Chapter 3 for a more detailed description of Berryman’s results). Similarly, contrasting the distribution of meat and maize between the capital and smaller sites within the neighbouring valleys reveals that both rural and urban residents consumed maize in greater quantities

[2] It should be noted that individuals interred within the civic-ceremonial sector of Tiwanaku, and on a ceremonial mound outside the core, consumed more maize than other residents, which can suggest an association of elite status with high levels of maize consumption (see Berryman 2010; and Chapters 3 and 4 in this dissertation).

during the Tiwanaku period than in previous phases (Berryman 2010: 278-280; Wright *et al.* 2003: 388). Furthermore, no significant differences were noted in terms of the acquisition and consumption of meat between rural and urban residents, though consumption increases overall for the Tiwanaku period (Berryman 2010: 280; A. Webster 1993). These trends suggest that meat and maize consumption at Tiwanaku could be linked to more than simple differential access to luxury foods based on social status, and suggests caution when using direct analogy with Inka ethnohistorical records and ethnographic studies in the interpretation of pre-Inka groups.

In this introductory chapter, I situate my research within the broader theoretical context of the anthropology of food. This discussion demonstrates the variety of topics and theoretical viewpoints through which food can be investigated. That is, it shows that food, or cuisine (which includes all aspects of food production, acquisition, consumption, serving, and discard), can illuminate a wide range of issues, from gender relations within the household to the building of a national identity. Following the discussion on the anthropology of food, I present an introduction to the use of social zooarchaeology as an interpretive tool for faunal analysts. This application of standard zooarchaeological methods to elucidate social issues at the human scale is instrumental to my interpretation of culinary practices at Mollo Kontu. This chapter is designed to demonstrate that the interpretation of archaeological correlates of food need not be restricted to discussions of the broader political economy or an enumeration of the components of the Tiwanaku diet. Faunal analyses of domestic contexts as seen through the lens of cuisine can be particularly useful in illuminating issues of identity where an emic understanding is hampered by the lack of written records as is the case for Tiwanaku.

The Anthropology of Food

Food is not only a biological imperative; it is part of an intensely *social* activity. Yet it was sometimes overlooked as a subject of analysis by anthropologists during the first half of the 20th century. According to Mary Douglas, this earlier lack of enthusiasm in academia was due to “intellectual compartmentalization” (Douglas 1984: 2), particularly between the food sciences and social sciences, which prohibited the cross-pollination of thought, and made the social use of food an under-studied area. Mintz and Dubois (2002) suggest that the exponential growth of interest in the social aspects of food in the last three decades or so is due to concerns with globalization, the affluence of Western societies, cosmopolitanism, and the inclusivist policies of the United States. This growing interest in the investigation of foodways by anthropologists and social scientists is exemplified by the explosion in published readers and edited volumes on the subject (e.g. Caplan 1997; Counihan 2002; Counihan and Van Esterik 1997; Dietler and Hayden 2001; Macbeth 1997; Watson 1997a; Watson and Caldwell 2005). In archaeology, interest in the social aspects of food has been particularly focused on identifying feasting events and interpreting their relations to status and socio-political negotiations. Archaeological discussions of foodways also focus on issues of identity and culture contact, including the influence of colonisation on the adoption of new culinary practices.

The following section presents an overview of anthropological and archaeological food studies. It is organized into themes that more or less follow the historical trajectory of the anthropology of food. First, a discussion of food as part of a functionalist social system is presented, followed by a review of the more symbolic meaning of food as seen through the analytical lens of structuralism. This section then veers toward a discussion of Marxist and cultural materialist interpretations manifest in a focus on food procurement and production technologies and their effect on the larger social system of a group or society, on the capacity to adapt to constraints imposed by the environment and on the ways elites manipulate aspects of foodways to mask social inequalities. Following the presentation of these macro-scale historical frameworks, the discussion of the anthropology of food focuses on an alternative interest in understanding culture change at a micro-scale of analysis with the incorporation of agency and daily practice.

The section on practice theory is divided in two themes. First, the introduction of actor motivations into archaeological and anthropological investigations has been particularly successful through the analysis of food exchange in communal feasting events, emphasizing the political role of food in the creation, negotiation, and reinforcement of social inequalities. Second, the emphasis on the role of daily activities in the creation and embodiment of larger social structures predicated in practice theory leads to discussions of the politics of food choices through investigations of daily culinary practices.

Finally, the presentation of the underpinnings of anthropological research on foodways concludes with discussions concerning national cuisines, and the integration of non-local foods into an established culinary tradition.

Through this analysis, we gain an understanding of how new culinary practices are integrated into local cuisines and how local foodways become identified with broader social groups (such as nations and states). Furthermore, it provides a historical perspective on how quickly certain foodstuff, cooking techniques, or meal organization can become 'localized.'

Food as Part of the Social System

Food studies from much of the 20th century reflect the broader differences between European social anthropology and American cultural anthropology. Examples of social anthropologists' investigation of food include the functionalist work of Audrey Richards (2004 [1932], 1939) and Marcel Mauss (1990 [1954]), and the structuralist research of Claude Lévi-Strauss (1997 [1966], 1969) and Mary Douglas (1966, 1997 [1975], 1984). In the case of American anthropology, Boasian anthropology did not spark investigations that focused specifically on food; the integration of food in cultural anthropology from the Boasian perspective laid in descriptions of food production and preparation. The emphasis on cultural descriptions stemmed from Boas' fundamental criticism of the earlier 19th century Cultural Evolutionism movement. Cultural evolutionists placed past and modern groups into distinct stages on an evolutionary scale, the apex of which was Victorian society. In Lewis Henry Morgan's (1877) evolutionary scheme, "savages" and "barbarians" that preceded "civilizations" were defined somewhat inconsistently by their food production technology (Erickson and Murphy 1998: 47); "savages" were hunting and gathering while "barbarians" domesticated plants and animals. Boas criticized these evolutionary schemes for their lack of empirical support and set out to record as much information as possible on modern groups' lifeways.

American cultural anthropology emerged from two ideological contexts; the humanist point of view, which is associated with an evolutionary view of culture in anthropology, and a nationalist movement born in Germany that encouraged the study of 'the people', or *Volksgeist*, to get at an authentic 'culture' (Kuper 1999: 38-39). The influence of the *Volksgeist* movement is seen in the Boasian school of anthropology that typified American cultural anthropology for the first half of the twentieth century. It presented 'culture' as a historical accretion of the contacts, exchanges, and population movements of a group's members, which lead to historically and geographically differentiated groups. Here, the accretion of cultural factors is not associated with progress; Boasians favoured a relativist position where values and practices were culturally variable, and therefore not subject to evaluation. In this context, food and food-related behaviours are always present, but are not at the center of the study of a culture. Boas' ethnographic fieldwork with the Kwakiutl of British Columbia describes the institution of the *potlatch* (Boas 1966: 77-104) whereby copper objects, blankets, and food are exchanged as a means to acquire and maintain prestige. Food is occasionally mentioned, such as in discussions of the rules surrounding the "grease feast" portion of the potlach (see Boas 1966: 102), but the emphasis in Boas' descriptions of the potlatch is mainly on the exchange etiquette. As such, critics of Boasian anthropology often target Boas' emphasis on detailing Kwakiutl blueberry pie recipes without offering insights into the possible role of these recipes in understanding broader sociocultural systems as a point of criticism (e.g. Harris 2001 [1968]: 314).

A more specific anthropological study of food started with the British school of anthropology. British social anthropology, or 'functionalist anthropology', as spearheaded by Bronislaw Malinowski (1944 [1922]) and A. R. Radcliffe-Brown (1952), broke away from the popular evolutionist intellectual models of the late 19th century. In particular, functional anthropologists stepped away from the historical aspects of those currents to investigate the social structure of present societies in context and treated cultures as integrated wholes. Malinowski and Radcliffe-Brown, however, disagreed fundamentally on their definition of functionalism; to Malinowski, society functioned to fulfill biological needs whereas Radcliffe-Brown, heavily influenced by Durkheim and Mauss' work (see below), was focused on understanding how different social institutions created a functional society (Erickson and Murphy 1998).

Food, as a biological imperative, was a part of Malinowski's view of culture, although the social ramifications of food were not explicitly studied until Audrey Richards' (2004 [1932], 1939) pioneering anthropological study of the Southern Bantu's diet. The student of Malinowski chose nutrition and foodways as a topic of interest as it combined her anthropological interests with her prior background in biology. Richards demonstrated that "nutrition in human society cannot be considered as a biological instinct alone" (Richards 2004 [1932]: 211). Her careful and comprehensive examination of social relations, as they relate to food exchange, spoke of the emotional qualities assigned to different foods, the role of food in rituals, and the nutritional and physiological effects of particular foodstuff.

In France the study of food through an anthropological and sociological lens is especially associated with the work of Marcel Mauss and in particular his research on exchange relationships, including food exchange such as the North American potlatch. Mauss' (1990 [1954]) theory on gift exchange elaborated on

Emile Durkheim's position on the functioning of societies (Douglas 1990). His proposition that gifts may appear voluntary, but are in reality part of a reciprocal system of exchanges that is obligatory (although not explicitly), demonstrated that gift exchange has more than an economic value; it has a social value. In fact, gift exchange is the medium for creating and maintaining social relations in small-scale societies. There is an expectation that when one accepts a gift, the receiver will reciprocate at a later time, therefore continuing the social relationship after the transaction. As such, it is not a disinterested act. As with Boas' interest in the Kwakiutl potlatch, Mauss' focus was on the exchange mechanisms rather than on *what* was being exchanged. Whether food, beads, blankets, or live pigs were exchanged did not matter; what was important was that exchange created a social debt.

These early studies concerning the social role of foodways situate food squarely in the social realm. They showed that food is more than a biological imperative, and can be manipulated to create and manage social relations. Although functionalist studies were later critiqued for not providing a way to explain long-term social changes, these ideas, especially Mauss' work on food exchange, were reprised and incorporated into explanations for social change through an investigative focus on *gastropolitics* (Appadurai 1981) and the development of archaeological theories on the role of feasting in the establishment and maintenance of political power, as is discussed later in this chapter.

Food as Classification

Structuralists, such as Douglas (1966, 1997 [1975], 1984) and Lévi-Strauss (1997 [1966], 1969), have argued that foodways reflect cognitive categories. Lévi-Strauss looked for basic universal cognitive categories, although he acknowledged that content is idiosyncratic to the social group under investigation. His general theory suggests that there are cognitive configurations in the human brain that encourage people to classify things in structured ways. In his culinary triangle exposition, Lévi-Strauss (1997 [1966]) defines the classificatory schemes of food preparation techniques in relation to the nature/culture dichotomy that, he argues, characterizes all societies. The points of the triangle are formed by the 'raw', the 'cooked', and the 'rotten', and preparation techniques such as roasting, boiling and steaming are situated at varying distance from nature ('raw' and 'rotten') and culture ('cooked'). Lévi-Strauss was looking for constants to the exclusion of exhaustive knowledge of one society. Mary Douglas (1984) argued that Lévi-Strauss stepped too far away from the lives and social relations of the people under study in his quest to understand the structure of the mind through social structure. Further, she criticized Lévi-Strauss for his emphasis on intellectual stimuli to the detriment of the emotive forces in symbolic action (Douglas 1984; see also Kuper 1996: 174).

Mary Douglas' ideas combine both Malinowskian functionalism and Lévi-Strauss' structuralism (Appadurai 1981; Passariello 1990). Her corpus of research and writing on food is quite extensive and she explores different aspects and scales of foodways. In her early work on taboos (Douglas 1966), Douglas first explicitly exposed her analogy between foodways and the cultural order using the example of the dietary rules in Leviticus in order to explain how Jewish dietary restrictions relate to a greater classificatory system; they are a metaphor for the holiness and completeness of God (see Passariello 1990 for a detailed analysis of Douglas' work). Her general argument was that social orders are classificatory systems, and the study of a society's rules and regulations exposes a social logic that is unspoken.

Douglas (1997 [1975]) later turned her attention to meals, their composition, and their daily and annual sequences. Concentrating on British and Jewish dietary rules, Douglas uncovered how the social order is expressed through structuring the sequences of meals. This focus on the details of daily life illustrates her argument that a small-scale analysis is more appropriate than the universal approach of Lévi-Strauss in the study of the social dimension of food (Douglas 1984). Nevertheless, she lamented that culture-specific studies, and their subsequent categories, do not provide a cross-cultural baseline for comparisons. Douglas later stepped away from the identification of the specific messages conveyed by certain food. Instead she sought clues "to the sheer *quantity* of discriminated meaning that the food could carry" in order to investigate the use of food as a social mechanism of exclusion and involvement (Douglas 1984: 20; emphasis in original). That is, Douglas investigated the complexity of social rules and etiquette surrounding food – from what to wear at dinner, to whether it is appropriate to eat peas on a knife – by recording instances where the rules are applied, and when they are not. These rules, and changes to them, constitute a "system of signs" that can be read by other members whose "shared consciousness defines a subculture" (Douglas 1984:

21). As such, Douglas agrees with Pierre Bourdieu[3] (1984) that food, and food etiquette, distinguishes those 'in the know', and can therefore be used as a means for inclusion or exclusion (Douglas 1984: 9).

Cultural Materialism, Marxism, and Food

American anthropology saw a renewed interest in evolutionary anthropology in the second half of the 20th century, which provided much fodder for food research. Historical materialism was postulated as the appropriate way to investigate long-term social changes, and the Marxist emphasis on food production called for the reinterpretation of the symbolic aspects of food uncovered by functionalists and structuralists as ideology manipulation by elites to hide unequal relations of production. The links between identity and culinary practices, when discussed, are presented in terms of access to resources and social status, and suggest that food production and consumption patterns are born out of environmental particularism, as well as broad political and economic trends.

A commitment to a new evolutionary anthropology grew in the 1950s in American anthropology, removed from the unilinear models of progress of the 19th and early 20th century. This trend was led by Leslie White (1959) who revived Morgan's evolutionary anthropology, and added Marxist components to it. For White, culture was composed of three distinct sub-systems: technology, social relations, and ideology. Changes in technology, particularly 'energy revolutions' such as first the invention of tools which allowed for an increase in food calorie intakes, then the domestication of plant and animals for use as draught animals,

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[3] Douglas cites Bourdieu's 1979 French edition of *La Distinction*, which was subsequently translated into English in 1984.

followed by the use of fossil fuel, and finally the invention of nuclear technology, marked shifts in social relations, which result in changes in ideology (Erickson and Murphy 1998: 117). That is, culture change is predicated by technology. This emphasis on the primacy of technology and material culture was ultimately the entry point for a Processual or New Archaeology into the anthropological theory discourse, as will be discussed later.

Following White (1959), Marvin Harris's (2001[1968], 1985) theory of cultural materialism placed the primary emphasis on means of production (i.e. technology and environment) and demography as the infrastructure of social life. Ideology, therefore, is ultimately the result or by-product of environmental and technological constraints. Indeed, in his work on food habits, Harris' (1985) response to structuralism was to suggest that although food can be symbolic and bear messages, the initial choice of these specific foods is not *ad hoc*, but rather based on practical nutritional and ecological benefits. For example, using historical accounts, Harris (1985) traced the appearance of the Indian taboo against eating cows and explains this taboo as a result of population growth coupled with environmental changes, which together made the previously abundant cattle more onerous to keep, but even more so to kill. Cattle, after all, were still necessary for use as plough animals and for their milk. Thus the importance of keeping cattle alive was eventually integrated into the dogma that outlines the taboo with respect to eating cows.

Ultimately, where structuralists, such as Douglas and Lévi-Strauss, and cultural materialists, such as Harris, differ is on the reasoning behind the choice of what to eat and what not to eat. That is, while structuralists argue that food preferences and avoidances are based on symbolic value, cultural materialists argue that they are the result of rational economic choices.

The interest in developing nomothetic explanatory models of cultural processes through scientific inquiries shared by White's (1959) systems theory and Julian Steward's (1955) cultural ecology and multilinear evolution, and later on by Harris' cultural materialism (2001[1968]), influenced the creation and development of a 'New Archaeology' (or Processual Archaeology) in the early 1960s. Lewis Binford (1962), a student of Leslie White and an early proponent of New Archaeology, challenged archaeologists' previous approach to material culture, which focused on building chronologies through the development of artefact typologies and rather sought to demonstrate how archaeologists could use material culture to explain social systems. That is, New or Processual Archaeology would use archaeological data to investigate cultural processes.

Culture, to Binford, was "humanity's extrasomatic means of adaptation," a rational adaptation to environmental changes, population pressures and inter-group competition (Trigger 2006: 394). Borrowing in part from functionalism, processual archaeology compared cultural systems to a complex organism like the human body where every part has its proper function and a change in one will likely affect other areas of the system (Johnson 2010: 79). Such a biological metaphor allows for the creation of cross-cultural models (as most organic bodies confronted with similar set of conditions will react similarly, so will cultural systems) and explains changes as rational adaptations that can best be seen by an outside observer not immersed in the system. These functional models gloss over the fact that when faced with external change (say a drought), multiple strategies are available to cope with the issue; the choice of which option to favor is based on that group's cultural preferences. That is, choices made in reaction to social, technological or environmental changes are particular to a cultural group's emic perspective. In terms of investigations of food, archaeologists were particularly interested in food procurement methods (i.e. hunting versus scavenging[4]) and generalized models for sharing behaviour (e.g. Binford 1984b). As will be discussed in the second part of this chapter, both the need for recreating past environmental conditions and the investigation of food procurement techniques as means of adaptation were important factors in the popularization of the discipline of zooarchaeology.

Marxism and Food: Global Historical Currents and Class

The influence of Marxist currents on anthropological studies of food also led to the investigation of the effects of global historical processes on foodways, and on the role of food in status (or class) differences. Two seminal works exemplifying these trends include Jack Goody's (1982) *Cooking, Cuisine, and Class: A Study in Comparative Sociology* and Sydney Mintz's (1985) *Sweetness and Power: The Place of Sugar in Modern History*.

In *Cooking, Cuisine, and Class: A Study in Comparative Sociology*, Goody sees the structuralist and functionalist approaches to food studies as complementary. He emphasizes that "a concern with 'meaning' (at whatever level) does not exclude a concern with the social role of food, which some see as an important kind of meaning" (Goody 1982: 33). Nonetheless, both approaches lack a historical dimension. Using a cross-cultural comparative and historical

[4] See the large body of literature on the 'Klasies River Mouth' debate focused on determining if the meat consumed by early hominid was scavenged of carcasses left aside by carnivores or if hominids were the hunters (e.g. Bartram and Marean 1999; Binford 1984a; Klein 1989; Klein *et al.* 1999; Outram 2000, 2001).

approach, Goody sought to elucidate why certain African societies do not seem to have a 'high cuisine,' like those of Europe, which differentiates elites from the lower classes. He argues that to fully understand cuisine, and in order to recognize hierarchical, regional, and temporal variations, the entire food system needs to be studied, from production to consumption. Only by taking into consideration the full range of cuisine is one able to investigate the many ways in which food is linked to the social aspects of a culture. For example, the work and technology involved in food production and storage are linked to economic factors, whereas distribution of what is produced is overtly political (Goody 1982: 37). It is not only food distribution that can be political; food preparation is also political, as it reproduces social hierarchies at the household level, as it is often the domain of women and/or workers. Consumption of the prepared food is "where the identity and differentiation of the group is brought out in the practice of eating together or separately, as well as in the content of what is eaten by different collectivities" (Goody 1982: 38). That is, Goody (1982) pushed for looking beyond food production to investigate further unequal social relations and identity; these themes are explored further in the next section on food and politics.

Mintz's (1985) *Sweetness and Power: The Place of Sugar in Modern History* highlights the role of global economic and political currents in colonial and post-colonial times in the transformation of a single commodity, sugar. Here, Mintz traces the trajectory of sugar from a foodstuff used exclusively by European elites, to a staple of the British proletariat during the industrial revolution. Part of his motivation for tracking the introduction and integration of new foods within a western nation is to develop and contribute to an "anthropology of modern life" (Mintz 1985: xxviii). That is, Mintz demonstrates that anthropology need not only focus on 'untouched' societies' (or ignore the aspects of their lives that were clearly affected by globalisation and interaction with western groups); anthropology can also have a role to play in understanding the modern, globalised world.

Mintz (1985; 1997a) focuses on the production and consumption of sugar through time to track broader political and economic trends in Europe, and to understand their effects on local populations. The widespread adoption of sugar along with tea and coffee, a triumvirate Mintz terms the "drug-food complex" (1997a: 364), is linked to a number of interlocking social factors. These include England's enthusiastic participation in new pan-European economic ventures, and sugar's association with medicinal properties. Furthermore, sugar's high economic yields per area of cultivated land, and the use of slaves to work on sugar plantations, made sugar an attractive and lucrative investment for British investors. Mintz makes no attempt to argue for a clear cause and effect relationship, but instead seeks to demonstrate the many arenas (i.e. social, political, and economic) involved in the adoption and use of a foodstuff. He paraphrases Clifford Geertz (1973) by calling these many influences 'webs of signification' (1985: 157). Mintz asks:

> Where does the locus of meaning reside? For most human beings most of the time, the meanings believed to inhere in things and in the relationships among things and acts are not given but, rather, are learned. Most of us, most of the time, act within plays the lines of which require recognition, not invention. To say this is not to deny individuality or the human capacity to add, transform, and reject meanings, but it is to insist that the webs of signification that we as individuals spin are exceedingly small and fine (and mostly trivial); for the most part they reside within other webs of immense scale, surpassing single lives in time and space (1985: 157-158).

Therefore, Mintz argues that although some choices were given to the English consumers, there is a correlation between what they came to eat, and how they viewed food and eating in their daily lives, with greater political and economic changes over which consumers had no control (1997a: 366). For Mintz, actors' motivations, ultimately, do not have much effect on their consumption behaviours.

Food in the Politics and Practices of Daily Life

Mintz (1985, 1997a) explains social changes by focusing on wider 'webs of signification' seen mainly through the distancing lens of history. But other social scientists argue that this type of broad level explanation ignores how social changes come about at the level of daily practices (e.g. Bourdieu 1984; Giddens 1984).[5] That is, according to these critics, the focus should be placed on explaining how social structures are reproduced and modified (consciously or unconsciously) through individual actions. In terms of this form of the anthropological study of food, two research avenues are predominant: investigations of the political roles of feasting events in the negotiation of power structures, and investigations of expressions of class or identity at the household level through everyday practices.

Feasting

The emphasis on an historical approach, led by Marxist anthropologists, highlighted the importance of viewing social interactions as a dynamic and changing force, which contrasts with the functionalist view of society where social structures are in a state of equilibrium. For example, while Mauss

[5] See also Dietler 2001, Dobres and Robb 2000, Weismantel 1988 for discussions and applications of practice theory.

described gift exchange as a functional mechanism for the reinforcement of social relations, others would argue that what happens once a gift is received is not set in stone; that is, an individuals' actions will determine the outcome. The meanings embedded in exchange relations are not static, but are dynamic tools used by different, often competing, individuals. By participating in exchange relations, one can effect change or maintain the *status quo*. In the study of food, this new take on exchange theory has been applied mainly to feasting events.

The renewed interest in the idea of exchange as a social mechanism was reintroduced to anthropological discourse by Arjun Appadurai's work on the gastropolitics of South East Asia and commodity exchange (1981, 1986a, 1986b). Appadurai aligned himself with structural functionalists, such as Douglas, who try to bridge Malinowski's functionalist approach of seeing food as a medium of social integration, with the structural approach of Lévi-Strauss where food also holds meaning. Appadurai argued that food's "semiotic virtuosity" (1981: 494) comes from its perishable nature, which ensures that food-related behaviours are reproduced every day. This allows the use of food as a conduit for everyday social discourse and highlights its "capacity to mobilize strong emotions" (*ibid.*). His observations of three different contexts within the Tamil Brahmin community of South India (a household, a wedding, and temple offerings), suggest that food in South Asia "serve[s] two diametrically opposed semiotic functions" (1981: 496). On the one hand, it can represent equality, intimacy, and solidarity in social relationships; on the other hand, it can be used to illustrate and reinforce relations of inequality based on rank, social distance or segmentation. Appadurai argued that every meal has this dual function, with cultural rules in place to counter the homogenizing effects of the biological need to eat. Food thus becomes a medium for social struggle and tensions.

Taking Appadurai's later definition of politics as "relations, assumptions, and contests pertaining to power" (Appadurai 1986b: 57), and therefore possibly ranging from the negotiation of gender roles to the creation and maintenance of empires, we can see more clearly how aspects of the significance or social role of food might be manipulated for political ends. This manipulation of food can take place in a variety of arenas, from the household to public events, and can be used by different social actors. The role of communal feasting in political manoeuvring and social tensions, rather than in maintaining the social equilibrium (e.g. Mauss 1990 [1954]), is one way the importance of food and culinary practices has been explored in both cultural anthropology and archaeology.

Michael Dietler defines the feast as an "analytical rubric used to describe forms of ritual activity" (2001: 65) where participants engage in the communal consumption of food and drinks. This ritual can be harnessed to influence the social, economic, and political spheres of the participants. Dietler agrees with Bourdieu (1984) that daily meals can also be "ritualized" events that shape participants' social dispositions and reinforce the social order, or *habitus*. However, Dietler adds that the main difference between everyday meals and feasting events is that the former are usually "less consciously public performances" (2001: 70). As will be discussed in the following section, research on daily cuisine demonstrates that while household meals may be less overtly political, they are in no way apolitical practices.

Feasts are “inherently political” (Dietler 2001: 66); they are the locus for the negotiation and manipulation of political relations in many societies (see also Hayden 2001). Although they often do have an integrative function, similar to Turner’s (1969) concept of *communitas*, they are also forums for internal tensions (Dietler 2001: 69). These events are symbolic representations of the social order, and of how participants perceive the social order. They also provide a medium for social influence through which participants can manipulate their social position and earn symbolic capital. That is, feasting provides a dynamic means of competition for power, and the reproduction or contestation of the social order and authority. The study of feasts, therefore, brings individuals’ intents and actions to the process of broader socio-political changes by focusing on the “micropolitics of daily life” (Dietler 2001: 66).

Dietler describes three modes of commensal politics in terms of their symbolic political use. In the first mode, “empowering feasts” (Dietler 2001: 76) are used to create or acquire social power, with an emphasis on the quantity of food and beverages served. “Patron-role feasts” (Dietler 2001: 82) are feasts that maintain existing inequalities, where participants have unequal status; here too, the emphasis is on quantity. Finally, “diacritical feasts” are used to maintain inequalities with an emphasis on style; that is, the emphasis is on etiquette, special serving vessels, and/or haute cuisine. Diacritical feasting represents the culinary practices that are not shared among people of different status and corresponds to the type of cuisine Goody (1982) argued was absent in the African societies he studied. Dietler (2001) suggests that even in cases where rulers have similar diets to commoners, such as in the examples used by Goody, rules of etiquette are present to create a distinction between the groups. Such rules can take the form of food prohibitions, sexual abstinence by the cooks, and/or the privileged right to butcher and distribute animals with certain symbolic value. Although Dietler views feasts as inherently political, he emphasizes that his definition of power sees feasts not as finite goods but rather a “relational phenomenon,” where asymmetrical relations of power have to be constantly renegotiated through symbolic practices (2001: 77). The multivocal nature of feasting is due to its different audiences; feasting with the gods or ancestors necessitates certain requisite actions, but it also needs to appeal to an audience of living participants.

An alternative, though in no way contradictory, discussion of feasting is presented by Brian Hayden (1990; 2001). As a self-avowed cultural materialist (Dietler and Hayden 2001: 2), he uses a cross-cultural approach to demonstrate that feasting is “an important adaptive behavior for human beings” (Hayden 2001: 24). Feasts are part of a “social technology” used for the creation and maintenance of social relationships that provide access to labour, resources, and/or security (Hayden 2001: 26). As such, feasts are political events that are advantageous as much for the “aggrandizers” who seek to elevate their prestige or status through competitive feasting, as for the participants who forge and maintain beneficial alliances (e.g. Hayden 1990).

Ultimately, both Hayden’s and Dietler’s positions emphasize the role of feasting participants in the creation and maintenance of power relations. These investigations of feasting events as a mechanism for social change successfully incorporate a desire to explain broad social phenomena with the study of actor’s motivations. In fact, archaeological evidence of feasting is used to extrapolate the creation, maintenance, and negotiation of unequal power relations couched in terms of community building. This interpretation is particularly attractive to Andean archaeologists allowing for the interpretation of feasting archaeological correlates as the material manifestation for the appropriation of Andean concepts of reciprocity and hospitality to create and maintain social differentiations, as will be discussed in the next chapter.

Daily Practices

Investigations of feasting events have been popular with many archaeologists, perhaps because they provide a means to frame somewhat static archaeological remains into a dynamic narrative of power negotiation. Power relations expressed through the social exchange of food, however, are not confined only to the feasting settings. As Appadurai (1981) suggests, food's "semiotic virtuosity," and its capacity to be both inclusionary and exclusionary, is performed at the household level too. In fact, the ingestion of food as a "highly condensed social fact" (Appadurai 1981: 494), no matter the context of consumption, represents the embodiment of relations of production and exchange, and provides a link between the domestic and political economies at the individual level (Dietler 2001: 72; see also Smith 2006).

In *Distinction: A Social Critique of the Judgment of Taste*, Pierre Bourdieu (1984) argues that 'taste' is used to demarcate social classes in French society. Though his work is based on the sociological study of French society, many of Bourdieu's arguments and observations can be used as analytical frameworks in investigations of diverse societies and their relations with food. Three points are particularly important for the present dissertation: his use of taste as an identity marker (or "classifier"), the notion that culinary practices cannot be explained simply in terms of economic means (or lack thereof), and the importance and complexity of etiquette in food consumption.

Bourdieu's arguments on taste and culinary practices need to be understood within his larger notion of *habitus* as a structured and structuring system of classification (1977, 1984). *Habitus* is a system of classification of practices, of the recognition of practice, and the classification categories themselves. Taste is a similar notion, and is itself embedded in *habitus*:

> Taste classifies, and it classifies the classifier. Social subjects, classified by their classifications, distinguish themselves by the distinctions they make, between the beautiful and the ugly, the distinguished and the vulgar, in which their position in the objective classifications is expressed or betrayed (Bourdieu 1984: 6).

Here, taste is an identity marker, in that it can be read and understood within and between social groups. Taste, therefore, *distinguishes*.

In Bourdieu's work, taste is a reflection of the French social class system. However, taste is not dependent only on an individual's economic means. Indeed, choices in lifestyle, especially the consumption of ordinary everyday items, go beyond simple economic necessity. They are made "because the social relations objectified in familiar objects […] impress themselves through bodily experiences" (Bourdieu 1984: 77). In particular, those choices linked to early learning in the household (i.e. clothing, home furnishings, and importantly, cooking), before tastes are shaped by the education system, are the most durable dispositions humans have. They linger on, no matter whether individuals move up the social ladder. In fact, Bourdieu states that "it is probably in tastes in *food* that one would find the strongest and most indelible mark of infant learning, the lessons which longest withstand the distancing or collapse of the native world and most durably maintain nostalgia for it" (Bourdieu 1984: 79 [emphasis in the original]). In other words, although an individual's circumstances may change with respect to status or newly acquired tastes, the taste of food will be slow to change, and certain aspects will never be fully abandoned to fit the new lifestyle.

Finally, Bourdieu highlights how cuisine is much more than what is eaten. There is an etiquette to eating. Eating involves seating arrangements, serving protocols, proper utensils and plates, and so on. These traits are as much a part of French cuisine as the meal consumed, and are intrinsically linked to French social classes. Bourdieu describes the overly stylised meal of the bourgeoisie which contrasts with the "easy" meal of the French working-class:

> The manner of presenting and consuming the food, the organization of the meal and setting of the places, strictly differentiated according to the sequence of dishes and arranged to please the eye, the presentation of the dishes, considered as much in terms of shape and colour (like works of art) as of their consumable substance, the etiquette governing posture and gesture, ways of serving oneself and others, of using the different utensils, the seating plan, strictly but discreetly hierarchical, the censorship of all bodily manifestations of the act or pleasure of eating (such as noise or haste), the very refinement of the things consumed, with quality more important than quantity – this whole commitment to stylization tends to shift the emphasis from substance and function to form and manner, and so to deny the crudely material reality of the act of eating and of the things consumed, or, which amounts to the same thing, the basely material vulgarity of those who indulge in the immediate satisfactions of food and drinks (Bourdieu 1984: 196)

The idea that meals can be highly involved and regulated events echoes Appadurai's (1981) argument that meals are socially regulated to counter the homogenizing effects of food as a biological imperative. All humans may need to eat, but not everyone knows how to eat 'properly'. Bourdieu's work on etiquette is also echoed in Dietler's (2001) discussion of the diacritical feast, organized to reinforce social status and difference, and focused on style and etiquette as markers of distinctions.

Mary Weismantel (1988) also used the investigation of the everyday practices of dress, food, and speech at the household level, but through the example of an indigenous community in the Ecuadorian Andes. Her goal was not to investigate social classes *per se*, but rather the effect of changes in the social fabric of Ecuador brought about by modernity as seen at the household level. In her ethnographic study, family members express positions on acculturation and change brought about by modernity through culinary practices, and discussions of these practices. Women of the area are particularly concerned with the increased reliance on mass-produced items as opposed to the use of products from self-sufficient households or small communities. The conflicts of traditional rural subsistence living and urban class-based living are expressed through the kitchen.

It is through the transformation of products into meals that households internalize the external world. Weismantel notes that as the men of the household are forced to go to the cities to gain money for necessary commodities, the women stay in the countryside. This polarizes the household along gender lines. In the capital, men get exposed to colonial culture, which creates tension between the desire to adopt 'modern' practices and foodstuffs, and the desire to stay true to the 'traditional' ways of living and eating. This tension is expressed through discussion, comments, and banter about who uses white rice in the indigenous community as opposed to barley.[6] The choice of

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[6] Note that in this case, what consists of the 'traditional' diet includes crops such as barley, which are not native to South America. A discussion of the construction of

barley, a product grown in the highlands and ground by women, instead of white rice, a market commodity associated with modern urban living, is significant. White rice symbolizes 'conflict' in *Indio* communities because of its association with 'whiteness'. This conflict is often manifested in the household through gender relations. The juxtaposition of colonialism and class in Weismantel's (1988) study, as seen through the eyes of indigenous households, demonstrates how culinary practices express one's cultural identity, or one's aspired class identity. Meal preparation is also the forum where gender tensions are performed in a setting where women have a good degree of control.

Serving etiquette is another facet of indigenous Ecuadorian cuisine where women can manipulate gender relations without using words. Meal service reproduces household relations as women serve males first, according to a complex set of rules guided by factors of age and gender. Although serving rules repeat the conventional social order, they can also be manipulated by women to express discontent as they control the finer points of the serving etiquette (e.g. who between an older woman and a younger man will get served first) and what is being served. A cold soup or a small bland meal can express discontent that would not be voiced otherwise. Weismantel's (1988) study permits the observer to "grasp the way that hegemony and resistance work through the infinite, unimportant incidents and objects of everyday life" (Weismantel 1988: 25). Her research, much like Mintz's (1985, 1997b), focuses on the effects of broad social changes (i.e. modernity). However, her data are not

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national cuisine, especially Wilk's (2002) argument on the importance of global movements on the creation of a Belizean cuisine, is presented below.

historical in scope but rather rooted in daily practices that demonstrate how change is effected, or resisted, at the household level.

Monica Smith (2006) also focuses her investigations of politics using daily food consumption at the domestic level in her archaeological case-study of rice as a food preference in South East Asia. She argues that broadly shared food preferences are not necessarily conditioned by politics or economics, as Marxists would suggest; rather, the choice of what to eat is made by individuals within “a complex social context” (2006: 480). For example, in the diachronic case study of South East Asia from the first millennium A.D. to the 16th century A.D., Smith (2006) proposes that the development of intensive rice agriculture was done through consensus between elites and commoners who both wished for the increased production of this preferred food. To investigate the importance of food for social cohesion, she suggests archaeologists investigate daily domestic consumption, and not only feasting. By providing a better understanding of food preferences at the household level, we can uncover what drives social changes. As food is ingested into the body and thus internalized, the “act of consuming food may represent the ultimate basic locus of identity, conformity, and resistance” (2006: 480). In South East Asia, the preference for daily rice consumption was the dominant motivation behind agricultural intensification, and therefore behind changes in political economy and labour extraction.

Smith’s example illustrates how high-status foods can also be a staple food within the domestic sphere without losing their high-status quality. A collection of ancient texts from all time-periods investigated mention rice as food for the gods used in rituals, as having medicinal properties, and as a daily staple food for commoners and elites alike. Smith argues that “the acquisition and consumption of rice became the measure of both household nutritional adequacy and participation in a ritually elevated mode of consumption” (2006: 483). Although it could be argued that political leaders manipulated the value of rice in order to create consensus (a false consciousness masking elites’ motivations), Smith counters that “the longevity and ubiquity of food preferences in the textual record indicates that cultural ideas and belief systems sustained political groups, not the other way around” (2006: 489). When the goal is to produce a culturally preferred food source that will be distributed to the entire population, consensus is more likely to be in operation. Through their involvement in the production and consumption of rice, commoners feel their status is elevated; this in turn helps to promote the emergence of consensus.

Food as Political Identity: Nationalist Cuisine, Globalization and Localization

Although Smith (2006) demonstrates that food preferences need not be predominantly conditioned by capitalist goals of food conglomerates, or by economic results of colonization and globalization, her research does not explain the introduction of new foodstuff or culinary techniques to a broadly shared cuisine. The present section discusses studies on the creation of ‘national’ cuisine, the global spread of American fast food, and the localization of foreign foods into deeply local practices. These themes may seem far removed from Tiwanaku cuisine, yet they nicely unpack the factors involved in the introduction and adoption of new culinary elements. Culinary practices, past and present, are constantly created, reinterpreted, negotiated and abandoned. The following discussion investigates how these social changes come to be.

<u>The Making of a National Cuisine</u>

Studies of national cuisines in historical context demonstrate that local 'traditions' are often shaped by national or global trends. Cuisine is often the stronghold of nationalism; groups are often identified through their 'typical' national dishes. Yet these emblematic foods have different histories and their prominence in the national cuisine is not always stable. Thus, understanding the motivations behind the adoption of national cuisines promotes our understanding of the role of food in shaping a broad political identity such as that of the Tiwanaku-wide identity.

Appadurai (1988) addresses this issue in his study of English language Indian cookbooks created for the Indian urban middle-classes. Here, Appadurai suggests that the structure of cookbooks, often written out of nostalgia by expatriates, unify the different regional recipes under a common Indian meal structure of rice, bread, and vegetables. The cookbooks therefore blend ethnic and regional differences into a coherent national integrationist identity without losing track of the food's regional origins. The importance of nostalgia for the creation of cuisine echoes Bourdieu's (1984) work on the emotional importance of early food learning for the maintenance of food choices. Two examples of more recent work on the subject of food and nationalism are presented here, one from Japan and the other from Belize.

Katarzyna Cwiertka (1998) investigated the history of the creation of a Japanese national cuisine and diet. She argues that modifications of the Japanese diet have historically been pushed forward by the political pursuits of the Japanese state. The adoption of western cuisine elements, in particular some foodstuff and cooking techniques, was a long process shaped by attempts to emulate westerners which started in the 1800s. The initial adoption of certain western elements by Japanese elites marked an effort to make the country more appealing to European sailors. Over time, a trickle effect led to the dissemination of these techniques among commoners, who modified recipes to integrate Japanese foodstuffs. Upon the militarization of Japanese society in the 20^{th} century, the soldier's diet, which included many western elements such as canned goods and beef, came to be identified with notions of 'proper' nutrition, physical health and strength, and was adopted by civilians. Variety in diet became an ideology promoted within the newly formed middle-class, thereby encouraging the inclusion of new foodstuff and cooking techniques in the daily diet. This was further encouraged by the Japanese state, which desired a strong nation with deep nationalist feelings. Strong individuals can be achieved with proper nutrition, while a united nationalistic ideology can be expressed through the erasure of regional foodways. Thus, Cwiertka (1998) sees Japanese cuisine as the result of a shift in political ideology toward the building of a unified and strong nation, through the emulation of powerful countries. What is less clear is why these new culinary practices were accepted so quickly by non-elites.

National cuisines do not have to be shaped by elite tastes and interests. A relevant example of the creation of a national cuisine defined both within the private and public sphere is Richard Wilk's (2002) research on Belizean cuisine. Wilk proposes that Belizean cuisine was created by three different groups as a response to encroaching globalization and westernization. He argues "globalization and local identity are closely related processes that depend intimately upon each other" (Wilk 2002: 68). Belize is a country populated by migrants from different areas of the colonial Americas, and where the indigenous culture was nearly eradicated before the migration process even began. The Belizean case study permits the analysis of the genesis of a national cuisine and identity as this is a young country; Belize only gained its independence in 1981. In this case, the idea of nationalism and national foods, and the fear of the nation foodways' destruction by globalization, was established before its political acceptance as a nation.

An important point raised by Wilk is that national foods are separated between the daily, non-reflective practices and the public performances, although both daily and public foods are authentic.[7] That is, the context of consumption affects what is served and consumed, yet both culinary traditions are equally representative of a shared identity. Changes over time are due in part to having a new audience, the tourists, for the public performance of Belizean national foods. Indeed, Wilk (2002) noticed that the introduction of tourism has had considerable effect on the national cuisine of Belize, itself based on the culinary history of Belize from colonial times to the present day. Tourism has brought the unpublicized, daily food practices of the lower classes during colonial times to the forefront of the discourse on cuisine in the 20th century. The cuisine was influenced by the search for the 'local experience' by early visitors, including anthropologists, who lamented the erosion of a food culture of rice and beans. Yet, variations were great between households and

[7] The contrast between private consumption and a public representation of a national cuisine can also highlight tensions between different segments of the population as is the case of llama meat consumption in modern-day La Paz, Bolivia. Ethnographic research on llama meat consumption by Clare Sammells (1998, 2010) suggests that middle- and upper-class mestizos (nonindigenous Bolivians) are weary of llama meat, which is associated with poor indigenous populations and diseases. They will avoid its consumption while Bolivia's 'indigenousness' is sold to tourists with llamas as symbols of national pride, and their meat served to tourists for a taste of the *tipicó*, or 'authentic'.

social classes, suggesting that Belizeans never truly had a fixed idealized food culture. Belizean cuisine was not only delineated by visitors, the expatriate Belizean community in the United States created an emblematic national cuisine and fostered nostalgia for their homeland fixed in certain dishes. Finally, upon the return of these expatriates, and through the economic ambitions of some Belizeans restaurateurs, 'typical' Belizean restaurants opened up in Belize for the ever-increasing tourist trade. In Wilk's words,

> one version of national food was developed in America by Belizeans for Americans; another was developed partly by Americans in Belize, for Belizeans; but a third version of Belizean food is the one that attracts the most attention: the version developed by Belizean and foreign entrepreneurs to feed foreign tourists with a taste for something authentically Belizean (2002: 84).

Therefore the national Belizean cuisine is the result of the fear of globalism by early visitors, as well as the increase of tourism. Cuisines associated with broadly shared identities go beyond what is served within households; in this case, identity as expressed through food has been driven by the nostalgia of a diaspora and a need to streamline menus for a new audience wanting to experience the 'authentic.' For Tiwanaku, I argue that the public and the private spheres were similarly distinct loci for "traditional" cuisines; the "state cuisine" performed in public settings and exported throughout its sphere of influence and diaspora (e.g. Goldstein 2000, 2005); and more local variations within neighborhoods, including a quintessentially local cuisine rooted in nostalgia at Mollo Kontu.

<u>Globalization/Localization</u>

The study of consumption and commodities in the post-colonial capitalist world does not have to be about the loss of authenticity of a local social group to globalizing forces that inexorably push foreign mass-produced commodities on them (e.g. Miller 1995). As was presented in the previous section, even in the capitalist world, the power to change social aspects is not held only in the hands of a few elites; everyone participates, consciously or not, in the reproduction, creation, or contestation of the social order. That is, groups can adopt and integrate those commodities to create or reinforce their identities. This is far from a new phenomenon; as mentioned previously, the indigenous Ecuadorian peasant studied by Weismantel located indigenous (and rural) identity in the consumption of barley, which is in fact a European domesticate introduced post-Conquest. The following discussion highlights the ways foreign foodstuff can be quickly integrated in local culinary practices and become part of their culinary identity, as the quick adoption of maize by segments of the population of Tiwanaku became associated with a Tiwanaku state identity.

The literature on food and globalization focuses prominently on fast-food conglomerates and their associated multinational corporations (e.g. Caldwell 2004; D. Miller 2005; Watson 1997a). In academia, the discourse on the effects of globalization on foodstuff is moving toward the empowerment of local choices. Discussions concerning consumers' motivations have led to an interest in the appropriation and recontextualization of commodities, that is, the "localization" of foreign commodities (e.g. Caldwell 2004; Watson 1997a). Miller (2005) argues that multinationals, such as Coca-Cola and McDonald's, represent a 'modern' or 'western' way of living to the local. Yet, in the example of the adoption of Coca-Cola in Trinidad, the product becomes embedded through appropriation in local conceptions of 'sweetness' that is markedly different from, and even antagonistic to, the way the company wants to market it. The McDonald's fast food restaurant chain in particular has been a popular case study in food studies for discussing localization, since McDonald's has become a symbol of the 'Americanization' of the world. Though clearly situated in the modern capitalist world, the following examples illuminate the many ways people in the past could react, engage and negotiate culinary changes brought about by contact with foreign groups.

Mintz (1997b) suggests that American-style fast food differs from other types of food served quickly (such as street vendors found worldwide) through the American fast food 'ethic of uniformity'. However, even in such a predictable environment as McDonald's, recent case studies demonstrate that what attracts customers in different cultural settings to McDonald's is not the same everywhere; furthermore, the appeal is certainly not the same as that which made the company so powerful in America (where fast production and consumption, as well as low prices contributed to McDonald's popularity). Mintz (1997b) instead links the initial adoption of such foreign foods not to the taste of the food *per se*, but rather to the endorsement of change in general. That is, eating at McDonald's can be seen as an act of protest to social norms, or as resistance, or even consent to Westernization.

Yunxiang Yan's (1997) analysis of McDonald's in China supports Mintz's argument. He suggests two different, but equally important reasons for the adoption of McDonald's in China. On the one hand, the Chinese state benefits from McDonald's public corporate motto of "QSC & V" (quality, service, cleanliness and value) as it reinforces its own promotion of a cleaner, more 'modern' work environment. Because of this, China initially encouraged the patronage of McDonald's restaurants; from this perspective, McDonald's acts as a symbol for positive progressive change associated with a modern America. On the other hand, according to Yan, the attraction to McDonald's for Chinese customers stems from its atmosphere of social equality. The menu is quite restricted and none of the items are associated with high or low status, thus one does not feel the need to compete with neighbouring customers, as is the case in the more traditional Chinese restaurant. This case study includes therefore both a political motive for the adoption of this foreign culinary practice, while presenting the adoption from the consumer's position. In both cases, it reflects an acceptance of certain social changes.

In the case of Russia, however, Melissa Caldwell (2004) does not see the 'domestication' of McDonald's in Moscow as a symbol of Muscovites' acceptance of change; McDonald's has been absorbed into Muscovites' daily lives through McDonald's marketing campaigns emphasizing 'Nash', a Russian concept evoking the comfort of 'home' whether at the household or national levels. That is, for Muscovites, eating at McDonald's reinforces nationalism. 'Localization' involves different processes, including familiarization and domestication, until the initially foreign entity becomes routine. Caldwell contrasts localization with notions of creolisation and globalisation, which emphasize the indigenous aspects left after the adoption of foreign aspects, and demonstrates "how the 'local' itself is reinvented through processes of domestication" (Caldwell 2004: 7). The local is already a malleable concept that is continually changing. In this way, McDonald's domestication is not a dilution of a Russian ethos, but rather a part of it.

Similar processes of appropriation and localization of foreign foodstuff happened in historical times before concerns for the 'loss of authenticity' of certain groups took over the study of globalization, as demonstrated by Mintz (1985). While Mintz's interests lied in questions of political economy rather than in the goals, desires, and motivations of local subject, Ross Jamieson (2001) provides a historical account of the adoption of foodstuff at a more individual level. Jamieson investigates the motivations behind the adoption of foreign foodstuff in colonial Europe through a historical approach. He asks why cacao, coffee, and tea, were adopted in Europe over other caffeine-bearing plant products, by questioning the historical trajectories of their production, trade, and consumption. The adoption of these 'drug foods', per Mintz's (1985) term, were not only due to their stimulant capacities during a period of industrialisation, but also because their respective material cultures appealed to elite and bourgeois Europeans.[8] That is, Jamieson (2001) draws attention to the fact that these commodities were more than just drinks; they came with their own material culture and etiquette.

Cacao, the drink of the Aztec elites, and its paraphernalia were quickly adopted by the colonial elite of New Spain, especially by elite women[9], before it became popular in Spain and the rest of Europe. The appeal of coffee in Europe, on the other hand, is linked to the Arab social institution of the coffeehouse and its associated furnishings transposed into the European setting (Jamieson 2001: 275). Coffeehouses, where women were not admitted, became a place of

[8] Mintz's (1985) argued that sugar consumption, in the triumvirate of drug foods (with coffee and tea), was introduced as a new business venture for England and trickled down to the lower classes as a medicine and stimulant in the new factory setting.
[9] Coe and Coe (2004) linked the adoption of cacao by New Spain's elites, and the creolization of the diet, to the high incidence of Spaniards taking Aztec wives or concubines.

gathering for the bourgeoisie, a place for discussing business among merchants or other professionals (Jamieson 2001: 282). Finally, tea in China was consumed through an elaborate ritual process in porcelain cups and teapots, hence both tea and porcelain became sought after commodities once adopted. Tea in Europe came to be associated with the domestic and feminine spheres, as opposed to the male world of coffeehouses, and the tea ritual led by the senior woman of the house represented the respectability of that household (Jamieson 2001). Therefore, it is more than foodstuffs that were adopted in the colonial process; institutions and rituals already in place in the New World, the Arab world, and China were also appropriated and "co-opted into a unified vision of a European mercantile world" (Jamieson 2001: 287).

The examples and discussions presented in this last section lead to a number of points about the link between food, broad scale socio-political and socio-economic identities, and the appropriation of 'non-local' foodstuff or culinary practices. National cuisines (or culinary practices shared on a broad social scale) are created and negotiated by both elites and non-elites. In many cases, an important factor in the creation of a coherent, shared national cuisine is the audience. For example, cuisines are transformed to appear exotic to the traveller, as in the Belizean case, or to appear familiar to foreigners as was the case for early Japan. Certain new foodstuffs are integrated easily into culinary practices because they can easily be made local. Their consumption, taste, or etiquette reminds the consumer of already established rules. Other foods are seen as a pathway to encourage social change in a less conspicuous arena than customary political actions. Culinary practices are, in fact, always changing, with newly acquired personal recipes and ingredients that fall in and out of favour;

however, while cuisine is never fixed, certain rules and practices require more time to change. One point remains: food as “embodied material culture” (Dietler 2001: 72) is engrained in social identities, from the domestic to the global spheres.

The Social Zooarchaeology Approach

It has been demonstrated that cuisine refers not only to what is eaten but how food is procured, prepared, served, and discarded. That is, the concept of cuisine moves food beyond simple nutrition to include all material and social aspects of food from production to discard, including proper etiquette, seating arrangements, serving protocols, along with the more often thought of recipes for meals and accompaniments. These facets, accumulated to form cuisine, are used as both inclusionary and exclusionary mechanisms; they distinguish those who *know*, from those who do not. As such, they can be used as correlates for identity. In the present dissertation, I track multiple facets of cuisine within the Tiwanaku neighbourhood of Mollo Kontu, concentrating on the interpretation of faunal assemblages through the lens of social zooarchaeology.

Social zooarchaeology is a new designation[10] that groups together zooarchaeological work that breaks away from processual research question to investigate human-animal relationships within a particular group. Though the research questions are different, many of the methodological techniques and concerns are shared between traditional zooarchaeology and social zooarchaeology.

[10] To my knowledge, the first reference to this type of zooarchaeological research as “social zooarchaeology” comes from the work of Arkadiusz Marciniak (2005) though it is becoming more prominently used, with Nerissa Russell’s 2011 publication titled *Social Zooarchaeology*.

As mentioned earlier in this chapter, zooarchaeology developed as a subdiscipline of archaeology through the development of processual archaeology in the early 1960s. The theoretical context at the time emphasized the role of the environment in the development of cultural systems, and focused particularly on the study of subsistence patterns and their material correlates. Animal remains found at archaeological sites held answers to some of these questions, and it is in this time period that the identification of animal remains switched hands from hired zoologists to archaeologists trained in zoology. This new subdiscipline did focus on foodways, but with a particular emphasis on the role of animals in subsistence and political economy, and with the recreation of past environments.

Binford's ethnoarchaeological work with the Nunamiut of the Arctic was also influential in the development of zooarchaeology as a subdiscipline. This work demonstrated how identification and analysis of archaeological faunal material cannot only be used to reconstruct past environments and diets, but can also be used in interpretations of site function and activity areas, and of the social ramifications of these procurement strategies (see Binford 1978, 1981). Ethnoarchaeological work quickly demonstrated that the patterns seen in excavated faunal materials not only reflect human behaviour but are also influenced by a slew of cultural and natural processes, or *taphonomic* processes. A great part of the important zooarchaeological work that have marked the last 30 years have focused on developing methods to identify such taphonomic processes.[11]

[11] Taphonomy is an important factor in zooarchaeological research and many of these identification methods have been applied in the present zooarchaeological analysis,

Zooarchaeological methods are used in a variety of contexts from early hominid sites to historical urban centers, and often focus on environmental reconstruction, studies of economic specialization, including animal domestication, and studies of the role of animals within a broader political economy. There have also been an increasing number of studies that use faunal remains to investigate questions of status differentiation, trade, ritual use of animals, and the use of animals as identity markers (see Crabtree 1990 and deFrance 2009b for extensive reviews of zooarchaeological research on complex societies). Andean zooarchaeology has benefited from a particularly prolific array of ethnoarchaeological research on modern camelid pastoralist groups, actualistic studies on camelids material, and their implications for interpreting the past (e.g. Aldenderfer 1998; Browman 1987, 1990a, 1990b; Dransart 2002; Flannery *et al.* 1989; Kent 1982; Kuznar 1991, 1995, 2001; Lairana 2008; Mengoni 1991; Miller 1979; Mondini 2002; Moore 1989; Stahl 1999; Tomka 1994; Wheeler and Mujíca 1981; Yacobaccio 2007). Andean zooarchaeology has also benefitted from archaeological reconstructions of past subsistence economies (e.g. Capriles *et al.* 2008; Perez 2005; A. Webster 1993; Webster and Janusek 2003; Wing 1972, 1975). This growing body of research provides analogies to facilitate the interpretation of archaeological faunal material from the Andes and understand the role of camelids within Andean groups.

In this dissertation, I use zooarchaeological methods to address issues of subsistence economy and political organization that often characterize

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such as the study of the effects of bone density on skeletal representation (e.g. Stahl 1999), the effects of weathering (Behrensmeyer 1978), the effects of carnivores (Haynes 1983; S. Kent 1981), and the effects of fragmentation (Grayson 1984; Lyman 1984, 1994) among many examples.

zooarchaeological research. However, I also aim to go beyond these issues to explore how faunal remains can divulge aspects of daily life within an urban neighbourhood influenced by practice theory (e.g. Bourdieu 1977, 1984; Giddens 1984). That is, I aim to reconstruct the rituals of daily life – tending to the herds, butchery and preparation, serving and consumption, and ultimately discard of animals –as it is through the transformation of products into meals that households internalize the external world (see Weismantel 1988). I situate this research within an emerging movement toward a more socially oriented type of zooarchaeology that uses practice theory, referred to as social zooarchaeology (e.g. Marciniak 2005; Orton 2010; Russell 2011). Arkadiusz Marciniak explains the movement as such:

> Social zooarchaeology is explicitly aimed at overcoming the 'economic' bias in studies of faunal remains. It focuses on the social context of animal use by recognising that animals were maintained and consumed in ways that accented social relationships, such as those creating identity, highlighting ancestry, inequalities, importance of gender, negotiating social roles, links, and evaluating and/or maintaining social status. These issues have to be addressed on a microscale at the level of everyday activities (Marciniak 2005: 238).

Therefore, social zooarchaeology is differentiated from traditional zooarchaeology through its interpretive goals. It asks of researchers to explore zooarchaeological data in a way that highlights the daily lives of those who created these assemblages. Certain aspects of conventional zooarchaeological research, rooted in processual archaeology and cultural ecology, have been modelled after palaeontology. The focus of these elements has become the recreation of past 'living populations', where taphonomic factors (i.e. those human and non-human agential that affect animal bones from the time of death until archaeological recovery and analysis) are viewed as hindrances to the recovery of information. For social zooarchaeologists, on the other hand, taphonomic factors only add to our interpretations (Orton 2010). Many of these factors are in fact the result of socially mediated cultural practices, such as bone breakage and burning, or the intense weathering of discarded bone found in household trash pits indicating their long-term exposure to natural elements. Social zooarchaeology aims to tease out the cultural from the natural factors in order to integrate faunal material within a discourse on the acquisition, preparation, consumption, and discard of food remains as daily practices instead of emphasizing the environmental, political, and economic factors necessary in their acquisition.

My analysis of Mollo Kontu faunal remains follows the common parameters of zooarchaeological methods, and thoroughly considers human and non-human taphonomic process influencing the assemblages' life history prior to excavation. What situates my investigation within social zooarchaeology is the use of taphonomic results to discuss the chain of events, or chaîne opératoire, from animal's lives and deaths through to their archaeological recovery. The research interest in the case of this domestic context is the recreation of daily culinary practices, a goal that is inscribed within the broader theoretical questions of daily practice and the archaeology of agency (e.g. Dobres and Robb 2000; Hodder 2000; Marciniak 2005; Russell 2011). Ultimately, what differentiates social zooarchaeology from the traditional ways of doing zooarchaeology is that it attempts to step away from the evolutionary and Marxist models out of which the discipline arose, and where technological and economic choices are the prime movers of culture change. Instead, social zooarchaeology seeks to situate choices in culinary practices within a broader range of human experiences.

Organization of the Dissertation

In this introductory chapter, I situated my zooarchaeological research on daily food at Tiwanaku within a broader discussion of the meaning of culinary practices. In particular, I present how food is a semiotic device both at the household levels and in public settings (such as feasting events); a political device used to externalize and manipulate social relations differently depending upon the setting. I presented how anthropologists and archaeologists have discussed the influence of broader political movements on food consumption at the local level, while addressing consumer motivations. This discussion further demonstrated that culinary practices are more than the sum of the calories consumed or mere reflections of modes of subsistence. Discussions of cuisine include production, acquisition, serving, etiquette, material culture, seating arrangement, regimented schedules of dishes and meals, and more. Identity is reinforced and expressed through the ingestion of foodstuff, and the manner through which food is prepared, served and consumed. Though not all of these aspects can be gleaned from archaeological research alone, the use of social zooarchaeology allows for interpretations that take into consideration theoretical aspects of the anthropology of food.

Chapter 2 illustrates the variability in herding strategies and culinary practices found in Andean ethnographic and ethnohistorical accounts, as well as archaeological research. I present four models of modern herding strategies based on the chosen camelid product exploitation and discuss their possible zooarchaeological signatures. Given that herd management in the post-colonial Andes can be a reflection of a drastically altered political economy along with the known reduction of camelid herd size compared to prehispanic time periods, ethnohistorical records are explored to explore yet another type of herding strategy and camelid use. Following this, archaeological models of ancient Andean political economy are presented, with a particular focus on their implications for camelid herding and distribution. In particular, this line of inquiry endeavours to determine how much of the ethnographic and ethnohistorical past can be pushed back into the prehispanic past. I argue that the archaeological data on Tiwanaku's subsistence economy and feasting practices do not conform to modern or Inka analogies. Zooarchaeological studies of Tiwanaku sites suggest that a large portion of camelids consumed were exploited for their meat rather than for wool or as pack animals. Furthermore, I suggest that the sudden ubiquity of non-local maize in Tiwanaku contexts, which accompanied the adoption of specific feasting practices characteristic of Tiwanaku influence, may not necessarily mean that maize beer was wholeheartedly accepted by all who used the ceramics associated with maize beer production and consumption. In fact, it is suggested that beer made of local staples may have been integrated to the Tiwanaku drinking etiquette by certain residents.

Chapter 3 introduces archaeological research at Tiwanaku. It presents Tiwanaku as an important ceremonial center where pilgrims and residents participated in rituals that promoted broadly shared beliefs. Analyses of architecture, both of the city-wide layout and of particular structures, illuminate aspects of this promoted ideology. Then the residential aspects of Tiwanaku as an urban center are presented, with an emphasis on its cosmopolitan social composition. Each extensively excavated neighbourhood is discussed, highlighting data that suggests differences in identity between neighbourhoods and broadly shared Tiwanaku traits.

Chapter 4 introduces the reader to the neighbourhood of Mollo Kontu, which is the analytical focus of this dissertation. A brief history of archaeological research in the area is presented, followed by a description of the results of the four years of excavations done by the Proyecto Jach'a Marka between 2005 and 2008. Analyses of excavated remains suggest that Mollo Kontu was a broadly domestic area, intensively occupied throughout the urban phase of Tiwanaku (ca. AD 600-1100). The faunal data analysed for the present dissertation comes from two broadly domestic excavated sectors of Mollo Kontu. Mollo Kontu, however, contains more than domestic remains; it is the seat of two possible ritual structures likely used by the neighbourhood's residents. Finally, Mollo Kontu is uniquely characterized by the presence of lake-like features (or *qochas*) that suggest an agro-pastoral component to the area.

Chapter 5 describes the faunal assemblage from Mollo Kontu contexts and the results of their analysis. The analysis and data are presented first to assess the influence of cultural and natural taphonomic processes on the recovery and interpretations of faunal samples. Results of bone density attrition analysis and identification of weathering and carnivore damage suggest that there was minimal post-depositional disturbance of the faunal assemblages. Therefore, the faunal material from Mollo Kontu can be used to answer anthropological questions. The chapter also presents the methodology used, as well as data collected on the fragmentation levels of specimens, butchery marks, and burning patterns, along with discussions of species representation, mortality profiles, pathologies and skeletal element representation.

Chapter 6 presents interpretations of the results from Chapter 5 in a discussion of food acquisition, preparation, and discard practices. Patterns in age profiles and pathologies suggest that Mollo Kontu residents acquired the camelids consumed mainly from their own herds. Analysis of the preparation techniques, especially the patterned placement of cutmarks on skeletal elements, suggests there was a 'customary' way to butcher and prepare camelids. Furthermore, the high degree of fragmentation of all bones suggest that rendering bone marrow and grease, most likely in soups or stews, was an important feature of Mollo Kontu cuisine. This is further validated through ceramic vessel analysis presented in Chapter 7. Intra-site comparison of garbage pit contents and morphology suggests that large pits are not necessarily correlates for feasting events as density of faunal material is not correlated with size of the pits. That is, feasting or domestic refuse cannot be recognized based on the size of the pit at Mollo Kontu. Furthermore, analysis of weathering suggest that a good proportion of the faunal material discarded in garbage pits had been exposed to the elements for months, if not years. This suggest that the content of garbage pits at Mollo Kontu likely accumulated at a slow rate rather than representing a single depositional event.

Chapter 7 presents the analysis of other archaeological correlates of cuisine at Mollo Kontu performed by other members of the Proyecto Jach'a Marka. Fish remains recovered at Mollo Kontu were all local, coming from nearby Lake Titicaca. Plant remains also emphasize consumption of local foodstuff, with significant recovery rates of domesticates such as tubers and chenopods, and wild resources such as cacti. However, paleoethnobotanical remains also suggest a high incidence of non-local maize at Mollo Kontu. This contrasts with bioarchaeological results of tests performed on human remains from the Mollo Kontu residential burials. These individuals consumed a very small amount of maize compared to the rest of the Tiwanaku population, yet they had easy access to it. Finally, analyses of ceramic data recovered from garbage pits suggest that Mollo Kontu was primarily domestic, though the remains of some ceremonial ware were present. The ceramic assemblages also contained vessels commonly associated with chicha production and consumption in similar ratios to those found in other sectors of the site. This suggests that beer consumption at the household level may not have necessarily included exclusively maize chicha, since Mollo Kontu residents consumed little maize in their diet. Overall, results presented in Chapters 5, 6, and 7 suggest that the cuisine of Mollo Kontu was overwhelmingly 'local.'

Chapter 8 presents an interpretation of the results and a set of conclusions, putting together an overarching narrative on identity within the urban center of Tiwanaku. I argue that the culinary choices of Mollo Kontu residents express an identity rooted in local traditions perhaps developed in the Late Formative period, which preceeds the urban phase of Tiwanaku. My zooarchaeological results are compared to previous zooarchaeological and bioarchaeological research to situate the Mollo Kontu data in a broad temporal and regional framework. It is suggested that camelids rose in importance at a time where multiple settlements on the altiplano competed against one another to gain socio-political and ritual power. Following this, I suggest that the cuisine of Mollo Kontu, and particularly the focus on camelid consumption, may not be uniquely related to a need for feasting food by emerging elites but also come more broadly from the association of camelids, by the populations participating in these feasts, with the socio-political, ritual and physical landscape out of which Tiwanaku flourished. As such, the consumption of these animals has links to the local landscape and history. The exclusive focus on camelids seen at Mollo Kontu is unequalled in other Tiwanaku sectors and settlements in the area. The consumption of camelids raised by Mollo Kontu residents would have created a strong connection to the local landscape and local resources. The accumulation of the data on food production and consumption presented in this dissertation demonstrates how Mollo Kontu's identity is anchored in the daily ingestion of preferred altiplano staples, primarily acquired independently from the state. These daily meals were punctuated by festivals where Tiwanaku's greater shared identity was integrated, or manipulated, through chicha consumption.

This dissertation illustrates how the study of culinary practices and public consumption events can help archaeologists tease out issues of identity within complex archaeological contexts, such as urban centers. Based on the analysis of faunal material from the neighbourhood of Mollo Kontu, and data from other aspects of culinary practices provided by members of the Proyecto Jach'a Marka, I argue that there were two broad levels of identity manifested through culinary practices at Tiwanaku. On the one hand, the consumption of chicha, with its hospitality and drinking etiquette, and role in feasting events, effectively homogenized participants into a Tiwanaku 'state' identity. On the other hand, the daily consumption of camelid meat, in both public and household settings reflected a 'local' identity perhaps sparked by some local groups in reaction to the cosmopolitanism sweeping the altiplano, rooted in the consumption of exotic maize. That is, an investigation of daily culinary practices informs us on the residents' levels of identification with the state and their own pre-state origins. If to be Tiwanaku was to consume maize beer, then to be Mollo Kontu was to eat local.

CHAPTER 2: FOOD, CAMELID PASTORALISM, AND POLITICAL ECONOMY IN THE ANDES

Food production, acquisition, and consumption are shaped by socially constructed *tastes* on the one hand, and by environmental, economic and political factors on the other hand. As Weismantel (1988: 24) puts it: “people grow the foods they want to eat (or buy them), but also eat the foods they can grow or buy.” This chapter discusses food production (including pastoral strategies), acquisition, preparation, and consumption in the Andean highlands using ethnographic, ethnohistorical, and archaeological examples. These models and strategies are presented to build analogies with which to interpret the Mollo Kontu food remains for the reconstruction of past foodways.

First, ethnographic and ethnoarchaeological research demonstrate the variability of pastoral strategies in modern communities, related in part to choices in product exploitation (i.e. meat, wool, and/or transport) and constrained by herd reproduction requirements. These varied strategies do not, however, translate into straightforward archaeological correlates. Most modern pastoral strategies are reflections of their post-colonial contexts which may have altered prehispanic ‘traditional’ management styles. In the second part of the chapter, I turn to pre-Conquest herding strategies and subsistence practices described in ethnohistorical accounts of the Inka Empire, and suggested by archaeological data. Ethnohistorical documents suggest that state herd management was left in the hands of local communities, while hinting that private ownership may have also been common. The value of certain foodstuff is assessed through a discussion of Inka ceremonial events and important exchanges. The food preparation and consumption at the local community level relies on archaeological data to suggest preparation techniques similar to the ones presented for modern Andean pastoralist groups.

In the third and final section of this chapter I present theoretical models and archaeological data that seek to push back further in time our understanding of modern and ethnohistorical Andean political economy, especially in relation to food production and consumption. In particular, Tiwanaku's political economy remains a debated subject of inquiry; multiple lines of evidence, including herding strategies and use of raised-field technology, are interpreted as demonstrating either centralized or decentralized control by the capital (e.g. Albarracin-Jordan 2003; Goldstein 2003, 2005; Janusek and Kolata 2003; Kolata 1986; Park 2001; A. Webster 1993).

Yet our understanding of foodways at Tiwanaku is not limited to issues of food production, but increasingly includes discussions of food consumption. In particular, Tiwanaku's widespread influence is associated with the production and consumption of maize beer for commensal politics. That is, hospitality rooted in the ingestion of chicha (maize beer) is viewed as an integral part of Tiwanaku's attraction and culinary identity within both the public and domestic spheres. As such, the study of everyday culinary practices co-existing with feasting practices further illuminates our understanding of political issues at Tiwanaku. In this chapter, I evaluate the role of maize beer consumption for the formation of a broad Tiwanaku identity. I suggest that the performance of hospitality duties and commensality significantly contributed to building Tiwanaku's identity, but the menu to be prepared and served was the prerogative of the hosts who could use food to express their positions on urban and state politics.

Food and Flocks: Modern Camelid Herders

This section presents published ethnographic and ethnoarchaeological data on modern Andean camelid pastoralists in order to assess the archaeological signatures of modern herding practices. The focus on pastoralist groups rather than ethnographies of purely agricultural groups allows for the creation of interpretive models of mortality profiles for faunal remains excavated within household contexts. That is, the age at which an animal is killed (age-at-death) and enters the archaeological record of household contexts is often influenced by the herd management strategies that pastoralists put into practice. Zooarchaeologists regularly use age-at-death frequencies from faunal assemblages to reconstruct past herd management practices[12] (see Chang and Koster 1986; Marciniak 2011; Payne 1973). Camelids provide many useful products both in life and in death, resulting in variable management strategies related to preferred product exploitation, and therefore leaving variable patterns in age-at-death frequencies. In the Andes, the primary desirable products and services of camelids are wool, meat, and beasts of burden in long-distance caravans. This section discusses four pastoral strategies based on ethnographic and ethnoarchaeological data. While these accounts suggest pastoralists often chose different strategies, in actuality, these practices result in similar camelid mortality profiles.

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[12] Chapter 5 of this dissertation for a more detailed description and critique of the use of mortality profiles

This section also presents data on household culinary practices in modern Andean communities to identify archaeological correlates for food preparation, especially meat preparation. These examples suggest that modern pastoral households eat very little meat and that it is usually served boiled in soups or in stews. Unlike roasting, this practice of boiling meat rarely leaves detectible traces of heat modification on bone surfaces, but may be recognized archaeologically through high levels of bone fragmentation related to reducing body parts into smaller pieces appropriate for serving household members.

Herding Practices

Ethnographic and ethnoarchaeological works on camelid husbandry focus mainly on small communities of specialized herders, or agro-pastoralists in the Andean *puna* environmental zone (i.e. above 3700 masl) where camelids are the primary economic focus (e.g. Browman 1990a; Dransart 2002; Flannery *et al.* 1989; Flores-Ochoa 1979 [1968]; Kuznar 1991; Miller 1979; Nachtigall 1966; Orlove 1981; Tomka 1994; Yacobaccio 2007). These pastoralists live in small hamlets, travelling at times to temporary or seasonal residences situated in high altitude terrain. Although Tiwanaku residents lived in an urban setting unlike that of modern pastoralist groups, ethnographic analyses of camelid herding communities give insight on environmental and biological factors influencing herd reproduction, the use of camelid products in daily practices, and the influence of herding practices on meat consumption for groups who have direct access to these animals.

Because camelids require access to extensive areas of pasturage and are well adapted to high elevations, modern Andean camelid pastoralism is undertaken mainly in the *puna*, an environment defined by its high altitude typically between 3700 and 5000 metres above sea level (masl). Most of the Bolivian altiplano, where Tiwanaku is situated, is considered a puna environment. The urban center of Tiwanaku is roughly 3800 masl, and is surrounded by mountainous areas that could have been used by camelid pastoralists. Puna environments are often viewed as marginal for agriculture production (S. Webster 1973: 129). Agro-pastoral inhabitants of the puna primarily focus on small-scale tuber and quinoa cultivation. Modern pastoral households acquire agricultural products by maintaining land on the flanks of the Andes that can sustain a greater array of crops than the puna environment, or by maintaining exchange relations with lower-elevation agriculturalists.

There are four camelid species in the Andes; the guanaco (*Lama guanicoe*) and vicuña (*Vicugna vicugna*) are wild species, whereas the llama (*Lama glama*) and the alpaca (*Lama paco* or *Vicugna paco*[13]) are domesticates. Domesticated llamas and alpacas are often utilized for different purposes in modern Andean communities. Alpaca husbandry usually focuses on producing fine wool (e.g. Dransart 2002; Flores-Ochoa 1979 [1968]), whereas llamas are used as pack animals for trade along the Andes (e.g. Browman 1990a, 1990b; Flannery *et al.* 1989). Though most animals are ultimately consumed once they are no longer productive (e.g. when their wool is too coarse, or when they can no longer participate in long-distance transport), there is no modern example of camelid herding aimed primarily at meat production in the ethnographic and ethnoarchaeological literature, though it is now a common practice at the

[13] The origins of the alpaca are still debated – see Kaldwell and colleagues (2001), Mengoni and Yacobaccio (2007), and Dransart (2002: 17-23) for discussions of this issue.

household level within some indigenous communities of the Bolivian altiplano (Randi Gladwell, pers. comm.). Lawrence Kuznar (1995), however, presents ethnoarchaeological data on herding of European livestock (i.e. goats, sheep, and cows) by Andean pastoralists for meat production (see also Yacobaccio 2007 for a discussion of a mixed fibre/meat pastoral strategy).

All four species of camelids are indistinguishable from one another osteologically, with the exception of some aspects of dentition and average body size. First, there are visible differences in incisor characteristics, where vicuña incisors are morphologically distinct from the other three species, guanaco and llama incisors are indistinguishable, and alpacas lack enamel on their lingual surface (Miller 1979: 6). Second, the South American camelids range in size, where guanacos represent the largest of the four species, followed by llamas, alpacas, and vicuñas representing the smallest. The reality, however, is that these size ranges are not fixed and often overlap between species. This is problematic when identifying and classifying disarticulated, often highly fragmented, skeletal remains from archaeological contexts. Most fragments of skeletal elements cannot be assigned to a specific camelid species. Jonathan Kent's (1982) ethnoarchaeological work provides useful statistical methods derived from standardized measurements of skeletal elements of all four species. While Kent's osteometric data does not accurately predict to which camelid species the specimen in question belongs, his statistical method nonetheless assists in approximating skeletal specimens to species based on the species average adult size range.[14] It is possible that more species may have existed prior to the Conquest (Miller and Gill 1990), an event that contributed to

[14] These statistical methods are discussed in more detail in Chapter 5.

the decimation of camelid populations throughout the Andes. Furthermore, camelid hybrids within and between domesticated and wild forms have been observed (Dransart 2002: 64-65; Moore 1989: 126). Hybrids and undocumented species raise the possibility that camelids from the Tiwanaku period may not fit into Kent's four size categories, which were derived primarily from modern camelid populations.

The domestication of llamas and alpacas saw the increased exploitation of valued camelid products. As mentioned above, currently the most common uses are for wool production and as pack animals in transport caravans. They also provide meat, most often when animals are deemed unproductive in their primary functions. These products, and others provided by camelids, are ingrained in every aspect of daily and ritual life. Wool is used for weaving garments, along with making bags and ropes. Camelid dung is used as fuel, which is of vital importance on the treeless altiplano where alternative sources of fuel are rare. Dung is also used as a fertilizer. In fact, certain types of potatoes cannot grow without the fertilizing benefits of camelid dung (Browman 1990a: 397). Camelids provide meat, viscera, blood, and bone grease and marrow for consumption, as well as large quantities of fat, a prized good used both in rituals and in cooking (Bastien 1978: 54; Flores-Ochoa 1979 [1968]: 94). In fact, alpaca carcasses can produce between four and six kilos of fat per animal (Flores-Ochoa 1979 [1968]: 94). The pelts and hides of camelids are used for bedding, bags, seats, sandals, while sinews and thongs are used for binding tools and roof frames (S. Webster 1972: 122). Bezoar stones, which form in camelid stomachs, are prized for their magical and medicinal powers (Moore 1989: 102).

Camelids therefore provide a wide range of products, both in the lifetime of the animal and once the animal is culled from the herd. The documentation of their potential uses is important to interpretations of faunal assemblages from archaeological contexts, particularly for camelid mortality profiles. That is, herders weigh the consequences of culling animals at each stage of growth by evaluating usefulness of individual animals. For example, fully grown juvenile animals would provide the highest amount of meat and fat, but culling female juveniles would greatly diminish the overall herd reproductive capacity. Culling male juveniles would eliminate them for cargo work. Finally, culling animals of either sexes would negatively impact wool and dung production. These practices influence the composition of faunal assemblages in archaeological contexts.

Ethnographic and ethnoarchaeological research in the Andes relating to herding strategies are discussed next to assess the many facets of camelid production. Four cases are presented to help build mortality profiles for each situation: camelids that are raised primarily for their wool, camelids kept primarily for their role in caravan transport, camelids that are raised for both wool and meat production and, finally, domesticates raised principally for their meat.

<u>Herding strategies: wool as a primary product</u>

Though modern pastoral strategies aimed at wool exploitation usually favour alpacas over llamas (e.g. Flores-Ochoa 1979 [1968]), both animals can be sheared (e.g. Penelope Dransart's 2002 observations of Chilean herders raising llamas for their wool). Camelids are usually sheared once every other year, with an average alpaca producing three kilograms of wool biennially (Flores-Ochoa

1979 [1968]: 93; Browman 1987: 127). Nowadays, wool producing camelids are killed at around 7 or 8 years of age (e.g. Dransart 2002: 12; Flores-Ochoa 1979 [1968]: 89), which means each animal provides wool on average three times during their lifetime. Herders explain that animals are culled between the ages of 7 and 8 because they are "no longer economically profitable," though their life expectancy is twice as long (Flores-Ochoa 1979 [1968]: 89). These data suggest that camelids do not produce large quantities of wool. For comparative purposes, wool production per sheep in New Zealand and Australia is around 3.5 and 5.5 kilograms annually (Khanvilkar *et al.* 2009: 43).

One of the biggest challenges in both llama and alpaca husbandry practices, and an influential factor in herd composition, is the issue of herd reproduction. The current alpaca fertility rate is only 50-60%, though this may be due to post-colonial changes in human-controlled breeding practices; pre-historic practices may have had higher fertility rates, perhaps as high as 70-85% (Browman 1987: 127). Furthermore, only 40% of pregnancies are carried to full term (Moore 1989: 107), which means that on average, female camelids give birth to one animal every two years once they are reproductively viable (around 2-2.5 years old). These compounded factors result in a very slow herd reproduction rate. Most herd management strategies, therefore, are concerned primarily with increasing, or at least maintaining, herd size (see Dransart 2002: 130). A consequence of this concern for herd reproduction is an older age-at-death profile for females kept alive for their reproductive capacities (Browman 1990a: 335).

The age-at-death patterns for males are more flexible. Although males produce fine wool, they will be culled before healty reproductively viable females if the management strategy of the herders demands the death of prime-age animals, since only a few males are necessary for herd reproduction. Given that herd size needs to be managed relative to available pasturage and sources of water, young males who would otherwise be good wool producers may be culled and consumed in areas with restricted pasture lands. For example, herd composition for wool producing economies generally presents a sex ratio of one male per 20 to 25 females (Browman 1990b: 398-399).

Another factor influencing the ratio of males to females within a herd is the aggressive behaviours displayed by male camelids that put the herd at risk of injuries and fatalities (Moore 1989: 102). Culling males at a young age circumvents this problem and diminishes herd size. If controlling herd size to control for pasturage and water sources is not an important factor in management strategies, male aggressive behaviour can be controlled through castration, which would not affect the ratios of males to females. In Dransart's (2002) case study of Chilean wool producers, castrated males are herded into adulthood except for select males used for reproduction. Overall, a wool-producing pastoral strategy would result in mortality patterns of females living to at least 8 years old. Male camelids would either be culled as juveniles, creating a higher incidence of young animals in the mortality profile, or kept into adulthood until the same age as the females, which would result in an overall older age profile.

Herding strategies: caravans

The use of camelids as pack animals for long-distance trade is usually restricted to the more adaptable llama rather than the alpaca. However, there are instances when alpacas can be used as pack animals (e.g. Moore 1989: 275). Llamas are kept as pack animals until they are too arthritic to carry their burden over long distances and steep terrain, or when their teeth are so worn that they can no longer eat properly and start losing weight. Arthritis starts developing in pack animals after 10 years of service (Flannery *et al.* 1989:100), that is, around 13 to 14 years of age since llamas are integrated into caravans around 3 years old. This makes the llamas "use-life" twice as long as that of the wool-producing alpacas.

Male llamas are generally preferred for use in caravans (Browman 1990a: 335), which means that both males and females would be kept alive into old age when herding camelids for use in transport. In the Ayacucho region of Peru, caravans are constituted primarily of castrated males of 4 years and over (Flannery et al. 1989: 96-97; see also Browman 1990b: 398-399). Herd reproduction is impeded by a multitude of factors, including camelids' low fertility rate, high infant mortality, loss due to puma attacks, death through parasites such as mange, and thievery. It is also imperative to maintain the correct ratio of males to females for herd reproduction. For example, Flannery and colleagues (1989) propose that the Ayacucho annual ritual of *suñay*, where gift of a camelid from the host's herd to a participant is customary, is in fact more than a display of generosity; it is a mechanism to ensure all herders have a sufficient number of reproductive males or females to guarantee herd reproduction. Imbalances in sex ratios within the herd through time are usually responsible for bringing a group to near extinction.

Females are kept for reproduction. There is no data as to the age-at-death of female llamas in these circumstances, but it is likely to follow that of the alpacas, around 8 years old (see above). The llama herds in Ayacucho averaged 25 animals per household, but ranged between 15 and 40 llamas, 75% of which were adults (Flannery *et al.* 1989: 104). Males often leave on caravans that can consist of only 2 to 3 animals, or go up to 15 to 20 animals from a herd of 40 heads. These herd numbers may be context specific, as Browman (1990a: 327-238) compiled data from all over the high Andes that suggest an average herd size ranging between 150 and 250 camelids.

<u>Herding strategies: mixed wool and meat</u>

Most archaeological studies of faunal mortality patterns to investigate economic specialization share the basic assumption that these animals are raised specifically to produce a limited number of products whereas mixed production strategies are often used (Yaccobacio 2007: 145). Camelids are raised for a diversity of products, and therefore herding strategies may emphasize the exploitation of multiple products. For example, traditional alpaca herders in southern Peru will keep males into adulthood to work as both pack animals and wool producers (Moore 1989: 275). In fact, species-specific specialization seen in most herds today may be a post-colonial artefact of camelid herd depletion since the introduction of European livestock (Yacobaccio 2007: 146).

Hugo Yacobaccio (2007) proposes an ethnoarchaeological model for a mixed exploitation strategy where both camelid wool and meat are the desired products. He demonstrates that in cases where wool is the main desired product, but meat is also an important exploited resource, the mortality profiles at the producer household level emphasize adult animals over younger animals.

This suggests that interpretations of high incidence of adult camelids may not represent a pastoral strategy aimed solely at wool production or use of camelids for long-distance transport.

Yacobaccio (2007) bases his model of a fibre/meat management system on his ethnoarchaeological observation of Andean herders of the northwest Argentinean puna. Like in the examples presented for wool production strategies, camelids that are raised for their wool and for meat production are sheared from the ages of 2 to 8 years old. The rate of slaughter for meat production in this case is of one adult animal (that is, 3.5 years old or older) every two months. This is in addition to the periodic sacrifice of very old animals (older than 8 years old) a few times a year to make *ch'arki*, a type of freeze-dried meat that can be stored for delayed consumption as it preserves for long time periods[15] (Yacobaccio 2007: 149). Yacobaccio's observations reinforce the issue of herd reproduction; the newborn mortality rate is between 38% and 50% due to illness (Yacobaccio 2007: 149). The high mortality rate of *crias* (newborn camelids) is not reflected however in the mortality profile presented, as these animals were buried away from the shelters and corrals analysed. The mixed fibre/meat system presents a mortality pattern where adults 3.5 years old and older predominate at over 70% over sub-adults and crias (Yacobaccio 2007: 151-152). That is, mortality profiles dominated by adult animals do not necessarily represent a single economic specialization in wool or for use as pack animals, but can also suggest a management strategy emphasizing meat production to some degree.

[15] Ethnohistorical records say that ch'arki could be made out of guanacos, llamas, alpacas, and deer (Murra 1956). It has been hypothesized that this type of production pre-dates the Inkas (Miller 1979; Miller and Burger 1995).

Herding strategies: meat

Modern camelid pastoral strategies either include a mix of production goals (fibre/meat/pack animals), or specialize in fibre production or caravan trading. There are no modern analogues for camelid herders who raise these animals for their meat only. However, Andean pastoralists nowadays herd European livestock such as goats, sheep, and cows, with a meat production strategy in mind (Kuznar 1996; Yacobaccio 2007). Kuznar (1996: 119) demonstrates that animals herded primarily for their meat showed a significantly higher proportion of bones from juvenile animals. The choice of killing young animals for their meat is predicated on the fact that as they grow, the animals rapidly assimilate forage into meat and fat, whereas once the growth period ends their consumption of pasturage does not increase their weight but only maintains it (Kuznar 1996: 119). Killing an animal at its prime age for meat production frees up good pasture land for the rest of the herd animals. Herding strategies with a focus on camelid meat production would likely still aim at optimum herd reproduction, therefore the mortality profiles would still include older females along with younger animals.

Implications of herding strategies for mortality profiles

The previous discussion of herd management strategies by modern South American camelid pastoralists demonstrates their variability and flexibility. Based on these descriptions, we can hypothesize how certain strategies would translate in the archaeological record. In particular, the age-at-death of male and female camelids is presented as the strongest indicator of resources likely exploited, but other factors such as pathologies allow for a more refined identification of possible herd strategies. The mortality profiles for all strategies would present older age-at-death for female camelids to ensure herd reproduction. Producer sites should also include very young animals that died of natural causes.

Wool production sites should be composed predominantly of animals 8 years old or older. It is also possible that subadult males (3 years old or younger) would be culled to prevent aggressive tendencies if castration was not performed. At sites where both wool and meat production was emphasized, over 70% of animals recovered were 3.5 years old or older, as males were periodically killed for their meat once they reached adulthood. In cases where herding strategies favoured the use of camelids for transport of goods, both males and females should reach old age. Furthermore, animals involved in transport may suffer from pathologies, such as arthritis, that are recognizable archaeologically, though the actual cause of the pathology can only be suggested.[16] These animals would most likely be adult males.

The discussion of the various modern cases primarily shows that even though certain biological constraints – such as the low herd reproduction rates and the resulting need to keep fertile females alive longer – would shape culling strategies in a consistent way, most herding strategies remain case-specific. The most significant difference in terms of mortality profiles between the four strategies discussed above is with herds aimed at meat production. The mortality profiles for herds aimed at meat production would contain a high ratio of juvenile animals (between 1.5 to 3 years old), although it is assumed

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[16] See Chapter 5 for a more in-depth discussion on the interpretation of pathological specimens.

that a number of females would also be kept into adulthood for herd reproduction.

Andean herding strategies are therefore not consistent between groups based on the varied ethnographical and ethnoarchaeological observations presented. In fact, it seems likely that herding strategies, even within the same group, fluctuate in time depending on household needs and environmental factors. Although zooarchaeologists may wish herding strategies to be fixed, and thus leave predictable signatures in the faunal record, the reality is that herders are flexible in their exploitation strategies (see Tomka 1994 for an example of intra-community variability). In addition, the faunal remains from which mortality profiles are produced are further affected by social factors that govern or influence patterns of distribution, preparation, consumption, and discard of meat. In the following section, I discuss these patterns, using modern ethnographic and ethnoarchaeological examples, along with an overview of "traditional" Andean meals and preparation techniques.

Andean Diet and Cuisine

Ethnographic and ethnoarchaeological research on modern pastoralist groups discussed above not only illuminates herd management strategies, but also informs us on meal preparation and consumption for pastoralist communities. Camelid pastoralists live mostly in high elevation ecological zones, as this is the preferred environment for camelids. These environmental zones however are not propitious for a wide variety of agricultural crops. This section not only presents information on the favoured methods of preparation for meat and agricultural products, it also demonstrates that the diet of modern herders does not consist solely of foodstuff grown and raised within high elevation environments, but is in fact supplemented by lower elevation foodstuff. Such inter-zonal exchange is common in the Andes and forms the basis of John Murra's vertical archipelago model (1975 [1972], 1985) for the procurement of resources from multiple ecological zones outside of a market economy.[17]

One of the most important insights from ethnographic and ethnoarchaeological observations of camelid herders is that pastoralists do not eat more meat than the agriculturalist villagers who live in lower elevation zones. In fact, only a very small portion of the pastoralists' diet consists of meat. The average number of animals killed in a year varies between case studies, with an average of one animal every two to three months (Moore 1989: 133; Yacobaccio 2007: 149). Notably, differences in the number of animals killed and consumed are based on the economic means of the household under study. For example, while a relatively poor family in Paratia (Peru) will kill 3 to 4 animals a year for household consumption, a well-to-do household can eat up to one camelid per month (Flores-Ochoa 1979 [1968]: 41). Yet, not all of the animals killed will necessarily be consumed by the household; great quantities of meat end up in lowland households (Flannery et al. 1989: 43). Meat is transformed into ch'arki that can be exchanged for lowland agricultural products. The consequences of ch'arki exchange on the archaeological record are discussed later in this chapter.

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[17] A detailed discussion of inter-zonal complementarity as expounded by Murra, and a discussion of the debates surrounding whether a similar system of zonal complementarity took place in the pre-Conquest past, are presented in the next section of this chapter.

Animals chosen for consumption are commonly unproductive older animals and younger females who have failed to reproduce (Moore 1989: 111). Animals that died of natural causes or by accident are also often consumed (Flores-Ochoa 1979 [1968]: 94), though there are exceptions. For example, Dransart (2002: 54-55) notes that herding communities of the Atacama puna of Chile do not consume animals killed by lightening (an occurrence that is not infrequent on the treeless altiplano), nor do they harvest the animal's fleece. In his Argentinean case study, Yacobaccio (2007: 150) notes that newborns that died from illnesses were not consumed; rather they were buried in distant locations away from the herder's residence and corals, which suggests their remains would not be recovered at household sites. Inka chronicles suggest that young animals that were afflicted with certain types of disease were not consumed but rather buried, sometimes alive, far from the herds they could contaminate (Bernabé Cobo [1653] cited in Kolata 2003c: 460). Ultimately, what is conceived as good to eat is variable, and although the particular emic reasoning behind consumption choices cannot be gleaned from archaeological material, the presence of taboos and food preferences will affect consumption patterns that zooarchaeologists can interpret through inferences from historical records and modern ethnographic studies.

The typical diet of modern herders in Peruvian highland communities, as observed by Flores Ochoa (1979 [1968]) and Flannery and colleagues (1989) consists mainly of carbohydrates, with potatoes (boiled or as *chuño* or *tunta*[18]) forming the bulk of the diet, along with good quantities of plants such as maize,

[18] *Chuño* and *tunta* are types of desiccated potatoes that preserve for very long time periods. They get reconstituted in water before consumption. See Flannery *et al.* (1989: 75-82) and Bruno (2008: 191-194) for a detailed description of their preparation.

tubers, quinoa, *cañiwa*, squashes and wheat (Flannery et al. 1989: 41-42).[19] Some days are meatless, but it is estimated that on average an individual consumes between 0 and 200 grams of meat per day (Flannery et al. 1989: 43). Paratían pastoralists in the Peruvian highlands ate three meals per day: a breakfast soup, a light lunch consisting often of left-over morning soup, or toasted grains and boiled *chuño* and/or maize, and another soup for dinner. Major ingredients used for these meals include grains such as quinoa, wheat, barley and maize, and tubers including chuño, tunta and *oka*, and pieces of meat, either fresh or dried as ch'arki (Flores-Ochoa 1979 [1968]: 42-43). Since Paratían pastoralists grow little other than tubers at higher altitudes, they would exchange ch'arki and chuño with farmers in lower areas for the majority of the ingredients necessary for their meals. Blood sausages were also consumed, though rarely as they do not keep easily. Condiments included *ají*[20] and edible clays. Drinking consisted mostly of hot beverages such as coffee or herbal infusions, and a variety of alcohols. Coca leaves acquired from lower elevation areas were chewed or infused throughout the day (Flannery *et al*. 1989: 43; Flores-Ochoa 1979 [1968]: 44), as coca is an appetite suppressant that also alleviates fatigue.

Generally, most of the meat consumed is in the form of chopped up pieces of meat on bone boiled in stews or soups (Miller 1979: 88; Moore 1989: 200). Boiling fragmented bones allows the release of marrow and bone grease into the broth for flavouring. For zooarchaeological purposes, high fragmentation of bones could be associated with this type of cooking, but the

[19] Maize, squashes and wheat are not grown in the puna but need to be exchanged from lower elevation zones.
[20] *Ají* is a type of chilli pepper grown in lower elevation zones.

action of boiling *per se* does not leave noticeable marks on the bones.[21] Miller (1979:86) mentions that sometimes slabs of ribs are roasted on an open fire, leaving burn marks only on the exposed areas of the bones (i.e. the defleshed sections) if they are placed directly in the fire. Another cooking technique observed is called *pachamanca* where joints of meat on the bone are placed with tubers in an earth oven. This technique, however, appears to leave no heat modification on the bone, at least none observable with the naked eye (Moore 1989: 200-201).

In sum, these three cooking techniques, (i.e. boiling in stews and soups, roasting over an open flame, and the use of a pachamanca oven) leave few to no readily visible traces on faunal remains. High bone fragmentation levels could suggest boiling meat in soups or stew, although bone fragmentation could be post-depositional. Therefore, inferences on culinary practices need to be strengthened with other archaeological correlates. For example, the archaeological recovery of a "bowl-shaped" pachamanca-style hearth with a burned surface and large rocks (Moore 1989:201), or the correlation of bone fragment size with the diameter of cooking pots (e.g. deFrance 2010), would promote discussion of meal preparation techniques.

Although ethnographies and ethnoarchaeological research provide useful analogies to build interpretive frameworks of past behaviours, a number of these modern practices have been shaped by colonial and post-colonial events, such as the introduction of European crops and livestock, the diminution of large camelid herds, and the introduction of land reforms that marginalized

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[21] Although, Koon et al.'s (2010) research using a Transmission Electron Microscopy (TME) approach is showing promising results for the identification of bone modifications under conditions of low cooking heat.

indigenous groups. Furthermore, the production and distribution of camelids for urban residents can be more complex and multi-layered than household subsistence economies (e.g. Zeder1991, 2003). Information on food production and cuisine set in more complex socio-political and economic spheres can be teased out of the chronicles and historical documents that followed the Spaniard's conquest of the Inka Empire. Within the context of this dissertation, the example of Inka herding and culinary practices may therefore present more accurate analogues for the interpretation of material from the ancient urban center of Tiwanaku.

Ethnohistorical accounts of the Inka Empire

> Oh, Lord, ancient Lord, expert Creator, thou who maketh and establishes, saying: 'in this lower world let them eat, let them drink,' increase the food of those whom thou hast established, those whom thou hast created. Thou who commandeth and multiplieth, saying: 'Let there be potatoes, maize, and all sorts of food,' so that they shall not suffer and, not suffering, do thy will; let it not freeze, let it not hail; keep them in peace.[22]

When Spaniards explored the Andes and met its inhabitants, they wrote down their puzzlement, fascination, and at times horror with the Andean ways they encountered. These records serve as a fountain of information for the Andean scholar wishing to get a glimpse into Andean socio-political organization and worldview. Spaniards were particularly interested in recording Inka statecraft and management, along with the wealth of the Empire. Of particular interest for this dissertation, the Spaniards described the Inka state's herd management system, including estimations of camelid herd size and

[22] Quechua prayer recorded by Molina de Cuzco in Relación de las Fabulas y Ritos de los Incas (1943), and translated by John H. Rowe for John V. Murra; published in Murra 1956, p. 37.

ownership data found mostly in census documents called *visitas*. This section details what is known of the Inka state's herd management system and infers possible local ownership and management strategies at the community level. Following this discussion, information on food distribution, preparation and consumption is presented.[23]

Herding under the Inka Empire

The Spaniard fascination with the Inkas' large camelid herds affords us an approximation of how the Inka state managed its animal population. All camelids belonged to the Inka upon a community's incorporation into the Empire. Herds would then be separated in a tripartite division, with one third belonging to the state, one third reserved for the Inka religion, and one third gifted back to the community for their own self-sufficiency. Camelids of the Inka state were tended to by local herders in the puna areas, away from the planted fields (Murra 1956: 80). In most communities, these herders were young people, roughly between the ages of 9 to 20 years old, though it is possible that in regions with great herd size, full-time specialists took care of them (Murra 1956: 91-92).

The animals that were part of the state's herds were counted in the tens of thousands. One of their primary roles was to furnish the state in wool for textile production. In Inka times, textile was made of alpaca wool, whereas the rough llama wool was used for making rope (Murra 1956: 117) or coarse clothing (Rowe 1946). The importance of fine wool cloth cannot be

[23] The material I present in this section of the dissertation comes from well-known investigative work on the Spanish chronicles by John V. Murra (1956) and John H. Rowe (1946), rather than the originals themselves. Murra's (1956) dissertation work on the economic system of the Inkas is one of the most comprehensive analyses of the Inka way of life as seen through the biased observations of Spanish chroniclers.

underestimated in the Inka world; textiles were burnt, sacrificed and/or exchanged in various events from political and military dealings to religious ceremonies. Fine textile was used to broker peace and provided as bride wealth, among its many usages (Murra 1956: 115).[24] Cloth was made by women at the household level as part of a rotating labor duty owed to the state, but there were also specialists such as the *aqllakunas*, or Chosen Women, and male expert weavers who would create particularly prized textiles (e.g. Costin 1998).

Llamas were also used as pack animals for the army and for trade along the Andean mountainous landscape. Llama trains would leave for the coast packed with potatoes, chuño, ch'arki and wool, and would come back with coca leaves and maize from the lowlands (Flannery 1989: 115). At the time of the Conquest, llamas were considered productive from 3 to 10 or 12 years old (Rowe 1946: 219), an age range similar to the use-life of llamas in modern Ayacucho (Flannery *et al.* 1989: 100).

Camelids were not only valued for their wool, meat, and cargo capacities; camelid by-products were also used similarly in Inka times as in ethnographic examples. Llama fat had important ritual properties. For example it could be burnt with coca leaves for divination. Camelid dung was used as fuel and fertilizer (Murra 1956: 90). Camelids were also sacrificed for the Inka state religion, and donated by the state to local *curacas*[25] for their loyalty (Flannery *et al.* 1989: 109). The latter suggests that local lords could have large private herds, and were able to give away some of their animals in exchange for labour.

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[24] See also Costin (1993, 1998, 2002) and Murra (1962) for detailed discussions of the importance of textiles in Andean political economy, gender relations, and social identity formation.
[25] Local hereditary leaders

A few families could have herds as large as 1700, particularly those of the curacas, and these would be so large as to need extra hands to tend to the herd (Murra 1968, 1984). Private ownership of herds, outside of state control, is not detailed within the ethnohistorical records of the Conquest, but is likely since different chroniclers mention grants of llamas to individuals and gambling on llama races, implying some kind of private ownership (Murra 1956: 93). In fact, the Aymara region in the Southern Titicaca basin where Tiwanaku is located was one of the richest in camelid herds; a number of these herds are said to have belonged to its inhabitants outside of state control (Murra 1956: 90).

Incaic Foodways

Our current understanding of foodways under the Inka Empire comes from archaeological and ethnohistorical accounts. This section hints at the value of certain foodstuff through their documented role in Inka ceremonial practices, and provides a brief description of plant and animal production and consumption during the Inka period. In terms of food preparation and cuisine in non-ceremonial contexts, archaeology fills in the blanks left by the Spaniards' records.

Most of the foodstuffs Spanish chroniclers documented relates to their role in ceremonies. For example, Polo (in Murra 1956: 32) talks of one thousand guinea pigs immolated by priests each month, along with a hundred llamas, to avoid damage to crops by frost. Similarly, coca leaves, a highly valued cultigen, were primarily used for ceremonial purposes; in fact some observers believed it to be a royal monopoly (Murra 1956: 30). This contrasts with the modern widespread consumption of coca leaves by people of all social status, even in zones where it does not grow, such as the high elevation puna. Maize was a particularly prominent foodstuff in the writings of the chroniclers, and rituals surrounding its planting and harvesting were recorded in great detail. It may be that maize caught the attention of Spanish observers because of its consumption in the form of chicha, a prized fermented drink, in visible public rituals. Maize, along with llamas and textiles, were also common gifts offered at community level ceremonies such as at a child's first haircut ceremony and as bride wealth in Inka times (Murra 1956: 112), which further speaks to the intrinsic value given to camelids (both alive and their wool), and to maize.

In contrast to maize, little is known about potato cultivation and consumption during the Inka period based on the Spanish sources. Murra (1956: 21-22) argues that the association of potatoes with peasant life and poverty, and the fact that ritual performances for their growth took place at the local level in villages where chroniclers would not be spending much time, is responsible for the limited importance accorded to this staple in the ethnohistorical record. That is, the daily consumption of potatoes and other crops was hidden from chroniclers, tucked away in residential settings.

In terms of meat consumption under the Inka Empire, the ethnohistorical records suggest that meat of all species of camelid was eaten, but meat was considered a luxury for commoners (Murra 1956: 379). For many non-elites, meat was only consumed while on army duty or at ceremonial events where the meat of a sacrificed camelid was distributed. In contrast, the upper classes had regular access to much greater quantities of meat, and the men and women serving the Inka religion were fed meat from the Sun's herds (Murra 1956: 88-89). Therefore larger meat consumption levels were dictated either by direct access to large herds, or through elite status. Low meat consumption for non-elites may not have been common throughout the Empire however. Indeed, comparison of pre-Inka and Inka time period faunal assemblages at the site of Xauxa in the Peruvian highlands suggest strong meat consumption during both periods (Sandefur 2001). Furthermore, the Collasuyu[26] region of the Inka Empire, which includes Tiwanaku, was singled out in Spanish records for its higher levels of meat consumption, as camelids were more numerous per capita.

Other than llamas and alpacas, domesticated animals at the time of the Conquest include guinea pig (*cuy*), dogs, and the Muscovy duck (Stahl 2008). Guinea pigs were raised in the kitchen much like they are today. The Inkas did not eat dogs and looked down on those groups who did (Rowe 1946: 219). The origins and domestication of the Muscovy ducks are still obscure, but the species is depicted on pre-Inka Moche and Chimú vessels from the Peruvian North Coast, suggesting that their domestication predates the Inka period (Stahl 2008: 123). These domesticated ducks were not relegated only to the Coast, but were also present in the Central Andes (DeFrance 2009b: 111).

The consumption of wild animal species was likely constrained by sumptuary laws; hunting was a privilege of the Inka king since all land and resources belonged to him. Nonetheless, state-sponsored communal hunts where captured deer and guanacos were turned into ch'arki, provided occasional wild meat for those who partook in the hunt (Murra 1956: 83). Fishing was not an important activity around Cuzco, where most chroniclers focused their attention, so it is not discussed prominently in ethnohistorical records.

[26] The Inka Empire, or Tawantinsuyu, was divided into four quarters or 'suyus,' radiating from the capital, Cuzco. Collasuyu is the name of the quarter that encompasses the Titicaca Basin.

However, we know from archaeology that fishing was an important activity in other areas of the Inka Empire, such as around Lake Titicaca and in coastal regions (e.g. Kolata 2003c: 461; Marcus *et al.* 1999).

Meal preparation and cooking techniques described at the time of the Conquest appear to have been quite similar to those of modern pastoralists. Meat was boiled, roasted over a fire or in a pachamanca oven, or toasted over a flat dish (Bray 2003a: 8; Rowe 1946: 220-221). It was also prepared and consumed as ch'arki, sometimes reconstituted in stews or soups. Thus the little we know about daily meat consumption from ethnohistorical sources is generally representative of the culinary practices noted in the ethnographic and ethnoarchaeological work on modern pastoral groups.

Prehispanic Political Economy and Food in the Andes

Andean archaeologists regularly draw on ethnographic, ethnoarchaeological, and ethnohistorical records on food production and consumption in order to interpret the archaeological record of their region and to determine which patterns can be pushed further back in time as evidence for direct historical correlates. This section presents models of resource procurement commonly referenced in discussions of Andean political economy. Murra's (1975 [1972], 1985) 'vertical archipelago' remains the most influential Andean model for the acquisition and distribution of resources from multiple ecological zones outside of a market economy, a nearly absent feature in the Andes at the time of the Conquest. Its implications for Tiwanaku's political economy are reviewed and critiqued with a particular focus on camelid herding strategies. Archaeological researchers investigating the Tiwanaku hinterland and its sphere of influence have used, tested and critiqued these models to delineate the contours of the political economy of the Tiwanaku polity. Tiwanaku's inhabitants relied on camelid meat and local cultigens for subsistence, and engaged in exchange with lowland areas to acquire non-local maize, a new addition to local culinary practices. Evidence for changes to culinary practices with the advent of Tiwanaku's emergence as an important political center is not limited to the addition of maize, but also includes the concurrent adoption of a ceramic assemblage devised for the preparation, serving, and consumption of liquids (including fermented beverages such as chicha). These combined lines of evidence are often used as correlates to suggest that maize beer was the social lubricant that permitted the integration of disparate groups into a Tiwanaku identity. It is suggested, however, that this ceramic paraphernalia instead illustrates the adoption of a heightened value given to hospitality and commensality that includes the consumption of both local and foreign foodstuff.

Models of Andean Political Economy and Subsistence

Through his detailed ethnohistorical research on the Inka economic system, Murra developed an influential pan-Andean model of community settlement patterns and resource exploitation, which he described as a 'vertical archipelago,' or a string of 'islands' from varied elevations and ecological zones exploited by members of a single community allowing for community self-sufficiency outside of a market economy (Murra 1968: 121-123, 1975 [1972], 1985). This idea is first outlined in his dissertation work (Murra 1956), where Murra describes the Inka economic system as an institution replicating community self-sufficiency at a greater scale. With the publication of the

Chucuito *visitas* (i.e. census data) a few years later, Murra (1968, 1975 [1972], 1985) revisits this idea of communal self-sufficiency. Using census data from the Lupaqa kingdom,[27] he argues that to gain access to resources from other environmental regions, communities would send a few families to live in different ecological zones. This model is based on the vertical ecology of the Andes, where the steep mountain terrain and changes in altitude permits access to varied ecological zones within a few hours or a few days walk. Communities sent members to live in different ecological zones and the goods they produced (e.g., camelid meat from the puna, or maize and coca from the lowlands) were exchanged between members of the community. These households still identified with the original group, in this case the Lupaqa, though they did not share the same geographical location. These residential bases dotting the Andes thus created "archipelagos," disparate ecological niches. According to Murra, this "Andean mode of production" bypassed the need for the development of markets or more formalized systems of exchange with dedicated specialists. That is, exchange was performed through long-established reciprocal relations within a community.[28] The idea of community economic self-sufficiency through the reciprocal exchange of resources from varied ecological zones has been embraced by many Andeanists, who have sought to test how far back in time this system extends.

Andeanists have applied, tested, revised, and even occasionally rejected Murra's veriticality model (e.g. Bray 2005; Browman 1981; Goldstein 2000, 2005;

[27] The Lupaqa were a pre-Inka polity centered on the Lake Titicaca Basin, who were incorporated into the Inka Empire.
[28] 'Community' here can be an ayllu (an Andean form of social organisation linking its members through a real or fictive ancestor), or a more broadly defined ethnic group (which can be seen as a maximal ayllu – the sum and apex of all local ayllus in a nested organisation sharing a common origin).

Miller and Burger 1995; Stanish 2003; Tung 2008; Van Buren 1996). Interaction and exchange of resources between different ecological zones is easier to demonstrate archaeologically than the familial, political or ethnic affiliation of the groups involved in the exchange. This section presents a discussion of a few archaeological case studies that pushed further our understanding of posited exchange relations between Andean ecological zones in the prehispanic past. First, the 'ch'arki effect' is discussed as a potential zooarchaeological correlate for vertical reciprocal relations, extended far into the Andean past. Then a revision of the Lupaqa case study by Mary Van Buren (1996) suggests that the vertical relations described in the Chucuito visitas were a recent development at the time of the Conquest, and were not in place to benefit entire communities but rather to funnel resources to local elites. Third is a presentation of David Browman's (1981) altiplano-specific model of verticality. This model proposes that populations living in the flat expanses of the Bolivian altiplano where Tiwanaku is located acquired goods from different altitudinal zones through llama caravan trade specialists. Finally, Paul Goldstein applies a modified version of the verticality model to the Tiwanaku colonies from the Moquegua valley in Peru. He suggests that the exchange and reciprocal relations between the colonies and Tiwanaku can be best understood as ayllus in diaspora; that is, that exchange remains rooted in reciprocal exchange between groups sharing kinship ties, rather than through a state redistribution system.

Zooarchaeological correlates for the production of ch'arki in puna environments, and its consumption in the lower elevation site of Chavín de Huántar pushed the introduction of vertical exchange systems back in time to 500 B.C. (Miller and Burger 1995). This 'ch'arki effect' (*sensu* Miller 1979: 210) consists of a predominance of proximal limb bones at the lower elevation consumer sites. Conversely, cranial elements and lower limb bones are found in higher frequencies in higher altitude producer sites (i.e. herding communities). This model is based on Miller's (1979) ethnoarchaeological observations of highland camelid herders in Peru. He notes that although modern ch'arki production is variable, most herders leave the bones attached to the meat (Miller 1979:99), which means that the bones travel with the meat from production to consumption sites. His observations suggest that all parts of the body are used in making ch'arki, except for lower limbs (i.e. metapodials and phalanges) and the head, which is usually consumed locally while it is still fresh.

Stahl (1999) has challenged the association of this skeletal distribution pattern with ch'arki exchange between communities residing at different elevations based on ethnographic examples of variability in ch'arki production and on the influence of differential bone density on skeletal element frequencies. Stahl argues that the ch'arki effect fails to take into account the diversity of ch'arki production and other methods of producing freeze-dried meat products through time and space (Stahl 1999). In fact, ch'arki often refers to deboned strips of meat, which would make ch'arki archaeologically invisible. However, a related technique called *chalona* leaves the bone attached to the meat[29] (Stahl 1999). Furthermore, Stahl's (1999) bone density index for South

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[29] Flores-Ochoa (1979 [1968]: 41) says that chalona refers to dried sheep meat versus ch'arki, which is made of camelid meat. He does not mention whether one, both, or none were deboned, and this definition could not be applied to the pre-Columbian period since sheep are Old World domesticates introduced after the colonisation. It therefore appears that the use of the terms chalona and ch'arki is variable. In addition, Browman (1989: 263) observed ch'arki made of flattened heads sold in Aymara Bolivian markets, further suggesting that ch'arki production can be highly variable in time and space.

American camelids[30] suggests that the elevated presence of skulls and phalanges associated with ch'arki production centers by Miller and Burger (1995) may not be due to having sent other skeletal elements to lower elevations through reciprocal exchange, but rather reflects the fact that skulls and phalanges are extremely dense and durable elements that are less likely to disappear from the zooarchaeological record through taphonomic processes.

The research at Chavín de Huántar, a pilgrimage site in the central highlands of Peru with a residential component occupied from 900 to 200 B.C., does provide a diachronic view of subsistence in the social area, and demonstrates that unlike what Murra (1968, 1975 [1972]) suggested with the vertical archipelago model, the exploitation of complementary environmental zones was not undertaken to palliate for a lack of resources, or to diminish the risks associated with agriculture in harsh environments. In fact, Chavín's local environment was rich in fauna and crops (Miller and Burger 1995: 449). Instead, unequal redistribution of animal skeletal parts coincides with the appearance of social stratification within and between the sites of the valley, an idea that is explored further in Mary Van Buren's (1996) critique of the verticality model.

Van Buren (1996) argues that the vertical archipelago model needs revision due to its implicit Functionalist description of state redistribution as working within a stable unchanging system benefiting all members of a community. She proposes that the verticality model overlooks the differing motivations of the actors involved in the production, distribution, and consumption of resources. Her re-examination of the Chucuito visitas and excavations at the site of Torata Alta in the Moquegua valley (a likely Lupaqa

[30] Stahl's bone density index is discussed in greater detail in Chapter 5.

settlement in this lower elevation zone) suggest that the Lupaqa vertical archipelago organisation described by Murra is not an ancient Andean form of exchange but dates, at the earliest, to the Inka time period, and that lowland resources were funnelled to the local elites and only redistributed through work feasts in Colonial and Inka times. The first point suggests that the vertical archipelago model of self-sufficient reciprocal exchange should not be applied uncritically to the pre-Inka past. The latter point demonstrates that in the Lupaqa case, the acquisition of lowland resources was aimed at reinforcing political power rather than benefiting all members of a community. Non-elite households may have relied on barter or exchange, possibly with people that were ethnically different, to obtain non-local goods (Van Buren 1996: 348). As such, Van Buren argues that the archipelago model artificially diminishes the importance of trade and barter in the Andean past, a position that is shared by David Browman (1981, 1997).

Browman (1981) argues that the verticality model presented by Murra may be accurate for the Lupaqa but is not appropriate for the Southern Lake Titicaca Basin, or Bolivian altiplano, where Tiwanaku is situated. The Bolivian altiplano is a vast flat expanse of land that requires days to cross before reaching a different ecological zone. Browman (1981) therefore argues that setting up colonies in diverse ecological zones for exchange at the community level would be impractical for residents living in the middle of the altiplano, such as Tiwanaku residents. As an alternative to Murra's model of exchange and reciprocity, Browman proposes an 'altiplano mode' where networks of llama caravan led by specialists allowed for the trade of food, raw material, crafts and the spread of religious ideology within markets, rather than situating exchange between members of the same *ayllu*.[31]

Part of Browman's (1981) model relies on the recognition of changing camelid herding strategies in the archaeological past based principally on excavated material at the pre-Tiwanaku Formative period site of Chiripa (see Figure 2-1). The model states that by 4000 B.C., 'carnivorous pastoralism' (Browman 1981: 408), or the herding of camelids for their meat, was the main subsistence of the altiplano to be replaced a few millennia later by herding for wool production and use of camelids as cargo animals. This shift in herding strategies has important consequences for herd dynamics, herder social status and herding community social organisation. As wool becomes a valued commodity, herd size increases, which simultaneously allows owners of large herds to hold more prestige in a society, fostering the development of social inequality. Importantly, large herds require expansion into new territories to gain sufficient pasturage land. As unclaimed grazing lands become exhausted, herders need to develop different subsistence practices. By 1200 to 1000 B.C., a number of sedentary villages can be identified presenting evidence of plant domestication, and wild fruit and lacustrine resource consumption (Browman 1981: 410-412). By 1350 to 850 B.C., exotic goods are present in archaeological assemblages. This signals that caravan trade networks were in place by that time. By the end of the Formative period, Tiwanaku managed to use its control of this camelid fuelled economic mechanism to export both the products of its resident artisans and its religious ideology (Browman 1981: 416).

[31] 'Ayllu' is a later Andean term referring to a corporate group linked through fictive or real kinship ties.

Browman's (1981) altiplano model of trade and exchange through caravan network was not based on substantial zooarchaeological evidence. Since its publication, the strong dichotomy hypothesized between 'carnivorous pastoralism' and caravan specialists has not played out as strongly in the few zooarchaeological studies of Tiwanaku material. Tiwanaku faunal remains, including those of Mollo Kontu presented in this dissertation, indicate that a type of 'carnivorous pastoralism' was in place in Tiwanaku times (Vallières 2011, 2012; Webster 1993; Webster and Janusek 2003). This is not to suggest that llama caravans were not an integral part of Tiwanaku's socio-economic development; indeed, I argue in this dissertation that camelids from Mollo Kontu were exploited for their meat and their role as cargo animals in transport caravans. This exploitation of camelids does not appear to be correlated with a higher social status by Tiwanaku times, though it may have been in the earlier Formative period as Browman (1981) hypothesized.

The work of Paul Goldstein (2000, 2005) on Tiwanaku colonies in the lower elevation Moquegua valley in Peru suggests that Tiwanaku may have indeed use a self-sufficient system of reciprocity and exchange notwithstanding the vast distance between the two areas. Goldstein argues that Murra's vertical archipelago model, despite many valid criticisms, is still a valuable way to conceptualize Tiwanaku social, political, and economical relations between ecological zones when seen as "ayllus in diaspora" (Goldstein 2000: 186). Using Tiwanaku settlements in the valley of Moquegua in southern Peru as an example, he suggests that, just like modern diaspora communities, the inhabitants of archipelago colonies were long-term residents who identified with, and kept the rights, privileges, and obligations to their homeland communities in the Bolivian altiplano (Goldstein 2000: 188-189). As such, the homeland retains its primacy as a locus of identity through the residents of remote archipelagos shared sense of kinship with family members residing in the homeland. In the case of Tiwanaku's maximal ayllu, or uppermost ayllu affiliation within the nested ayllu organisation, kinship was most likely fictive.

The multi-ethnic aspect of the diaspora model was rendered possible in Tiwanaku's case due to the polity's integrative approach (Goldstein 2000: 203). In fact, Tiwanaku as a "pluralist confederation" rather than a centralized state (see Goldstein 2005: 306) would not have controlled the flow of goods, at least in the initial stages of Moquegua colonization. Chicha drinking and the adoption of the Tiwanaku ceramic assemblage associated with its production and consumption suggests that Tiwanaku's influence at Moquegua was consensual rather than coercive, with feasting done at the smaller corporate level rather than in state-sponsored events (Goldstein 2003). Yet the increasing homeland demands on Moquegua's colonizers for maize, which was necessary to expand and sustain Tiwanaku's political authority, weakened the relations of reciprocity and redistribution that characterized the early settlement of the diasporic archipelagos (Goldstein 2005: 320).

The Political Economy and Food of Tiwanaku

Issues of political organization and food production systems are often linked in archaeological research. This is particularly true for Marxist-influenced research where changes in the modes of production, often detectable in the archaeological record through technological changes, are correlated with political changes that may be more difficult to track archaeologically. Recent interest in the investigation of the political and ritual ramifications of feasting, particularly the role of chicha consumption, has brought the importance of food acquisition, redistribution, and consumption to the forefront. In the following discussion of Tiwanaku's food economy, I outline our current understanding of herding and agricultural production within the Tiwanaku altiplano hinterland. Afterwards, I examine the role of maize and commensal consumption in the lives of Tiwanaku inhabitants.

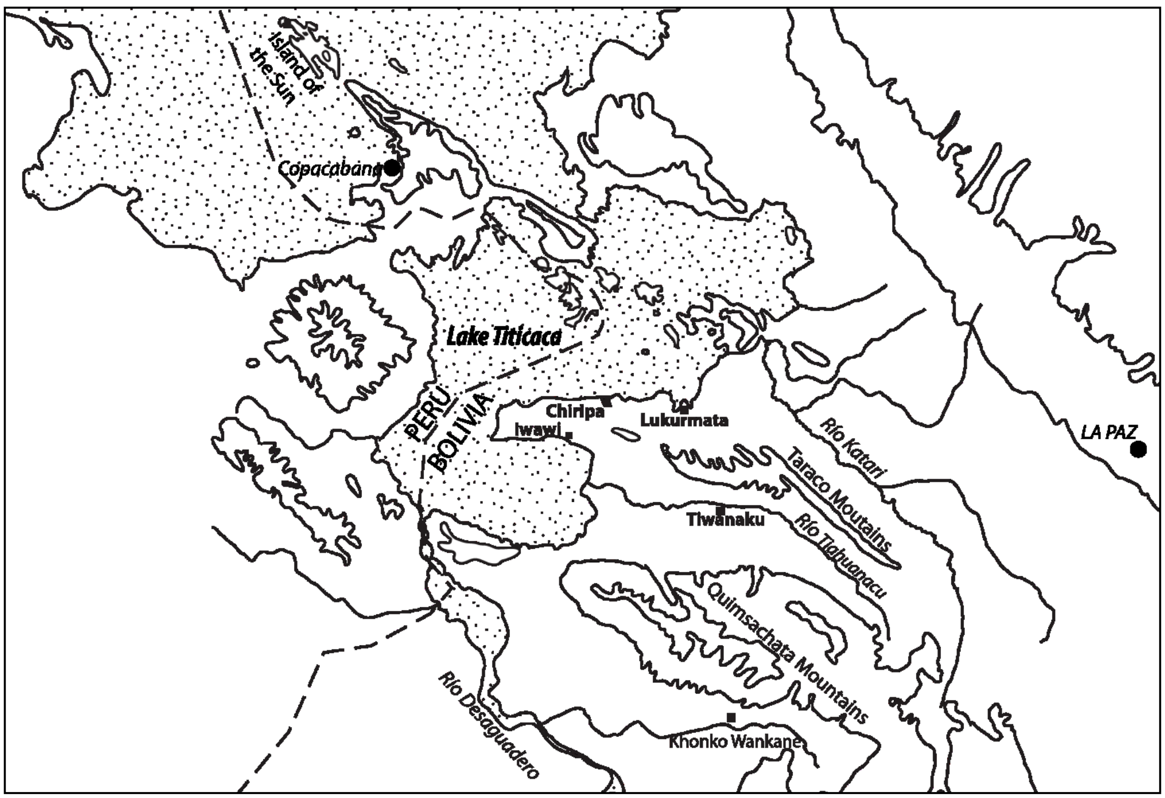

Figure 2-1: Map of the Southern Titicaca Basin (courtesy of Nicole Couture).

Prior to my own dissertation research, two seminal zooarchaeological studies were conducted to investigate Tiwanaku's political economy, although the investigators came to quite different conclusions (Park 2001; Webster 1993). Both Park (2001) and Webster (1993) use a diacritical perspective, spanning the

Formative Period[32] to post-Tiwanaku, in order to study how the rise of the Tiwanaku polity affected pastoral practices in the Southern Titicaca Basin. On the one hand, Ann Webster (1993) sees an increased centralization of camelid resources and distribution within the Tiwanaku valley, suggestive of a centralized state. On the other hand, Julie Park's (2001) analysis of the faunal assemblage from the hinterland site of Iwawi (see Figure 2-1) leads her to argue that camelid production was locally organized and remained autonomous from the Tiwanaku state.

Webster (1993) uses faunal data from eight rural sites from the Tiwanaku valley (see Matthews 2003), in addition to assemblages from the secondary center of Lukurmata in the neighbouring Katari valley (see Figure 2-1) and Tiwanaku, to help clarify the economic importance of camelids in the Tiwanaku polity over time. Her analysis challenges Browman's assertions that camelids were raised primarily as pack animals and wool producers in Tiwanaku times by demonstrating that camelids were not raised solely for their use as cargo animals. In fact, camelids in the region were continually raised primarily for their meat based on the preponderance of young animals in faunal assemblages. However, this does not negate the young animal's role in wool production, their use as pack animals, or their importance in rituals (Webster 1993; Webster and Janusek 2003). Webster (1993: 263) argues that the combination of intensification in the exploitation of domesticated camelids seen in Tiwanaku times (as opposed to the procurement of wild animals), with the high presence of 0 to 18 months old animals, and the overrepresentation of limb versus axial

[32] The Formative Period in the Titicaca Basin refers to the time period from sedentarization (ca. 1500 B.C.) to the rise of Tiwanaku as a urban center around 500 A.D.

elements, suggests a centralized distribution of ch'arki meat packages within the Tiwanaku hinterland. In this scenario, the young animals are culled for consumption around 1 year old and distributed as ch'arki (Webster 1993: 214-216).

Park (2001: 98) is critical of Webster's (1993) age data interpretations. She argues that the categories are too broad, particularly for the 0 to 18 months category. She contrasts this with the faunal assemblage from Iwawi, a small settlement on the Taraco peninsula (see Figure 2-1) occupied in pre-Tiwanaku times until after Tiwanaku's abandonment. The diachronic analysis of a small domestic compound at Iwawi also presents a high incidence of young animals as Webster (1993) demonstrates for Tiwanaku. In fact, 80% of all individuals are in the 0 to 18 months category. However, 39% of those individuals represent neonates from newborn to 3 months old, animals that would not be considered optimal for meat consumption in a redistributive system. This presence of neonates reflects the high infant mortality rates of camelid herds. As such, a sustained presence of neonates is more suggestive of herd ownership than of a meat specialization.

Park's (2001) faunal analysis is geared toward testing different political economy models for the region. She discounts Murra's (1968, 1975 [1972]) vertical archipelago model and Browman's (1978) altiplano model on the basis that there is very little reliance on subsistence items acquired from trade or exchange at Iwawi. Furthermore, though there are older animals, some with pathologies possibly linked to load bearing, the majority of the animals identified were very young. This suggests that the main pastoral strategy at Iwawi was not geared toward the use of camelids in caravan transport. Park is also critical of the "Centralised Imperialist State" model, which presents Tiwanaku as a centralized state in charge of food production and distribution, including camelid resources (see Kolata 1986; Ponce Sangines 1981; Stanish 2003; Webster 1993). In particular, the skeletal element representation found at Iwawi suggests camelids arrived at, and left the site 'on the hoof', that is, complete and likely alive, rather than distributed in meat packages as suggested by Webster (1993). Park (2001: 125) does raise the possibility that juvenile camelids (ca. 1 to 3 years old), absent for the most part in the Iwawi assemblages, were moved out of the site perhaps through obligations to the Tiwanaku state. She argues, however, that the pastoral strategies represented in the Iwawi sample, especially the presence of infectious lesions on camelid bones suggesting that sick animals were not killed at the first sign of disease, does not reflect the kind of intense herd management seen in the ethnohistorical record for the Inka Empire. Finally, Park uses the apparent lack of changes in pastoral strategies before and during Tiwanaku influence, and the exploitation of camelids for meat, wool, and transport, to suggest that herds at Iwawi were locally managed, and autonomous from the Tiwanaku state. State intervention was mediated by community leaders and/or elites, and each household had control over their herds. Therefore, the organisation of herding presented by Park (2001) for Iwawi appears to paint a picture of small family holdings similar to those of modern ethnographic examples of Andean pastoralists (e.g. Flannery *et al.* 1989; Flores-Ochoa 1979 [1968]).

Residents of the Bolivian altiplano did not rely only on camelid herds to meet their subsistence needs; agriculture also played an important role in Tiwanaku's political economy. Although modern ethnographies of the puna regions depict the altiplano as a marginal environment for agriculture, this image does not reflect past agricultural exploitation of the Bolivian altiplano. In fact, during the Tiwanaku period, large sections of the southern Titicaca basin were transformed through the incorporation of raised-fields as an agricultural practice. The raised-fields provided ample access to agricultural yields for the altiplano population (see Erickson 1988, 2003; Janusek and Kolata 2003, 2004; Kolata 1986, 2003c; Wright *et al.* 2003).

Raised-fields consist of long and narrow elevated earth platforms flanked by canals. Extensive landscapes of fossil raised fields were recorded and excavated in the neighbouring Katari valley, close to Lukurmata (Kolata 1986, 1993; Janusek and Kolata 2003, 2004). In the Tiwanaku valley, raised-fields were also noted during survey works (Albarracin-Jordan 2003; Matthews 2003). These raised-fields, likely used to grow potatoes and quinoa, were designed to improve drainage and decrease frost risks, and thus increase the agricultural yield of the area (Erickson 1988; Wright *et al.* 2003). Their discovery was initially interpreted as a correlate for Tiwanaku's centralized authority (Kolata 1986).

Intensive survey and excavation across the Katari valley by John Janusek and Alan Kolata (2003) provided data on the chronology of raised-field construction and abandonment, and led to a revision of the initial assertion that Tiwanaku's subsistence economy relied principally on raised-fields. Though raised-field technology likely developed during the Formative Period out of local agricultural knowledge, it is only by 900 A.D. that their construction and use explodes. This intensification of raised-field production is concurrent with reduced settlement population in the entire Katari valley (Janusek and Kolata 2003, 2004). Furthermore, by A.D. 800 the population of Lukurmata, the largest site in the Katari valley, declines sharply and no domestic occupations dating to that period have been excavated to date (Berman 1994). Janusek and Kolata (2004: 423) suggest that the depopulation of the valley may in fact suggest a migration to the Moquegua colonies of Peru through a proto-*mitmaq*[33] institution given the two populations close genetic relationship (e.g. Blom 1999; Blom *et al.* 1998). Janusek and Kolata argue that by A.D. 900 the entire Katari basin became a Tiwanaku agricultural estate (Janusek and Kolata 2003: 164).

The Role of Maize at Tiwanaku

The presence of fossil raised-fields is a clear indicator that Tiwanaku's political economy relied on agriculture, but it is through paleoethnobotanical studies of plant remains (Bruno and Ramos 2009; Wright *et al.* 2003) and isotopic analyses of human remains (Berryman 2010; Knudson 2004; Knudson *et al.* 2004) that the contribution of plant foods to the Tiwanaku (and pre-Tiwanaku) diet and economy can be assessed in more detail. Paleoethnobotanical results from Tiwanaku urban contexts show that "local agricultural production, rather than long-distance trade, was the principal engine driving the political economy of the Tiwanaku heartland" (Wright *et al.* 2003: 402). That is, Tiwanaku was not dependent on trade or exchange with lower environmental zones to fulfill its population's basic subsistence needs. Chenopods and tubers are consistently recovered in the archaeological record, along with high amounts of non-cultigens remains (e.g. grasses) present due to the use of camelid dung as fuel (Bruno and Ramos 2009; Wright *et al.* 2003).

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[33] 'Mitmaq' is an Inka term designating a group sent to inhabit a foreign region. They were either comprised of groups loyal to the Inkas sent to consolidate newly conquered areas where inhabitants might be rebellious, or dissident groups sent to work in distant lands in the hope of cutting off ties of support.

These plant remains are all adapted to the local altiplano environment and have a long history of use in the area (Bruno 2008).

Tiwanaku's archaeologically recovered plant food remains also demonstrate the use of maize, a non-local cultigens that appears quite suddenly and abundantly in the archaeological record in the Tiwanaku periods. Paleoethnobotanical remains (Wright *et al*. 2003) and isotopic analyses of individual human skeleton remains (Berryman 2010) recovered from Tiwanaku neighbourhoods and earlier Formative Period sites suggest significantly higher distribution and consumption rates of maize in Tiwanaku times compared to the Formative Period. Maize may not have been vital from a nutritional standpoint, given the high caloric values of locally grown chenopods and tubers, yet it became a social necessity for the Tiwanaku polity and its sphere of influence. The sudden inclusion of maize in Tiwanaku-era households and ritual contexts (Wright *et al*. 2003), compared to its near absence in the Late Formative Period (Bruno 2008), is often associated, either implicitly or explicitly, with feasting events, even as the context of its consumption remains unknown.

Andean scholars often associate maize with feasting because it is an exotic item in the Bolivian altiplano. As an exotic staple necessitating long-distance procurement through trade or exchange with groups living at lower elevations, maize can also be seen as a luxury item mainly accessible to elites who could then distribute maize products within the context of empowering rituals or work feasts. The foreign origins of maize when found in altiplano contexts, and its possible consumption as chicha in commensal events and ritual practices could make it a 'luxury food' in the sense given by Christine Hastorf (2003a). 'Luxury foods', Hastorf argues, are usually deemed so in relation to the degree of difficulty required to acquire them, or are made luxurious within the limited context of their consumption. Yet maize at Tiwanaku was both an exotic item and a seemingly accessible foodstuff for elites and commoners alike, as it is ubiquitous in all contexts of the urban center, including lower status residential areas and garbage pits (Bruno and Ramos 2009; Wright *et al.* 2003). Maize was accessible and consumed by all, even if not in equal amounts between sectors and individuals.[34]

The other reason the presence of maize at Tiwanaku is associated with feasting events is through analogy with the later Inka. Maize can be transformed into chicha, a maize beer that was instrumental in lubricating Inka political relations and rituals[35] (e.g. Bray 2003a, 2003b; P. Goldstein 2003; Hastorf 2003a; Hastorf and Johanessen 1993; Jennings and Bowser 2009; Murra 1956). It is likely that maize beer was analogously involved in Tiwanaku feasting. The latter point is reinforced by the concurrent adoption of maize and a ceramic assemblage including drinking cups (*keros*)[36], and jars (*tinajas*) thought to be used for chicha storage and preparation. These vessels are ubiquitous within Tiwanaku sites, in domestic as well as ritual contexts. Another line of evidence reinforcing the association of these ceramic vessels with, if not maize beer consumption, at least beer consumption in ritual and political contexts such as feasts, is the integration of some of the monoliths within major Tiwanaku monumental structures likely used for large congregations. These monoliths depict elite personages holding a kero in one hand, and a snuff tablet used for

[34] See Chapter 3 for a more in-depth detailing of maize consumption per Tiwanaku neighbourhoods as presented in Berryman 2010
[35] Although Hastorf (2003a: 547) points out that many Andean plants can be used to make chicha, including manioc, *chenopodium* (including quinoa), and *molle* (*Schinus molle*, a lowland small fruit).
[36] Keros were later used by Inkas to drink chicha.

the ingestion of hallucinogenic drugs in the other (Couture 2007). These lines of evidence provide a legitimate basis for the argument that maize beer was served within ritual consumption events at Tiwanaku, but they do not suggest that maize was only consumed as beer, or that beer was always made out of maize.

Chicha gains importance through its consumption context; its value lies partly with its association with commensalism, hospitality, ritual events, and its consumption etiquette (Anderson 2009; P. Goldstein 2003). Goldstein argues that Tiwanaku's expansion into new territories (see Figure 2-2), such as the Moquegua Valley was made consensual through a "mania for maize beer that took root everywhere Tiwanaku influence was accepted" (2003: 144). The transformation of maize into alcoholic beer was linked to an escalation in empowering feasts by "ayllu-like corporate groups operating within a loose confederative state" (Goldstein 2003: 165). That is, commensal drinking was not orchestrated by a centralized state, but by heads of households or ayllu figureheads competing for local power. Goldstein (2003: 162) supports this argument through the presence of chicha production areas (*chicherias*) in plazas surrounded by domestic architecture. Within these empowering feasts, hosts would provide the *most desired* type of beer to negotiate, maintain, and accrue their power. Tiwanaku's colonization of maize growing regions, such as Moquegua, is interpreted as an extension of the importance of chicha beer consumption for Tiwanaku inhabitants, and explains the rapid diffusion, adoption, and emulation of Tiwanaku ceramic styles in its periphery (Goldstein 2003).

While residents of Tiwanaku colonies were partaking in the consumption of large quantities of maize beer, feasting within contemporaneous native local sites showed more variety in the kinds of beer consumed (Costion and Green 2009). For example, no maize was recovered within the paleoethnobotanical remains of the site of Yahuay Alta, a small rural site of indigenous people not associated with either the Wari[37] or Tiwanaku occupations, even though feasting events were common (Costion 2009: 241). Furthermore, the Wari, who lived at the nearby provincial center of Cerro Baúl, consumed almost exclusively a beer made of the local *molle* berry (D. Goldstein *et al*. 2009; Moseley *et al*. 2005). As such, maize beer is not a universally preferred or desired beer in the Andes, but rather one choice among many possibilities. In this context, it was not maize, but rather *beer* that was valued and the choice of what beer to serve may have been dictated by the host and their guest's preferences.

[37] The Wari state was centered in the Central Peruvian Andes, with a territory extending south into the Moquegua valley of Peru. Wari occupation of the Moquegua valley, notably at Cerro Baúl, was contemporaneous with the Tiwanaku occupation of that valley, though they resided in distinct areas.

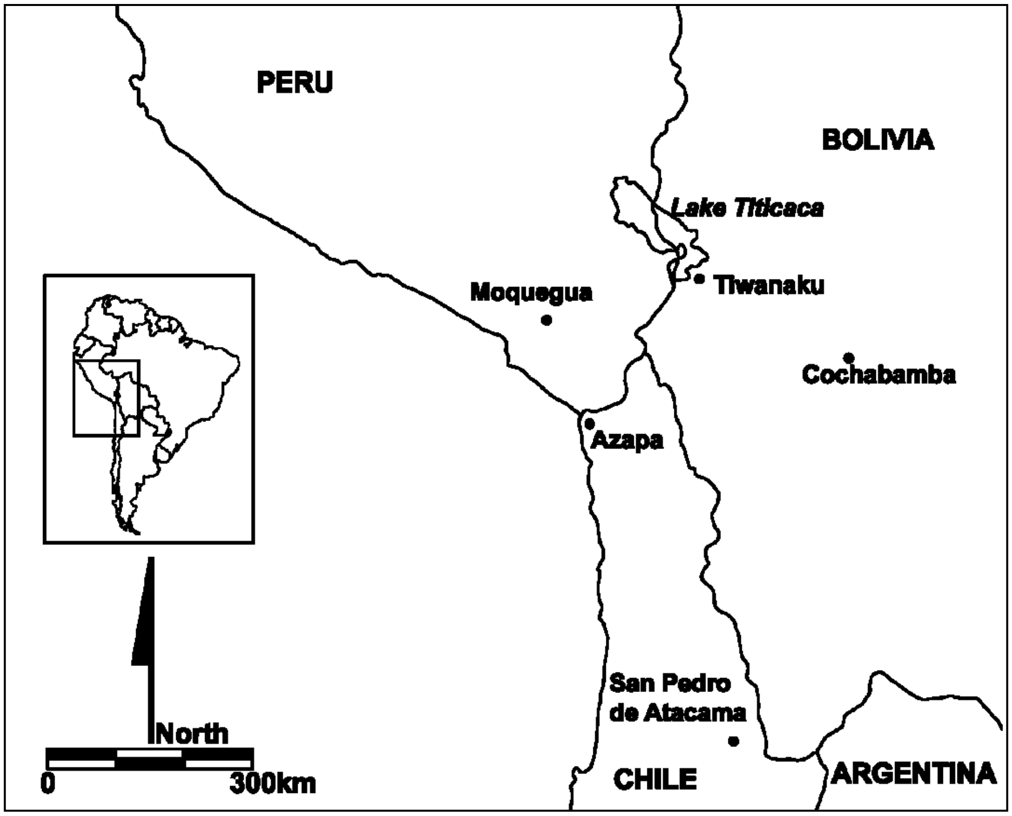

Figure 2-2: Map showing the major areas for the Tiwanaku 'sphere of influence' (map courtesy of Nicole Couture).

While Goldstein (2003) argues that maize chicha was the main ingredient in Tiwanaku's attraction in its sphere of influence, Karen Anderson (2009) uses data from lowland Cochabamba in eastern Bolivia to suggest that it is *drinking practices and customs* that marked Tiwanaku identity in the area, rather than the maize beer itself. Cochabamba is situated in an ideal region for growing maize. It was grown there in pre-Tiwanaku times, though it was not a *preferred* food (Anderson 2009: 175). Vessels used for the storage and transport of liquids, along with kero-like drinking vessels, were present in the archaeological record of the Cochabamba valley centuries before the Tiwanaku expansion, though these were rare and found mostly in mortuary contexts. Their association with these ceremonial contexts suggests that while beer drinking was likely a traditional local practice, beer consumption was not a daily occurrence. That is, if maize beer were a preferred food, maize's availability in the region would have facilitated its spread to more consumption contexts. Around A.D. 600, Tiwanaku-style vessels, particularly decorated keros, became staple items within domestic and ritual contexts throughout the Cochabamba region. While these vessels were locally produced, they reflected the tenets of Tiwanaku iconography, ceramic technology, and shape. Local artisans nonetheless infused a few of their own Cochambaba-style attributes in the production of their vessels. Anderson (2009: 191) argues this represents the adoption of Tiwanaku commensality and household hospitality practices, rather than being a reflection of the social value of maize beer. After all, maize beer was part of the ritual landscape in Cochabamba before Tiwanaku's influence. Therefore it is not the foodstuff, but rather the practices related to serving and consuming maize beer that were adopted in the Cochabamba area during the Tiwanaku period.

Although maize's contribution to the Tiwanaku diet is undeniable, and maize beer likely had a role in Tiwanaku feasting events, equating commensal politics with this non-local cultigen may present an incomplete picture of Tiwanaku forms of commensality. As common staples can be luxurious when consumed in heightened social settings, such as feasting events, it is equally possible that beer made from local plants and local foodstuffs may have been just as integral to Tiwanaku commensal politics (see also Smith 2006 for a similar discussion of the role of rice in South East Asia). To date, no remains of feasting events at Tiwanaku have been analysed in their entirety. However, several Tiwanaku scholars have interpreted the comingled deposits of camelid bones and ceramic vessels used for food and drink consumption found on the platforms of the Akapana pyramid as feasting remains, and have suggested that camelid meat was an integral part of ritual consumption events (Alconini 1993; Manzanilla 1992; Webster and Janusek 2003). Like maize, camelid skeletal remains are prominent in Tiwanaku domestic garbage pits and camelid meat was a significant part of all Tiwanaku residents' diet (Berryman 2010; Davis 2010; Vallières 2010, 2011, 2012; Webster 1993; Webster and Janusek 2003). Therefore both camelid meat and beer drinking were staples of ritualized public events and household level feasts, likely also included in daily meals.

If hospitality was commonly practiced at the household level, then the archaeological identification of 'special contexts,' and the separation of the mundane from the ritual, becomes complex (e.g. Grant 1989). Tiwanaku commensalism was ensconced in hospitality practices requiring proper drinking and serving ware, and the consumption in abundant quantities of non-exotic foodstuff such as camelid meat and possibly tubers. What was served, however, could have been the prerogative of the host, which was predicated on both the host's audience and the statement the host wished to make with the food and drink selection. The beer served and consumed at those events did not require that it be made from maize, although it may have been preferred over other kinds of beer. If Anderson (2009) is correct in locating the influence of Tiwanaku in the social practices surrounding beer drinking and commensality, rather than solely in the procurement of non-local maize, then it is possible that many types of beer and food were part of the culinary traditions of Tiwanaku's cosmopolitan residents.

Summary and Discussion: Food in Andean Context

This chapter illustrates the diversity of food production and culinary practices in the Andes through a discussion of ethnographic, ethnohistorical, and archaeological evidence. Although there are certain biological and environmental constraints that limit the choices available to altiplano residents, the diachronic view of highland adaptation shows that the choices made in herding strategies, agricultural production, product redistribution and exchange, and on what to consume and how to consume it, are far from uniform. Consequently, analogies drawn from either modern or Inka societies should be applied cautiously, even though these varied sources provide a basis for comparison in interpretations of archaeological remains.

Camelids have many uses that traverse the daily and ritual life of households and communities; they provide wool, dung for fuel and fertilizer, leather, meat, fat and blood, and are used to transport goods across long distance. Their low fertility rate and high infant mortality rates restrict herd reproduction. This results in the predominance of adult females and of neonates in the archaeological record. While certain groups will bury sick neonates far from their residential areas, others will consume them; older animals may be transformed into ch'arki and exchanged for agricultural products at lower elevations, therefore leaving no trace in the herder's highland residence. If kept until they are no longer productive, camelids used in transport caravans may show signs of bone pathologies such as arthritis. The natural aggressive tendencies in male camelids may result in castration (which would leave no archaeological markers), or in the culling of juvenile males, which would provide meat for the herders and liberate fodder for the rest of the herd.

Ethnographies of modern Andean pastoralists suggest that common herd management by households does not necessarily mean these producers will consume more meat than agriculturalists. Most meals consist of soups and stews, which often contain chopped up pieces of meat, commonly attached to bone fragments. Meat can also be roasted or prepared in a pachamanca oven. None of these cooking techniques leave easily recognizable marks on the bones, but roasting can sometimes create burnt patches on bones, especially on areas that were not protected by meat. Furthermore, high levels of fragmentation may also suggest the reduction of body parts into manageable sizes for the use in soups and stews. Ch'arki production is also variable and therefore cannot be accurately recognized in the archaeological record.

Given that the subsistence practices of modern pastoralist households may not be reflective of prehispanic urban contexts with regard to meat procurement and distribution, Inka ethnohistorical accounts were used to investigate state-level herd administration and meat redistribution to commoners and elites. The Inka claimed ownership of all camelids in their conquered territories; although there are suggestions that individual ownership was also possible. Confiscated herds were divided and distributed into a tri-part system; one for use by the state, one belonging to the state's religion, and one would be gifted back to the community for their self-subsistence. All camelids would remain in local communities in order to be tended by the residents. According to ethnohistorical records, meat would rarely be part of commoners' diet; it was consumed mainly when working for the state. Sparse zooarchaeological data however suggests that this may not have been true in all areas of the Empire.

As chroniclers were primarily interested in recording Inka statecraft and resource holdings, they remained silent on food and pastoralism at the community level. For example, the local management of community herds is unknown, along with local redistribution practices. In fact, it remains unclear if camelids from one community were herded together, or if each household owned and took care of their own small herd. Accounts suggest that herds situated in the Titicaca Basin area were much larger than the ones managed at the household level in modern times. Therefore, even at the local community level, herding strategies may have been quite different from those of modern pastoralists. The research of Flannery and colleagues (1989) on long-term herd reproduction indicates that a greater pool of reproductive camelids would create herd stability and would greatly increase herd reproduction (see also Dransart 2002: 130). Therefore, large herds, owned individually but herded communally, could provide more meat per individual than modern herding strategies allow for small pastoralist hamlets.

Investigations have been undertaken to determine how much of the ethnographic and ethnohistorical past can be pushed back into the prehispanic past. Faunal and paleoethnobotanical research has contributed to the discussion of Tiwanaku's political economy. Zooarchaeological research by Ann Webster (1993) and Julie Park (2001) suggest similar trends in faunal remains, but derived opposing interpretations. Whereas Webster (1993) argues that meat distribution was a state sponsored activity both in the city and in the Tiwanaku valley, Park (2001) suggests that access to camelid meat at the small site of Iwawi remained independent of Tiwanaku's authority and was acquired through locally owned herds. Both analyses indicate a very high number of non-adult camelids in their mortality profiles, suggesting that Tiwanaku-era patterns are different from those from ethnographic examples.

Tiwanaku's subsistence economy also relied firmly on local agriculture, as suggested by the paleoethnobotanical record, bioarchaeological analyses, and the presence of large-scale raised-fields in the Katari valley. Yet the Tiwanaku period is intrinsically linked to the sudden importance given to the acquisition and consumption of non-local maize in both ritual and domestic contexts. The concurrent appearance of maize in the archaeological record with the adoption of ceramic paraphernalia, similar to that which the Inkas would centuries later use for the production, serving, and consumption of chicha, suggests that Tiwanaku's attraction was rooted in hospitality and commensal politics, permeating even to the household level. Yet the adoption of these culinary practices in maize growing areas suggest that the highest value may have more to do with the social practices of commensality and hospitality rather than an infatuation with maize as a foodstuff. Maize was generally a preferred food at Tiwanaku, without a doubt, but it is suggested that commensal practices also included the consumption of a variety of beers and local foods. In fact, the practices involved in commensality and hospitality may have been the central link to Tiwanaku's attraction, over the consumption of chicha.

Thus far, many scholars have presented Tiwanaku as a rather homogeneous entity whose practices were readily adopted by those it attracted. Yet, Tiwanaku as an urban capital was cosmopolitan and heterogeneous. In this chapter I have suggested that commensality and hospitality were part of a greater Tiwanaku identity, but what was actually served could reflect the varied identities of the hosts and their participants. The following chapter describes research within the urban center to define Tiwanaku as a city exemplifying a broadly shared state ideology, while comprised of citizens bound by their distinct neighbourhood compounds, clinging to their own identity, and demarcating themselves through architecture, cranial modification patterns, economic specialization, and culinary practices.

CHAPTER 3: TIWANAKU, THE URBAN CENTER

The site of Tiwanaku was more than the ceremonial capital of an Andean polity with an exportable ideology characterized by feasting and hospitality; it was also a densely populated city with its own urban culture, and a particular sense of place and history. Thousands lived in a single settlement, a setting unlike anything seen before on the Bolivian altiplano. Recent research discussed in this chapter suggests that the city of Tiwanaku was built to impress its role within a broadly shared cosmology upon visitors and residents. Over time the city came to encompass a broad range of social groups, many of whom were not connected to each other by kinship affiliation or ethnic origins. Tiwanaku, therefore, was both a place of heightened rituals and festivals, as well as a vibrant cosmopolitan center.

In this chapter, I introduce the city of Tiwanaku through a review of research about its broadly shared homogeneous identity and the heterogeneity of its residents. First, I describe the layout of the city and areas where archaeologists have focused their excavations. I then turn to Tiwanaku's broadly shared, attractive ideology through a discussion of previous analyses of the city's architectural form, particularly its monumental architecture. The urban center of Tiwanaku is interpreted as a cosmogram, that is, the physical form and organization of the built city is representative of its inhabitants' and visiting pilgrims' ideological beliefs. As a pilgrimage center, Tiwanaku's residents periodically hosted festivals and communal events, which unified both urban inhabitants and visitors from nearby and distant regions. As a cosmopolitan city, urban life was a vibrant interaction of citizens expressing and reifying their multiple identities through mundane practices of everyday existence. In the third and final section of the chapter I examine the cosmopolitan aspect of the city, that is, its heterogeneous social composition, through a presentation of research that focuses on its many residential neighbourhoods. This discussion highlights especially data that demonstrate the distinct identities of different neighbourhoods, without negating the overarching broadly shared Tiwanaku state identity.

An Introduction to Tiwanaku

Tiwanaku successfully distinguished itself from the many ceremonial settlements dotting the Titicaca Basin in the Formative period. How this came about is a complex narrative that to date remains a work in progress (e.g. Chávez 2004; Hastorf 2003b, 2003c; Janusek 2008; Klarich 2005; Stanish 2003). Nonetheless, it resulted in large numbers of people coming to Tiwanaku, not only as pilgrims eager to participate in its ritual life, but as permanent residents. Since its abandonment around A.D. 1150, the site has continued to trigger the fascination of many, from the royal Inkas who linked themselves to the ruins through their origin myth (see Kolata 1993), and early European explorers puzzled over such splendour in a seemingly desolate area, to national and international visitors hoping to experience its mystical powers (e.g. Sammells 2009).

For centuries only the ruins of Tiwanaku's monumental architecture have been visible on the surface, prompting early archaeologists (Bennett 1934; Squier 1877) to define Tiwanaku as an empty ceremonial center. Yet the ground surrounding these ruins is heavily littered with artifacts, indicating an intensive occupation of the site outside of the monumental areas (Parsons 1968; Ponce 1961). It is only in the last three decades that archaeological projects have started uncovering residential areas within and outside the monumental core. Prior to the 1980s, most archaeological research continued to focus on uncovering its monuments, especially within the civic-ceremonial center of the site (Kolata and Ponce Sangínes 2003; Ponce Sangínes 1981).

There are challenges to the investigation and interpretation of Tiwanaku as a city. Given the painstakingly slow nature of archaeological excavations, most of the city remains buried. Furthermore, the modern town of Tiahuanaco was built atop a portion of the site (see Figure 3-2), as is apparent every time new construction or infrastructure maintenance is undertaken. Therefore, there are areas of the ancient urban center that might never be explored archaeologically. Yet, even with these challenges, common in archaeological studies of large urban phenomenon, archaeologists are building a narrative for Tiwanaku's urban history using a range of techniques including pedestrian survey and surface collections, remote-sensing and excavations, as well as specialized analyses of ceramics, plants, animals, and human remains. Survey data suggests that the site measured roughly 6km² and housed a projected population between 15 000 and 20 000 individuals at its height, between A.D. 600 to 1000 (Kolata 2003a: 15). Tiwanaku's occupation spans the Late Formative (200 B.C. to A.D. 500), Tiwanaku IV (A.D. 500 to 800) and Tiwanaku V phases (A.D. 800 to 1150), but its urban character is restricted to Late Tiwanaku IV until the end of Late Tiwanaku V (A.D. 600-1150) (see Figure 3-1).

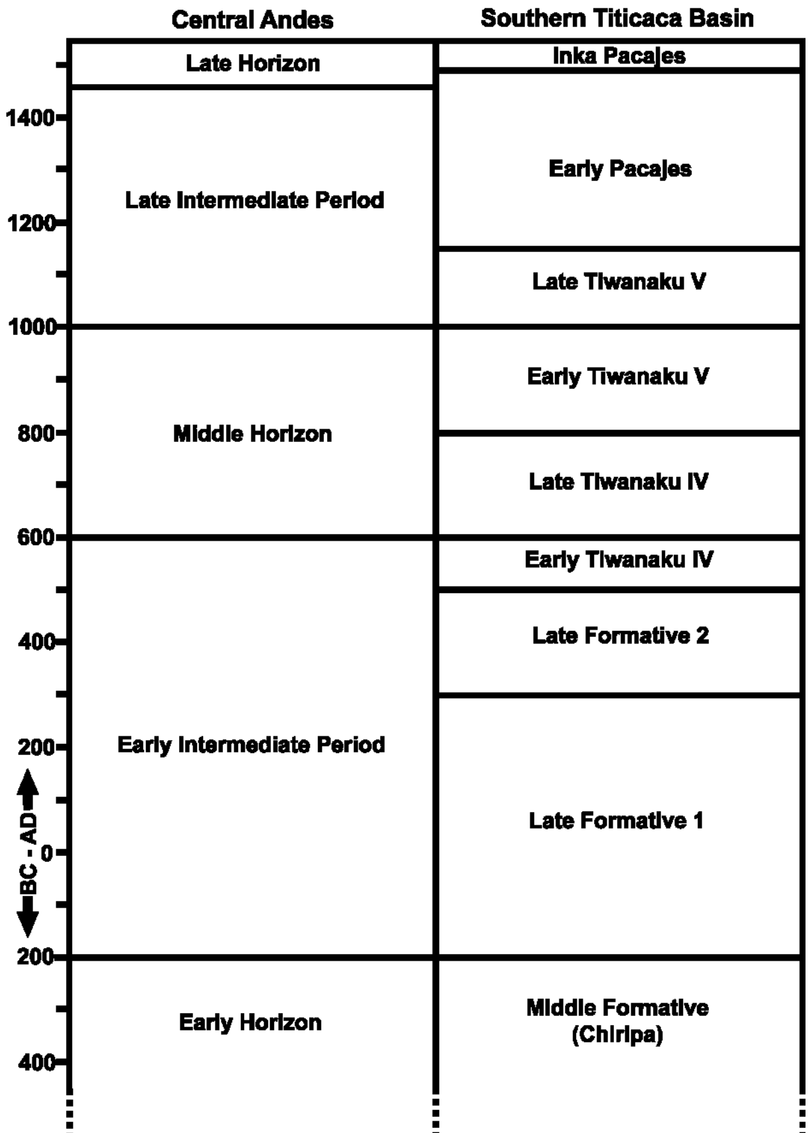

Figure 3-1: Chronology of the Southern Titicaca Basin (from Janusek 2003: 31, fig. 3.1).

The city of Tiwanaku consists of a monumental core encircled by a human-made moat (Kolata 2003b), which is in turn surrounded by a large residential area pockmarked by small artificial lakes (or qochas), a minor mound, and ceremonial architecture[38] including the Puma Punku, a monumental structure bordering the west side of the site. Although it was probably

[38] Note that all qochas identified thus far are in the Mollo Kontu sector of the site, along with the only identified minor mound.

continually in flux in terms of architectural construction, Tiwanaku witnessed at least two major episodes of massive urban renewal that reflected significant transformations in social and political relationships (Kolata 2003, 2004; Couture 2002, 2004; Janusek 2003b, 2004). The first characterizes the transition from the Late Formative 2 to the Tiwanaku IV periods (see Figure 3-1). This transition into Early Tiwanaku IV represents an initial transformative phase marked by the construction of the Akapana pyramid and the expansion of Tiwanaku's population. The second period of urban renewal marks the transition period between the Late Tiwanaku IV and the Tiwanaku V phases, at around AD 800. It is marked by the ritual closing of the Akapana pyramid (see Alconini 1993; Kolata 1993; Manzanilla 1992) and the levelling of certain residential complexes such as Akapana East 1 (Janusek 2003b), and the Putuni Palace complex (Couture 2002). It is during the late Tiwanaku IV phase that evidence for the widening of social inequalities become apparent within the site, including the emergence of royal lineages at the Putuni palace complex (Couture 2002; Couture and Sampeck 2003). This later urban renewal episode does not seem to have altered architectural patterns in the Mollo Kontu neighbourhood, where inhabitants built and rebuilt the perimeter walls of the residential compound following the same orientations over the centuries (see Chapter 4).

The earliest identified ceremonial structures at Tiwanaku are the Kalasasaya raised platform and the Semi-Subterranean Temple, a stone-lined sunken court directly east of the Kalasasaya (see Figure 3-2). These monumental buildings were built in an architectural style of sunken courts and raised platforms already present in the region during the Formative period (e.g. Beck 2004; Chávez 2004). Furthermore, stele of the earlier Yayamama style (see

Chávez 2004) were brought to the site and placed in the middle of the Semi-Subterranean temple. The architectural style and reference to a broadly shared religious ideology promoted the affiliation of Tiwanaku with past traditions (see Couture 2002). This emphasis on enduring traditions is further validated by the vast number of tenon heads, which were embedded in the walls of the semi-subterranean temple. While the uniqueness of each tenon head suggests ancestor veneration of disparate groups, their agglomeration within this particular ceremonial structure emphasizes inclusiveness (Couture 2002, 2004). That is, it physically united, in one location, a diversity of lineage-based groups under a widely shared practice of ancestor worship (see Hastorf 2003c for a discussion of Formative Period ancestor veneration). These figures all retained their distinctive markers. Their presence in the sunken court illustrates well the duality between a shared ideology on the one hand, and the multiplicity of distinct identities on the other, a duality which came to characterize Tiwanaku's residential population.

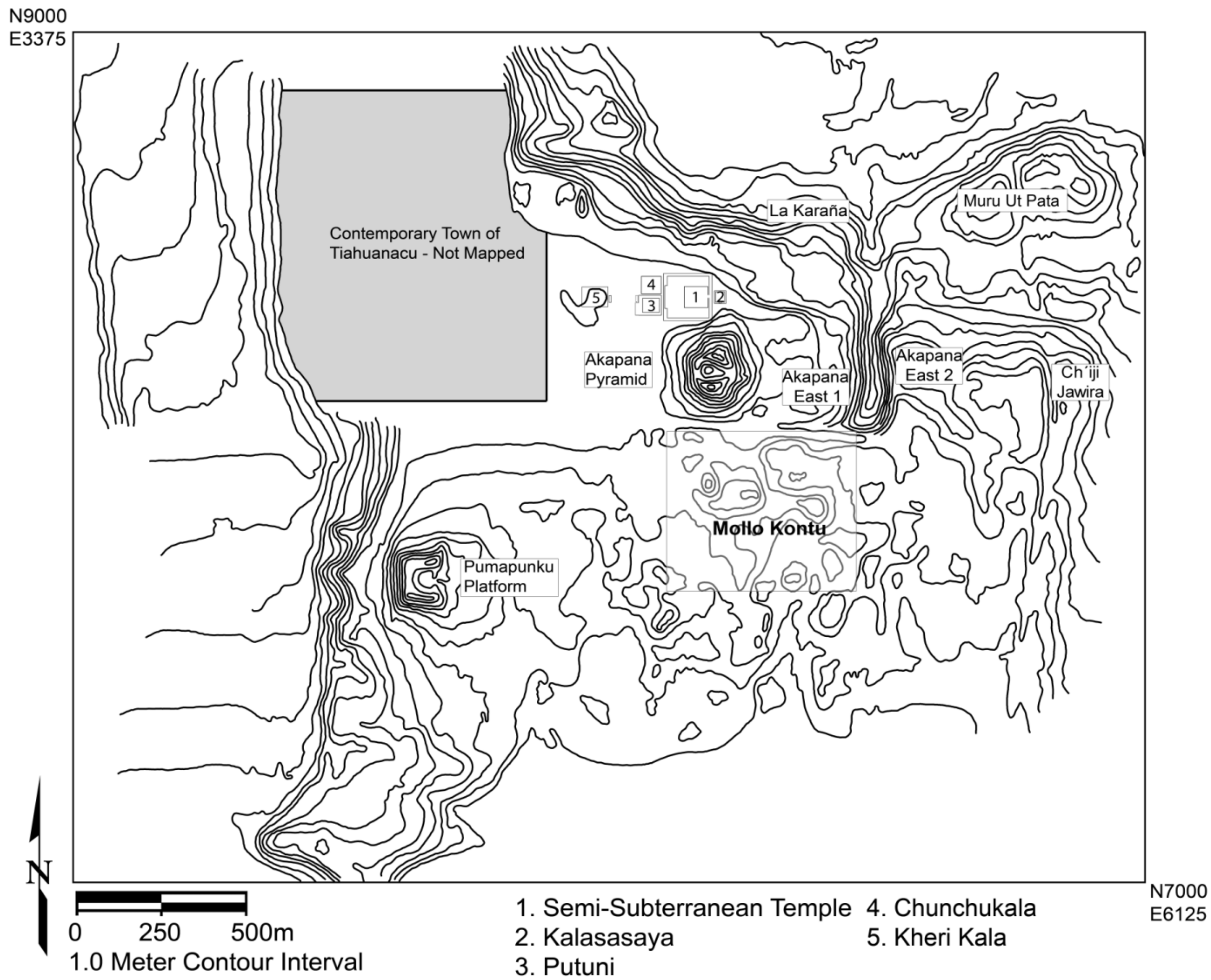

Figure 3-2: Topographic map of the urban center of Tiwanaku and its major excavated areas, modified from Kolata (2003: xxxiii, Map 1a).

We have no absolute dates for the construction of the Semi-Subterranean Temple; it could have been built around the same time as the Kalasasaya platform, or slightly earlier, since it conforms to the "platform and sunken court" architectural style characteristic of Formative Period sites (see Beck 2004; Chávez 2004). The construction of the Kalasasaya is attributed to the Late Formative 2 (LF2) as it is built directly over a Late Formative 1 (LF1) context. During his excavations of the construction fill below the Kalasasaya in the late 1950s and early 1960s, Carlos Ponce Sangínes (1961, 1981, 1993) found two Late Formative 1 strata he characterizes as residential; the remains of the LF1 occupation are clearly separated from the platform's fill by a layer of clear, nearly sterile soil. The oldest of the two LF1 occupations contained narrow paved pathways, burials, occupational remains, and small midden deposits with carbon, ash and an abundance of ceramic sherds; the human remains were found in circular pits with painted ceramics, silver and gold ornaments, sodalite beads close to their hands, and chuño (dehydrated potatoes) for sustenance (Ponce 1993: 51-52). Nicole Couture (2002: 314) argues that the construction of the Kalasasaya in LF2 over these burials and feasting vessels marks this location as ritually charged by Late Formative 2; not only were the builders of Kalasasaya aware of the earlier occupation (including both ritual and habitational remains), they chose to build the platform temple precisely in this place because of its pre-existing temporal and historical dimensions. In fact, "emerging elites were making an explicit statement regarding their relation to the original inhabitants and founders of Tiwanaku itself" (Couture 2002: 315). That is, while the Semi-Subterranean Temple referred back to a broadly shared Titicaca Basin religious tradition, emphasizing a sense of unity and community across multiple sites, the Kalasasaya marks the beginning of a new historical trajectory and origin myth that is rooted purely in Tiwanaku itself.

In Tiwanaku IV, the Kalasasaya and Semi-Subterranean Temple saw the installation of the Ponce and Bennett monoliths, both of which depict elite personages holding a kero cup in one hand, and a snuff tablet for drug consumption in the other. Couture (2002, 2004: 133) argues that the appearance of these monoliths is evidence of a shift away from an earlier emphasis on communal ancestral beliefs, and a sense of common origins towards the establishment and veneration of more recent, Tiwanaku-specific elite lineages.

That is, the emerging Tiwanaku elites co-opted the power and prestige associated with these past ideological currents (Couture 2002: 135, 2007a: 431). The seven-metre tall Bennett monolith was placed within the Semi-Subterranean Temple, effectively dwarfing the older Yayamama stele. The Ponce monolith was placed on the Kalasasaya platform facing east toward the Semi-Subterranean Temple, possibly meeting the gaze of the Bennett monolith[39] (Kolata 1993: 143).

It is not only the focus of worship that was reoriented in Tiwanaku IV; the site witnessed great changes in population size and the construction of new ceremonial buildings such as the Akapana Pyramid, which became the seat of elite sponsored public spectacles and feasts, as evidenced by the smashed ceramics, and human and camelid remains found on its lower terraces (Alconini 1993; Couture 2004; Manzanilla 1992). The Akapana pyramid is located directly south of the Kalasasaya and the Semi-Subterranean Temple, and is in line with the Quimsachata Mountains, situated due south. Excavations along the north and west side of the seven-tiered pyramid revealed that the surface and base of its lowest terrace were littered with the comingled remains of humans and camelids along with smashed feasting vessels (Alconini 1993; Manzanilla 1992; Manzanilla and Woodard 1990; Blom *et al.* 2003). Kolata (2004) argues that these remains are possibly part of a single, massive spectacle and feasting event to ritually mark the closing of the structure as the site's principal shrine towards the end of the Tiwanaku IV Period. During the subsequent Tiwanaku V Period, most ceremonial activity at the Akapana appears to have been restricted primarily to a series of structures on its summit; these were much smaller in

[39] The Bennett was found capsized on the ground in the Semi-Subterranean Temple therefore it is not known which direction it faced when erect (Bennett 1934).

scale and most likely limited to, and performed by elite groups. Interpretations of the pyramid's symbolism and details of its construction are presented in the next section.

Directly west of the Kalasasaya platform, and northwest of the Akapana, is an architectural complex known as the Putuni palace, an elite residential and ceremonial complex dating to the Tiwanaku V Period thought to have served as the living quarters and court of one of Tiwanaku's royal families (Couture 2007a; Couture and Sampeck 2003; Kolata 1993). The palace is attached to the Putuni Platform, an elevated structure with a sunken court made of finely cut stones. The platform was likely used for more intimate ceremonies than those held on the nearby Kalasasaya (Couture and Sampeck 2003). The Putuni area is one of many residential sectors within the civic-ceremonial's core. Excavated areas such as Akapana East 1 (e.g. Janusek 2003b, 2004a) and Akapana W1 (Mattox 2011) may have housed both elites and their retainers. The residential contexts of the Putuni area are presented with the discussion of the cosmopolitan aspect of the urban center of Tiwanaku.

Tiwanaku's central core does not only comprise of buildings; there are broad spaces that can be just as telling about the center's use as the monumental buildings. Ground-Penetrating Radar (GPR) surveys and selective excavations by Alexei Vranich's PAPA Project in the monumental core revealed dense gravel surfaces covering water canals on both the western and northeast sides of the Akapana (Koons 2006). The western surfaces, which are directly south of the Putuni Palace complex, follow the same patterns of construction, renewal, and abandonment, as those recognized by Couture and Sampeck (2003) in the Putuni complex (Yate and Augustine 2006). Two of the gravel plazas were built in Late Tiwanaku IV over razed Early Tiwanaku IV domestic areas, which included a hearth, utilitarian wares, and in one case a subfloor human burial. The western open-air plazas were repeatedly resurfaced, and although relatively clean, contained ceramic vessels, camelid remains, and uncommon artifacts such as pigments and gold and copper jewellery (Yates and Augustine 2006). Preliminary work led its excavators to suggest that some of these open-air plazas south of the Putuni may have been where elites dined (Yates and Augustine 2006). Ultimately, excavations within the civic-ceremonial core of Tiwanaku suggest that this area was used for both public and intimate ceremonies, and as a residential area for certain elites. Large open-air plazas facing the Akapana, the Semi-Subterranean Temple, and the large Kalasasaya platform could have held large congregations of ritual participants in public ceremonies, while areas such as the Putuni platform (Couture and Sampeck 2003) and open-space courts such as the ones found in Akapana W1 (Mattox 2011) and Akapana East 1 (Janusek 2003b, 2004a) were likely kept for more intimate ritual gatherings.

There are many more monumental buildings within the urban area of Tiwanaku, some just hints on the landscape, some partly excavated. Most of the currently known large-scale monuments are situated within the central monumental district, separated from the rest of the city by a moat. Yet the area outside of the moat contains one of Tiwanaku's largest monuments, the Pumapunku Temple Complex (Vranich 2006), which I discuss in more detail in the following section. Furthermore, the Mollo Kontu neighbourhood contains a small but finely made mound, itself also surrounded by a moat (Couture 1993, 2003). More plazas and platforms could still lay underground, as suggested by the preliminary excavations of the MK-E area of Mollo Kontu (see chapter 4). This suggests that ritual activities were not restricted to the civic-ceremonial core of the city, but were performed at different levels within the urban center. That is, ritual life at Tiwanaku was rooted both at the neighbourhood level and within larger, more public spaces.

However, excavations performed outside of the moated area have mainly unearthed domestic areas where non-elites of Tiwanaku practiced their daily lives. Extensively excavated residential neighbourhoods outside the moat include Akapana East 2 and Ch'iji Jawira to the east, and Mollo Kontu to the south (see Figure 3-2). These are presented in more detail in this chapter, within the discussion on the cosmopolitan nature of the urban center. In addition, recent excavations in the sector of Muru Ut Pata by Katherine Davis (2010)[40] also yielded a residential area northeast of the ceremonial core, including a series of cell-like rooms opening onto a patio area and bounded by a thick perimeter wall.

Most Tiwanaku domestic areas are characterized by compounds that are bounded by large perimeter walls, built of adobe bricks on stone foundations (e.g. Couture 2003; Janusek 2003b; Rivera 2003) and include amorphous refuse pits (Chapa and Davis 2007; Roddick and Janusek 2011; Vallières 2010). All compounds share a similar orientation, roughly in line with the cardinal directions. The content, internal layout and extent of these compounds remains speculative since no complete residential compound has been excavated to date. As we do not know the usual extent of compounds, nor if they even were of similar size, it cannot be inferred how many families or households may have

[40] The results of Davis' excavations have not yet been made available, which explains why a discussion of Muru Ut Pata is not integrated into the present dissertation.

lived in them. Certain compounds included the remains of more than just domestic activities; remnants of ceremonial and specialized activities are also common suggesting they resulted from "supra-household groupings similar to later Aymara *ayllus*" (Janusek 2004a: 187).

In the present dissertation, it is generally assumed that what we call 'neighbourhoods', such as Mollo Kontu, represent a cluster of bounded compounds.[41] In this sense, members of different compounds within a general area could still share a common neighbourhood identity, be it familial, ethnic, or through economic specialization. The delineation of neighbourhoods, which really consist of physically close excavation areas, has been justified by recent bioarchaeological work (Berryman 2010). Indeed, Berryman (2010) demonstrates that individuals' diets are similar within, and dissimilar between neighbourhoods. Although domestic neighbourhoods share many similarities across the site, they also present differences in artifact content, food consumption, cranial modification, and access to foreign goods, among other things. These differences form the basis of the argument for Tiwanaku as a cosmopolitan city, which I discuss later. First, interpretations of Tiwanaku's built form are presented to investigate the architectural manifestation of a broadly shared Tiwanaku ideology and its relation to Tiwanaku's widespread attraction for pilgrims and residents alike.

[41] The terms 'compounds,' 'barrios' and 'neighborhood' in Tiwanaku research have not been defined consistently and have at times been used interchangeably. The members of the Proyecto Jach'a Marca have realized, based on excavations at Mollo Kontu, that compounds are probably more restricted in size than a neighborhood. That is, a neighborhood, or 'barrio' would comprise multiple compounds.

Ideology in Built Form: Tiwanaku as a Cosmogram

What attracted so many individuals to Tiwanaku and enticed them to give up their rural modes of life in order to participate in this new urban phenomenon? As discussed within this section and intimated in the previous chapter, many researchers argue that Tiwanaku's attraction was rooted in its ritual status. The well-planned architecture of the city suggests Tiwanaku was built as a venue for festivals, performances, pomp and pageantry; Tiwanaku was built to impress through an awe-inducing externalisation of a broadly shared ideology. The works of two researchers on how Tiwanaku's built form exemplifies a broadly shared ideology are presented here. On the one hand, Kolata (1993, 2003b, 2003c, 2004; Kolata and Ponce 1992) proposes that Tiwanaku is a cosmogram, a built representation of a shared ideology that also justifies the elites' power. On the other hand, Vranich (1999, 2006; Isbell and Vranich 2004) suggests that Kolata's vision is based on a static description of the monuments; instead, constructions and renovations were always ongoing on visible façades to maintain the *illusion* of grandeur. In both cases, Tiwanaku monumental structures were built to inculcate the divine and inspire awe in visitors and residents alike. Their arguments mainly differ in their approach to interpreting architectural remains.

Kolata (1993, 2003b, 2003c, 2004; Kolata and Ponce 1992) argues that Tiwanaku followed a well-defined plan that mirrored in built form the shared ideology of its inhabitants, while simultaneously naturalizing social inequalities. Using the notion of cities as "celestial archetypes" following the works of Paul Wheatley (1971) and Geertz (1980) on urban centers (Kolata 2003b: 175), he suggests that Tiwanaku's principal attraction as a pilgrimage center and residential site was rooted in its imitation of sacred natural landscapes. That is, Tiwanaku's importance was born out of ritual and cosmology. In fact, certain pervasive and widely shared prehispanic ideological concepts on the relationships between nature and culture gleaned from ethnohistorical records can be applied to the analysis and interpretation of monumental architecture and the architectural plan of Tiwanaku. The symbolic importance of the city's monumental core is evident in the cardinal orientation of its overarching plan: the Akapana as a mountain metaphor, the moated core as an island and the residents' location within this built sacred landscape.

A principle of cardinality is present in the city's layout, especially in terms of the path of the sun across the urban landscape, but also with a north-south division. Most ceremonial structures, such as the Akapana, Kalasasaya and Pumapunku, have dual entrances on both their eastern and western façades. Kolata (2003b, 2004; Kolata and Ponce 1993: 234) further suggests that a north-south division is inferred in the city plan by the presence of dual ceremonial centers: the Akapana to the northeast and the Pumapunku in the southwest area of the city. In addition, the analysis of aerial photographs of the site suggests a substantial number of criss-crossing north-south and east-west roads and canals (Browman 2005). The orientation of residential compound entrances is yet unknown as none have been excavated to date, but the orientation of the perimeter walls uncovered in distinct neighbourhoods generally follow these principles of cardinality within a few degrees off true north (e.g. Couture 2003; Janusek 1994, 2003b; Rivera 2003; see also chapter 4). The importance of the orientation of perimeter walls is reinforced by evidence of multiple reconstruction events of perimeter walls practically one over another, while internal wall configurations are variable (see chapter 4).

Another dimension of Kolata's argument on how Tiwanaku's architecture reveals insights into Tiwanaku ideology is the location and construction of the Akapana pyramid. This structure can be conceived of as a sacred mountain, in particular the main peak of the Quimsachata range to the south. For example, the Akapana's tiered shape is reminiscent of a mountain, and a complex system of water canals drained water from the open-air sunken court at its summit down a series of internal and external conduits that made water gush in and out of the structure, imitating rainy season mountain streams (Kolata 1993, 2003b, 2004; Kolata and Ponce 1992). In fact, the links with the Quimsachata Mountain are more numerous. For example, the construction of the Akapana pyramid as a mountain shrine in the transition between the Late Formative and Tiwanaku IV periods effectively blocked the view of the Quimsachata from participants gathered in the Semi-Subterranean Temple, whose staircase initially framed the mountain (Benitez 2009). As such, building the Akapana in Early Tiwanaku IV marks a change in the organisation of ceremonial space by bringing the sacred mountain of past traditions to the elite central core of Tiwanaku.

Kolata further argues that the location of this human-made sacred mountain within the moat suggests the conceptual recreation of an island. Different versions of Inka creation myths recorded by chroniclers recount that the world was created at Lake Titicaca, whose nearest shores are located around 18 kilometres west of Tiwanaku (see Kolata 2003b: 176-177). In particular, the Island of the Sun on the Bolivian side of Lake Titicaca has a long occupation history (see Stanish and Bauer 2004); it was a sacred shrine in Inka times (e.g.

Dearborn *et al*. 1998) and the island housed a Tiwanaku ritual site (Seddon 1998). By recreating an island in the middle of the altiplano, the elites of Tiwanaku placed themselves at the center of the world; that is, the Akapana is representative of an *axis mundi*. By living within the sacred precinct of this metaphorical sacred mount *cum* island, Tiwanaku elites gained the right to intercede with the supernatural and therefore continued to symbolically reinforce their importance through in their residential patterns.

If the characteristics of the monumental core are the embodiment of a shared cosmology and moral order, then the social status of those living within this sacred space would be elevated by association (Kolata 1993, 2003b, 2004; Kolata and Ponce 1992). Kolata describes the social organization of the city as "concentric cline of urban social status" (Kolata 2003b: 178) intensifying the supernatural aura of Tiwanaku; the elites lived within the moated ceremonial core while the social status of residents living outside the moat declined the further away they lived from the sacred core. The built form of the city as a cosmogram gave the elite the moral authority necessary to justify their power as it rendered "natural" the social order they created (Kolata 2003b: 179).

In contrast to Kolata's emphasis on an idealized representation of a cosmological order through architectural layout, Vranich (1999, 2006; Isbell and Vranich 2004) focuses on the figurative and literal flaws behind the illusions of the awe-inspiring façades. He also emphasizes the role of monumental space and the city as a whole as a place of pilgrimage, worship and spectacles.

The flaws were architectural, with constant episodes of construction, reconstruction and renovations, and unfinished sections. For example, the southern and northern edges of the west-facing nearly half-kilometre long Pumapunku monumental structure remained unfinished upon its abandonment, and thus became asymmetrical in the many reconstruction episodes of the complex. While the less visible sides of the building were left in disrepair, the western side was made grandiose by its revetment, façades and double staircases which led processions of pilgrims into a maze of gateways and corridors until they reached the apex on the east side of the structure with its spectacular vista of the sprawling city, its ceremonial core and the snow-capped Illimani mountain that borders the modern-day capital of La Paz. But these flaws also reveal what could be seen as an intentional manipulation of these pilgrims into 'buying' what Tiwanaku had to sell. Vranich argues that "a guiding architectural tenet in the structuring of the Pumapunku Complex is the need to impress through an *illusion* of monumentality" (1999: 261; emphasis mine). That is, more focus was given to impress the visitor than to build 'perfect' monuments embodying strength and power. As such, the illusion is not shared by all; it was specifically targeted at enhancing the pilgrim's journey. His study of Tiwanaku monumentality uses a phenomenological approach which focuses on how these structures were likely *experienced* by those who used them. Visitors on a pilgrimage from Lake Titicaca to the snowcapped Illimani peak were first greeted by the Pumapunku platform, acting as a representative of the city. In this view, Tiwanaku's monumental architecture is not so much about expressing social status divisions, or representative of factional or kinship groups, but rather about putting forward a façade for visitors to see; these buildings are "statements about nationalism and cosmic structure" (Isbell and Vranich 2004: 181).

Investigations of Tiwanaku's monumentality therefore suggest that Tiwanaku's attraction resided in its capacity to inspire religious awe. The pageantry involved, the plazas, sunken courts and platforms amenable to holding large crowds, and the remains of domestic and ritual ceramics within those areas, all converge to suggest that Tiwanaku's attraction relied on its inspiring monumentality, its religious aura and its role in festivals and feasts. This is what Tiwanaku meant to its visitors and to elites who benefitted from these visits. But what of those that stayed? What factors explain the large population housed permanently at Tiwanaku? In Kolata's explanation of the site as a cosmogram, residents might want to stay close to the sacred. But if Tiwanaku is instead a front for recruiting workers and offerings, who would stay once the illusion of sacred grandeur wears off? Tiwanaku's built form was central to foster an attraction to, and perpetuation of, a broadly shared ideology rooted in rituals and ceremonies for visitors yet the domestic aspects of the site are not fully integrated into this narrative. As was argued more than half a century ago, Tiwanaku was not an empty pilgrimage center (see Kolata and Ponce 2003). It was an urban center which housed thousands, elites and commoners alike. Before we can understand the residents' motivations in adopting an urban way of life, we need to understand who actually stayed and how they were integrated into a broader urban political economy. Tiwanaku's urban character might be the more complex, even messy, part of its history.

A Cosmopolitan Center

The focus on Tiwanaku as a center for ceremonies, theatrics and commensality based on a broadly shared, or at least easily intelligible, ideology, puts forth the external appearance of homogeneity. It consequently masks internal heterogeneity. In fact, recent research indicates that Tiwanaku was a cosmopolitan city where people of different social status, ethnicity and occupational speciality cohabited. Deborah Blom (2005) describes the city of Tiwanaku as a 'borderland' where people marked their connection to their roots through two styles of cranial modification. Tiwanaku was not only the epicentre out of which ideas and material culture flowed out to its sphere of influence; it was where distinct groups converged, interacted and lived. As such, Tiwanaku's identity included its special status as an urban center where regionally and culturally diverse social groups coexisted; it was a "dynamic space of convergence" (Blom 1999: 175). The integrative function of commensal events and hospitality etiquette, emblematic of Tiwanaku's material culture, no doubt contributed to the creation of this animated and spectacular borderland. Yet, excavation and material analysis of different Tiwanaku neighbourhoods demonstrates that even within this inclusivist ideology, maintaining social distinctions remained essential.

Investigations of residential sectors by the members of Alan Kolata's Proyecto Wila Jawira (see Kolata 2003a) demonstrate differences between areas in sanitary practices, use of architectural construction materials, ratios of ceramic vessels and the presence of economic specialization; all of which can be used in a discussion of intra-site social differences and affiliations (Couture 2003; Couture and Sampeck 2003; Janusek 2003b, 2004; Rivera 2003; Wright *et al.* 2003). These investigations were conducted in residential areas located within and outside the moated core, which allows for a balanced description of elite and non-elite domestic patterns. Residences within the moated core are represented by the Putuni complex and the Akapana East 1 and Akapana East 1 Mound sectors. Large-scale excavations of areas of domestic occupation outside of the moat include the Akapana East 2, Ch'iji Jawira, and Mollo Kontu (see Figure 3-2). In addition, analyses of human remains, recovered from all of these residential areas, are integrated into the following discussion of the urban heterogeneous social affiliations, with particular attention given to information about diet and cranial modification. In the following section, I provide a description of the excavated material of the Putuni area, Akapana East sectors and Ch'iji Jawira. The data from the Mollo Kontu sector, which forms the basis of this dissertation, is presented in Chapter 4. These descriptions are presented to highlight the similarities and differences between neighbourhoods and interpret when possible the likely social differences and affiliations they exemplify.

The Putuni Complex

Excavations at the Putuni Complex, situated west of the Kalasasaya platform, revealed a long occupational history that spanned from the Late Formative 2 to Late Tiwanaku V (see Figure 3-3). Excavations below the Tiwanaku V Palace complex uncovered an initial occupation with domestic and ceremonial contexts and dating to the very end of Late Formative 2 (Couture 2002: 316). The following Early Tiwanaku IV Putuni occupation was domestic, with two residential compounds separated by a large east-west perimeter wall. While the North compound was heavily occupied and contained a kitchen complex, the South compound consisted of two residential structures and a substantial elite mortuary complex. Towards the end of the Tiwanaku IV Period, these domestic areas were razed to make way for construction of the final

Putuni Palace and the attached Putuni Platform, whose interior stone walls were lined with niches (Couture 2002, 2007a; Couture and Sampeck 2003). Changes in architecture, mortuary practices and material culture demonstrate how residents of this area transformed their social roles from ritual attendants or visitors of elevated status, to permanent elite residents and ultimately high elites at Tiwanaku. The aim of the following discussion of the Putuni complex is to demonstrate the ways in which "Tiwanaku elites distinguished themselves not only in terms of their ownership of tangible forms of property (such as palaces and mortuaries) but also in terms of access to specific kinds of esoteric knowledge" (Couture 2007a: 424). That is, to be elite at Tiwanaku was not only couched in terms of getting better access to exotic or valued resources, but was an embodied identity that was reinforced in daily practice.

Putuni's first occupational period is represented archaeologically by a red clay platform and a ceramic vessel cache. The platform was kept clean but ceramic sherds were recovered nonetheless. Of the ceramic remains recovered from the platform floor, 80% of were domestic (cooking and storage vessels), suggesting that that platform was used for mundane activities such as food preparation (Couture and Sampeck 2003: 231). Yet the carefully prepared platform's association with a cut-stone canal, in addition to the elaboration of its construction and fastidiousness in maintaining a trash-free floor, signals that its residents may have enjoyed an elevated social status. It is possible that the Putuni area at this time was used by ritual specialists associated with the Kalasasaya, or even special visitors; the paucity of artifacts suggests Putuni occupation was periodic rather than permanent (Couture and Sampeck 2003: 231-232).

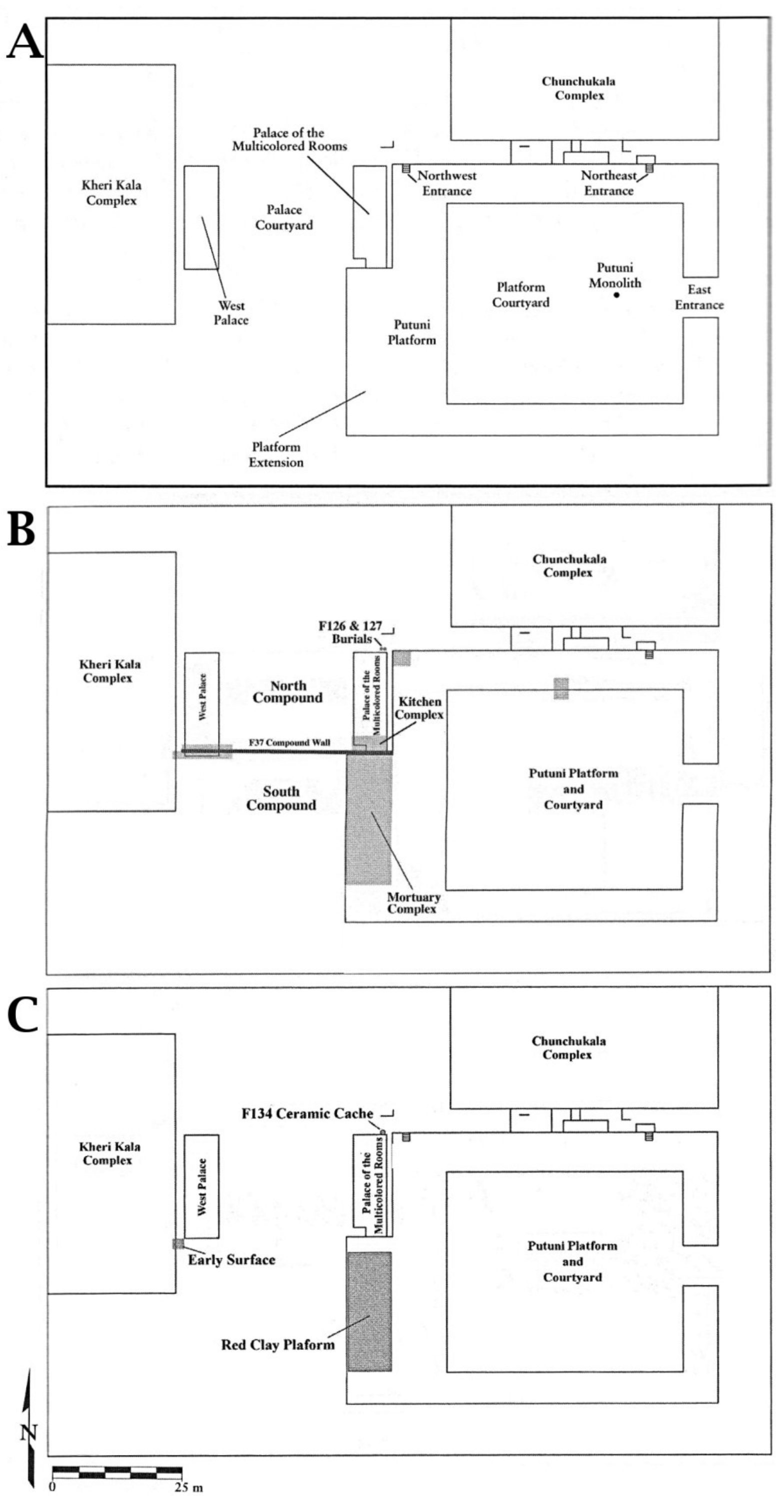

Figure 3-3: Putuni floor plans for the three occupation levels, placed in stratigraphic order (modified from Couture and Sampeck 2003). A) Plan locating the principal structures associated with the Tiwanaku V Putuni complex (Couture and Sampeck 2003: 228, figure 9.1); B) Plan locating excavated sectors of the Late Tiwanaku IV occupation (Couture and Sampeck 2003: 233, figure 9.10); C) Plan locating three excavated Late Formative 2 – Early Tiwanaku IV contexts, in reference to architectural features associated with the Tiwanaku V Putuni complex (Couture and Sampeck 2003: 229, figure 9.2).

This early occupation was demolished towards the very end of the LF2 Period and subsequently replaced by two domestic compounds in Tiwanaku IV. The south compound contained at least two residential structures and an elite mortuary complex, while the north compound included a heavily used three-room kitchen area and a residential area. The floors contained numerous hearths, along with storage and ash pits. Two more hearths and pits were excavated in an outdoor location north of the kitchen structure, demonstrating that cooking happened both indoors and outdoors (Couture and Sampeck 2003: 234). Like the previous structure, this residential complex also had a drainage canal, but was constructed using a mixture of cobblestones and repurposed dressed stones, which contrasts with the earlier cut-stone canal.

The mortuary area excavated in the South compound consisted of 10 heavily looted tombs containing elaborate offerings, including gold and quartzite jewelry, beads, bone tools and significant quantities of finely decorated ceramics (Couture and Sampeck 2003: 240). The small residential occupation excavated in the South compound contained cut-stone foundations and prepared red clay floors, although evidence for a badly destroyed structure with cobble stone foundations located 30 meters west of the mortuary complex suggests the presence of social differences within the Putuni area (Couture and Sampeck 2003: 243-244). *Escudilla* is the most commonly found ceramic type in Tiwanaku IV residential area of the Putuni Complex. These flared-rim bowls rarely appear in other Tiwanaku contexts, apart from offerings on the Akapana pyramid.

At the end of the 8th century, Putuni's Tiwanaku IV occupation was systematically closed and razed to the ground in order to make way for the construction of a multi-structure palace complex and elevated platform with an interior courtyard. Numerous human remains were buried between the destroyed Late Tiwanaku IV residential compounds and the construction fill of the new Tiwanaku V Palace structures. These remains are interpreted as deceased Putuni residents re-accommodated over episodes of renovation and construction (Couture 2007b). Dental analyses of five of skeletons recovered from these burials show high rates of tooth decay, suggesting an agro-pastoral diet that included high plant carbohydrate consumption, most likely maize (Berryman 2010: 195). Their isotopic signatures do not cluster together in a way that suggests similar diets; variance is particularly seen in terms of C4 values (i.e. maize and/or fish consumption); their diets were generally low on meat and local food, suggesting that the individuals buried under floors were not local to the altiplano (Berryman 2010: 241). Furthermore, cranial modification showed six individuals from the Putuni had a fronto-occipital style head associated with Moquegua settlements, one had an annular style head associated with the neighbouring site of Lukurmata and more generally the Katari valley, and one unmodified example (Blom 2005: 13-14). The high presence of fronto-occipital modifications further reinforces the suggestion that some of those individuals may have lived in the lowlands, perhaps as state administrators (Couture 2007b).

By the time the Late Tiwanaku IV occupation was razed to make space for the palace complex, this area was arguably the residence and court of a well-established dynasty (Couture 2004; Couture and Sampeck 2003). The two excavated structures within the Palace Complex, built on prepared red clay floors and with wall foundations of finely fitted andesite blocks, are organized around a large flagstone courtyard. Recovered fragments of painted adobe bricks suggest that the interior and exterior walls of these structures were painted in brilliant colors. In addition to the fine cut-stone architecture and the presence of sumptuary goods, the elevated status of the Putuni residents can be seen by the number of dedicatory human burials under one of the palaces. Of the Tiwanaku IV occupation, only the mortuary area was spared; in fact, the location of this area was elevated and integrated into the construction of the Putuni Platform, suggesting the importance of those who were buried there for the later residents of the area (Couture 2002, 2007a; Couture and Sampeck 2003).

The occupation history of the Putuni demonstrates that residents of that particular area of Tiwanaku's urban center increasingly sought to differentiate themselves from non-elite residents through their use of finer construction materials and an elaborate system of sanitation not found in other sectors. Couture (2004: 134) uses the presence of the latter to argue that Putuni residents sought to distinguish themselves through higher levels of cleanliness, using their body and living areas to signal their elevated status. The running water through the canals is suggestive of *camay*, a later Andean concept of animating vitalizing life force often represented through running water. The association of elites with running water flowing under the floors of their residence, carrying away impurities while animating the area, further distinguish them from non-elites. This argument is reinforced by ritual deposits found in excavated areas of larger canals in addition to the overall cleanliness of the Putuni floors. In fact, Melanie Wright and colleagues (2003) note that the presence of seeds in the soil samples of various sectors of the city decreased the closer they were located to the city's monumental core. Conversely, the ubiquity of seeds within ash pits presented the opposite pattern. That is, rubbish was not allowed to accumulate on the Palace floors, but was regularly swept up and disposed of in garbage pits away from living areas. Clearly, importance was placed on floor cleanliness in elite households, a characteristic that differentiated them from the commoners living further away from the moated core. As we will see in Chapter 4, people living at Mollo Kontu maintained in a very different attitude and were quite comfortable with the accumulation of garbage in and around their dwellings.

The high ratio of escudillas in Tiwanaku IV Putuni contexts, when compared to all the other residential areas excavated at Tiwanaku, represents another way elites used daily practices to distinguish themselves from non-elites. Indeed, the use of these shallow bowl with a wide flared rim (not unlike the rimmed soup or pasta bowls used in modern Western cuisine) would have been particularly difficult and potentially messy, especially for dishes with lots of liquid. This suggests that elites had developed a particular dining etiquette, a proper way to use of escudillas which required a certain savoir-faire (Couture 2004: 135). Furthermore, the distinct shape of escudillas hints that elite meals could have been significantly different from that of non-elite residents. That is, while the tall and narrow rimmed tazon bowls used for food consumption in most neighbourhoods suggest the consumption of soups or stews,[42] the shallow shape of the escudilla bowl and the openness of its rim might indicate the serving of meals that contained less liquids. For example, elites may have dined on small portions of roasted meat and tubers.

[42] See Chapter 7 for a detailed discussion of this argument.

Akapana East 1 and Akapana East 1 Mound

The Akapana East 1 (AKE1) and Akapana East 1 Mound (AKE1M) sectors are located inside the eastern edge of the moated core: AKE1 at the very edge of the moat, and AKE1M further west. The earliest occupation is in AKE1 and dates to Late Formative 2, prior to Tiwanaku's population explosion. This area is abandoned early and sees no reconstruction in Tiwanaku IV. Instead, the area over AKE1's initial occupations was pockmarked with refuse pits, like many areas in AKE1M, Akapana East 2 (AKE2), Ch'iji Jawira and Mollo Kontu, as will be discussed later. As AKE1 is abandoned, domestic occupations are built at AKE1M in Tiwanaku IV.

Excavations at AKE1M revealed two Tiwanaku IV north-south perimeter walls with a drainage ditch between them. This has been interpreted as a possible unpaved street (Janusek 2004b: 140), suggesting that some compounds at Tiwanaku were separated by thoroughfares (see Figure 3-4). Extensive archaeological remains were only uncovered in the compound to the West, where excavations exposed two multi-room domestic structures, each with earth brick wall foundations, a kitchen area and an adjoining patio. The patios were marred with garbage pits. One room was identified as a sleeping quarter based on a compacted floor free of ash which might have been where beds of grass or textile were laid out (Janusek 2003b: 270). Human burials were found under floors (Janusek 2004a: 193), a common occurrence in many residential areas of Tiwanaku, including Putuni as discussed above.

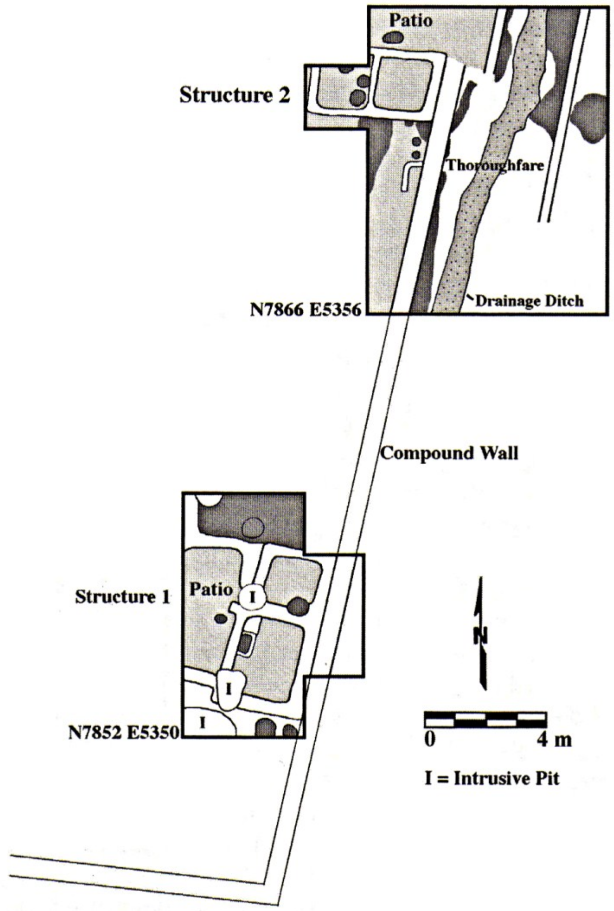

Figure 3-4: Floor plan of AKE1M excavations showing features associated with the Late Tiwanaku IV occupation (modified from Janusek 2003b: 269, figure 10.4).

As noted earlier in this chapter, the transition between the Late Tiwanaku IV and Early Tiwanaku V periods is characterized by an episode of 'urban renewal' which is associated with the rebuilding of many residential compounds across the site, including those at AKE 1 and AKE 1M. For example, during the Tiwanaku V period occupation at AKE1M a new perimeter wall is built over the previous western one, however, the interior configuration of space in the new compound changed significantly. The excavated areas consist in large outdoor areas and the remains of structures much larger than those of the previous occupation, with material suggestive of domestic activities. However, the density of material found is much lower with no clear middens or hearths (Janusek 2003b: 284).

AKE1, which was covered in huge amorphous garbage pits in the previous Tiwanaku IV period, sees the construction of two compounds in Tiwanaku V (see Figure 3-1). The South compound included a large kitchen and extensive outdoor area and a habitation room, all built on cobblestone foundations. In contrast to the relative cleanliness of AKE1M described above, the floors of the kitchen area were littered with high proportions of cooking ceramic vessels and bone fragments and contained no less than 12 hearths (Janusek 2004a: 199). The North compound included the remains of at least one sunken court made of fine ashlar foundations in an architectural style reminiscent of some structures within the Putuni complex. A few exotic vessels and sumptuary goods such as a copper band and feline tooth pendants were excavated, along with consumption refuse similar to those found in domestic areas including faunal bone fragments and cooking and serving ceramic ware. Janusek (2002, 2003b, 2004a: 200) argues that the north compound was dedicated to chicha brewing and food preparations for feasting events that would take place within its sunken court. As such, Janusek concludes that the domestic features excavated at AKE1 were not long-term residences but rather represent temporarily used structures whenever feasting was required.

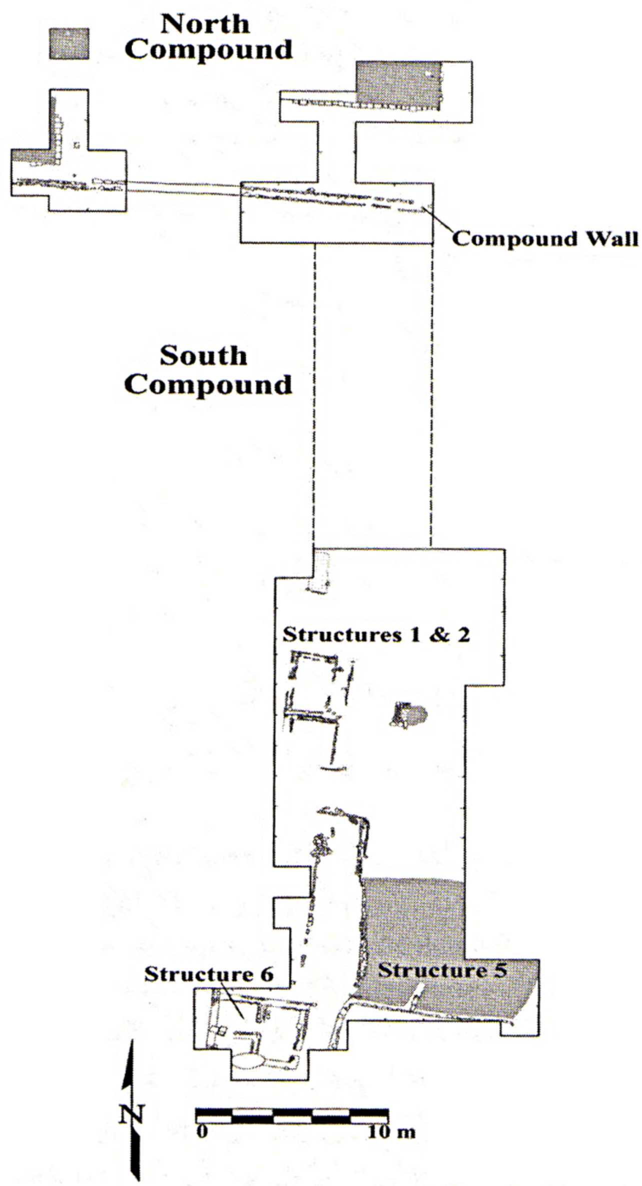

Figure 3-5: Floor plan of the Tiwanaku V occupation in AKE1 (modified from Janusek 2003b: 286, figure 10.18).

Janusek (2004a: 194; 2009: 171) argues that the large middens found in AKE1 and AKE1M, and likely other pits found throughout Tiwanaku, represent in part the remains of large feasts possibly mixed with domestic refuse as they are dense with consumption refuse and appear to have been filled in only one to a few dumping episodes. However, as I will discuss later in this dissertation, this interpretation does not hold true for the Mollo Kontu sector. In Chapter 6, I show that the analysed garbage pits in the Mollo Kontu excavation areas are not the by-product of large feasting events but rather correspond to regular accumulations of household refuse. As such, we should be very cautious about applying Janusek's interpretations for AKE1, an area of relatively elite occupation, to the rest of the site. This in turn, has important implications for our overall understanding or Tiwanaku's urban history and our characterizations of its population. At a minimum, we should be extremely cautious in interpreting Tiwanaku's residential neighbourhoods as loci for smaller corporate feasting events during festivals. Distinct excavated sectors may have been used differently by residents and pilgrims alike; in contrast to the North and South Compound of AKE1, Mollo Kontu never lost its permanent domestic function as will be demonstrated in the next chapter.

The bioarchaeological data for AKE1 and AKE1M residents are presented jointly and provide insight into their diet and possible economic specialization. Dental analyses of human remains found within Akapana East show that, like in the Putuni complex, individuals interred at AKE1 had a high caries rate which supports Janusek's argument that those using the area were involved in the production and consumption of maize beer (Berryman 2010: 195). Isotopic analyses suggest that these individuals did not all share a similar diet. The C4 consumption rates are variable within this group in terms of fish consumption, though they consumed the highest amount of maize of all Tiwanaku sectors tested (Berryman 2010: 238). Meat consumption levels were relatively low, and the majority of their diet was composed of local plants. The dietary results therefore suggest that the individuals interred in the Akapana East 1 sectors did not all share the same diet but all consistently consumed significant amount of maize, which reinforces the argument that this area was used by specialized chicha-makers. The cranial modification data also demonstrate heterogeneity within these sectors as three individuals had annular style heads, two individuals had front-occipital style heads, and one individual showed no indications of cranial modification (Blom 2005: 14).

Akapana East 2

Excavations of domestic architecture from Akapana East 2 (AKE2), an area 120 meters east of Tiwanaku's moated core, suggests a Late Tiwanaku IV through Early Tiwanaku V occupation (Janusek 2003b: 269, 2004a, 2004b). A house structure and patio was found in conjunction with perimeter walls east and south of them (see Figure 3-6). The patio displays multiple evidence of domestic activities including cooking, storage and refuse disposal (Janusek 2003b: 274-275). A cyst burial demarcated by an elongated stone slab and containing the remains of three individuals was found under a patio floor (Janusek 2004a: 193), and a foetal camelid was discovered under the northeast corner of the house structure (Janusek 2004b: 141). The area is not linked to any economic specialization or foreign origins through their material culture. The lack of sumptuary goods, in contrast to Putuni and Akapana East 1, suggest that the residents of Akapana East 2 were of lower social status than those living within the moated core.

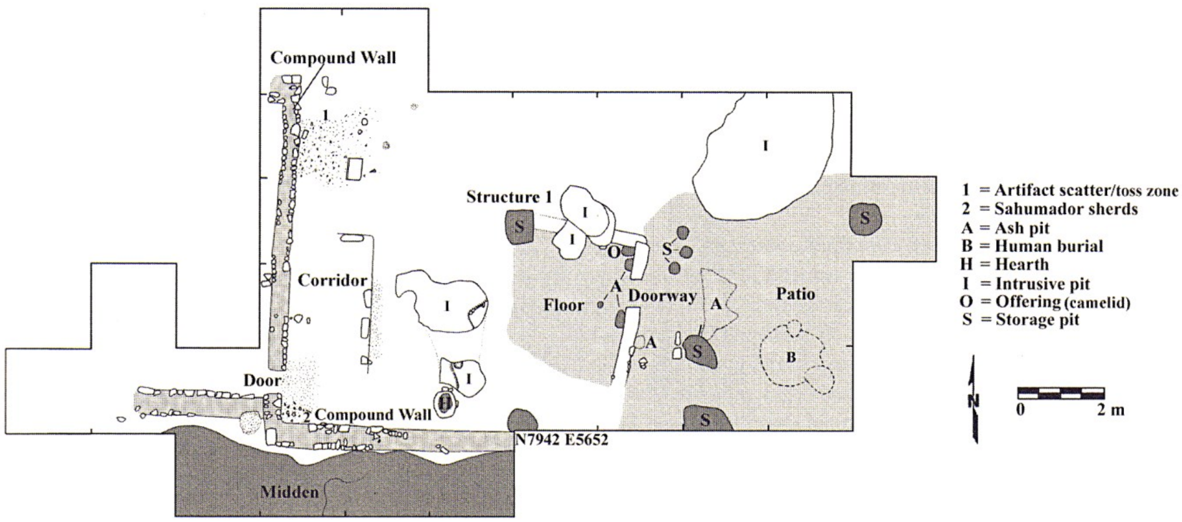

Figure 3-6: Floor plan of the Late Tiwanaku IV occupation of AKE 2 (modified from Janusek 2003b: 273, figure 10.11).

Ch'iji Jawira

Ch'iji Jawira is the excavation area situated the furthest away from the monumental core. Located approximately 1.2 km east of the monumental core, the results of a surface survey and broad horizontal excavations have revealed abundant evidence that Ch'iji Jawira was a specialized area for ceramic production (Rivera 2003). Evidence include ceramic production debris, misfired vessels, a large hearth and burned earth area likely used for the firing of vessels and tools such as lithic scrapers with clay residues on the working edges. A perimeter wall overlying production debris suggests Ch'iji Jawira was an established specialized ceramic production area prior to the adoption of Tiwanaku compound architectural tenets (Rivera 2003: 303). Although Tiwanaku material culture is characterized by the widespread use of standardized ceramic assemblages, possibly produced by ceramic specialists like those of Ch'iji Jawira, the analysis of ceramic production at Ch'iji Jawira suggests that this area was not the locus for the production of sumptuary and ritual wares (Rivera

2003: 310). That is, Ch'iji Jawira was not the production center for the standardized consumption vessels used in feasting events such as keros. Three lines of evidence suggest that the Ch'iji Jawira potters were autonomously organized and not under the direction of the ruling elites. First, Ch'iji Jawira was isolated from elite structures, which would otherwise suggest they were attached specialists. Second, specialization is aimed at the production of domestic wares as opposed to finely crafted serving wares. Finally, vessels produced at Ch'iji Jawira lack Tiwanaku corporate style iconography (Rivera 2003: 311-312). Rivera suggests that if there was a relationship between Ch'iji Jawira ceramicists and Tiwanaku's urban elites, it was most likely in the form of tributary obligations in goods or labour for the production of utilitarian ware, such as storage vessels (Rivera 2003: 312).

The identity of Ch'iji Jawira residents appear not to be only through their shared economic specialization, but also through a strong connection with groups from the Bolivian lowlands, particularly the area of Cochabamba. This is suggested through the presence of ceramic styles originating from eastern and southern Bolivia within Ch'iji Jawira excavated contexts. Moreover, a high ratio of maize was present in the paleoethnobotanical record (Wright *et al.* 2003). Combined, these two lines of evidence suggest that the inhabitants of the Ch'iji Jawira compound were in contact with those from the warmer environments of the Cochabamba Valley. While the relationship between them remains unknown, Rivera (2003: 313) proposes three hypotheses: the inhabitants of the compound were immigrants from these regions; they were networking with Tiwanaku colonies from the eastern lowlands; or they were maintaining social ties and reciprocal relationships with these groups based on real or fictive kinship ties.

The isotopic analyses of three individuals suggest that Ch'iji Jawira residents had a diet rich in meat, but lower maize consumption levels than seen in Akapana East 1 and Putuni individuals, even though large quantities of maize were recovered in the paleoethnobotanical samples. The data indicates a wide standard deviation between the individuals, in part due to high levels of fish consumption found in one individual (Berryman 2010: 236). Only one individual showed an annular cranial modification (Blom 2005: 14). In sum, it appears that the residents of Ch'iji Jawira had access to maize, but were not consuming it in great quantities. A similar situation is suggested for residents of Mollo Kontu, as will be discussed in the next chapter.

Mollo Kontu

Mollo Kontu, the basis of this dissertation work, is an extensive sector situated south of the moated core of Tiwanaku's ceremonial center. Several areas of Mollo Kontu have been the focus of excavations over the last 20 years (see Couture 1993, 2003; Couture *et al*. 2007, 2008, 2010a). My dissertation focuses on excavation materials recovered between the 2006 to 2008 field seasons, in particular those from two areas of intensive domestic occupation. Chapter 4 presents a detailed description of the occupation history of Mollo Kontu.

Discussion and Conclusions

The residents of Tiwanaku were unified under a broadly shared worldview materialized in its architecture; the city of Tiwanaku was physically designed to enhance a broadly shared state ideology that was expressed through civic gatherings, festivals and rituals. These gatherings reinforced the importance of commensality and hospitality, encapsulated into a specific drinking and eating etiquette. In public contexts, local elites may have harnessed these commensal practices to promote a Tiwanaku ideology where their own role within the social order was reified. This ideological system was exported and promoted throughout Tiwanaku's regional sphere of influence through commensal politics (see Anderson 2009; Goldstein 2003). Its popularity outside of the confines of the Southern Titicaca Basin strengthened the mystical aura of both the city and the state. Yet Tiwanaku was not only the epicenter of a popular ideology that attracted visitors far and wide, it was also a cosmopolitan urban center; the chosen residence for a vibrant and variegated permanent population.

Archaeological research presented in this chapter demonstrates that although the city presents clear evidence of homogeneity in its spatial layout, architectural construction and ceramic styles, there is multiple evidence of heterogeneity between residential neighbourhoods. These residential sectors contain distinct ratios of ceramic types, some indicated evidence of specialized work, variety in diet and status-based differentiation especially in residential architecture. Janusek (2003b: 282) argues that these distinct social affiliations and identities were akin to micro-ayllus focused on a common ancestry through the veneration or commemoration of individuals buried under their residences. For example, compound groups in some neighbourhoods maintained their own resource acquisition networks, dietary preferences and domestic and mortuary rituals. However, they would all coalesce together for periodic Tiwanaku-wide ceremonies and festivals where Tiwanaku-centric wares were central, reinforcing the power of ruling elites and a broad shared corporate style.

Our understanding of residential life at Tiwanaku grew out of the large-scale excavations carried out under the auspices of Alan Kolata's Proyecto Wila Jawira. Investigations conducted by the project, including excavations at the Putuni Complex (Couture 2002; Couture and Sampeck 2003), Akapana-East (Janusek 2003) and Ch'iji Jawira (Rivera 2003) demonstrate that not everyone living at Tiwanaku had the same lifestyle. Wright and colleague's (2003) paleoethnobotanical analysis of these neighbourhoods also suggested a division between residential areas in terms of the density of seeds and levels of floor cleanliness. An interest in the daily life of non-elite residents through one of the most commonplace yet intimate action – the elaboration, repetition and sometimes digression of foodways – furthers our understanding of urban living in pre-Inka times and points to the various ways in which residents, consciously or unconsciously, made Tiwanaku into a complex urban setting and regionally important ceremonial center. The next chapter presents the results of years of excavations within the Mollo Kontu neighbourhood which forms the basis of my zooarchaeological analysis. This discussion of the archaeology of Mollo Kontu presents this neighbourhood as a permanently occupied sector of the urban center and sets the stage for the interpretation of its residents' daily culinary practices.

CHAPTER 4: MOLLO KONTU

Mollo Kontu is an area due south of the civic-ceremonial center, measuring roughly 8 hectares (see Figure 3-2). Excavations in the Mollo Kontu sector of Tiwanaku reveal that it was a largely domestic area, intensively occupied across Tiwanaku's urban phase, that is, during the Tiwanaku IV and V periods. Dating of excavated material from the sectors that form the basis of the present analysis suggests an occupation period from the end of the 6th century until the middle of the 12th century.[43] The excavated areas within the Mollo Kontu sector include at least one ceremonial structure, domestic architecture and garbage pits, and mortuary features. The first intensive excavations in the area date to the early 1990s when Nicole Couture (1993) initiated excavations at the Mollo Kontu Mound and Mollo Kontu South. Mollo Kontu has been the focus of excavations for decades. The data used in the present dissertation come from the more recent excavations in the Mollo Kontu sector by members of the Proyecto Jach'a Marka, led by Nicole Couture, Deborah Blom, and Maria Bruno.

This chapter is meant to both introduce Mollo Kontu, and to situate the faunal remains analysed within the neighbourhood context. The history of research at Mollo Kontu is presented first, followed by a description of the geophysical survey and excavation work undertaken by the Proyecto Jach'a Marka. Results of archaeological research suggest that Mollo Kontu was an intensely occupied broadly domestic area with a possible agro-pastoral component represented by its unique high density of qochas, or lake features.

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[43] The excavation of a deep shaft tomb in 2000 showed a possible Late Formative 2 occupation for the area, but the data are not clear (Couture pers. comm.). The radiocarbon dates and the ceramic assemblages demonstrate a clear occupation starting from Early Tiwanaku IV.

Mollo Kontu residents occupied, renovated and reoccupied these spaces throughout many generations. They also commemorated their dead through careful burials within their residential areas, infusing their living spaces with certain emotional attachment. Mollo Kontu was the locus for the rituals of daily life for its residents; a place simultaneously entrenched within the Tiwanaku urban fabric and in some ways apart from its power.

Archaeological Research Predating the Proyecto Jach'a Marka

The earliest mention of Mollo Kontu comes from Ponce Sangínes (1961) whose test pits in this area revealed a great number of human internments (see Figure 4-1 for the placement of Ponce's early test pits). Extrapolating from this discovery, Ponce concluded that Mollo Kontu was a large-scale cemetery for the city. Excavations in this area since 2001 showed that there is indeed a high frequency of interred bodies, often placed in elaborate cyst tombs, but our findings do not seem to corroborate Ponce's extrapolations of a dense, dedicated cemetery. Instead, research at Mollo Kontu since Couture's early excavations as part of Alan Kolata's Proyecto Wila Jawira (see Couture 1993, 2003) suggests that Mollo Kontu was a broadly domestic area with residential structures and burials, ceremonial features and qochas.

Situated near the northern edge of the Mollo Kontu sector is the Mollo Kontu platform mound. This oval mound is a relatively small eroded platform structure built over a cobblestone foundation. It is roughly 3.5 meter tall and measures approximately 40 metres by 50 metres in diameter (Couture 2003: 202). It was probably topped by a now destroyed structure. The mound was first excavated by Couture (1993, 2003) and reinvestigated by the Proyecto Jach'a Marka in 2007 (Couture *et al.* 2008; see MK-M excavation area in Figure 4-1). Excavations revealed terrace walls on the north and west sides of the mound and a large number of human remains. Magnometry results suggest that the mound's walls continue on the west and south walls, with a possible entrance on its south side (Morrow and Williams 2009).

The similarities between the Mollo Kontu Mound and the Akapana pyramid lead Couture (2003; Couture *et al.* 2009) to suggest that the mound's function was similar to that of the Akapana; it was likely a local fertility shrine and mountain metaphor for the nearby Quimsachata mountain. Indeed, the topography of the MKM area shows a broad shallow depression around the mound, which connects to a large qocha to the east that would have filled with water, at least during the rainy seasons (see Figure 4-1). This qocha would have encircled the mound with water in a way reminiscent of the moat delimitating Tiwanaku's civic-ceremonial center. Furthermore, the surface of the mound is covered in small white pebbles from the Quimsachata Mountain, reminiscent of the blue-green pebbles found atop the Akapana pyramid (Couture 2003: 203; Kolata 1993: 104). The presence of these pebbles and the discovery of a great number of quartz and obsidian points embedded in the pyramid (see also Giesso 2003) seem to corroborate the ideological association of the Mollo Kontu Mound with mountains. Finally, the mound lines up with the Akapana to the north, and the Quimsachata Mountain to the south. The functional similarity between MK-M and the Akapana reinforces the broad sense of shared religious ideology between the residents of Mollo Kontu and Tiwanaku's elites. Yet subtle differences and its location outside of Tiwanaku's core demonstrate that Mollo

Kontu residents modified these ideological concepts and organized part of their ritual life outside of the civic-ceremonial precinct.

The surface and base of the MK-M terraces were lined with 26 human bodies, mainly children and youths, likely deposited within a short amount of time before the abandonment of the building, toward the onset of the Tiwanaku V time period (Couture *et al.* 2009). Among the human offerings was also uncovered the complete skeleton of a 5 month old dog arranged post *rigor mortis* in a sleeping position, as attested by the presence of cutmarks on its paws (Mendoza España 2008; Vallières *et al.* 2009). The human remains (approximately half of which are children) found along its revetment, associated with at least one animal sacrifice, may also represent a powerful form of offering to ensure agricultural fertility.

Contemporaneous with the first excavation of the mound were excavations south of the Mollo Kontu Mound. The excavation of Mollo Kontu South (MK-S) revealed the presence of domestic architecture, including a large compound wall, and dense occupation as demonstrated by the large amount of domestic refuse. Residential space in this neighbourhood followed the overarching architectural organization of the site with bounded compounds enclosed by adobe or tapial perimeter walls, similar to those previously described for the Akapana East sectors, the Tiwanaku IV Putuni, and Ch'iji Jawira. MK-S showed evidence of repeated occupations spanning from Late Tiwanaku IV through the end of Tiwanaku V. The horizontal excavations of Mollo Kontu, lasting two field seasons, did not reach sterile, which suggests that the area could have been occupied in earlier time too.

Archaeological Research by the Proyecto Jach'a Marka

A systematic geophysical survey over 1.2 hectares of the general area of Mollo Kontu south of the Mollo Kontu Mound was carried out in 2004 (Vining *et al*. 2008). Some of the anomalies identified in 2004, were selected for test excavation in 2005 (Couture and Blom 2005); the results of the test excavations, in turn, were used to select the location of large scale excavations of sectors MK-A, MK-D and MK-E by the Proyecto Jach'a Marka between 2006 and 2008. Furthermore, a fine scale topographic map of the Mollo Kontu area was created over 16 hectares in 2007 (see Figure 4-1). This topographic work shows the presence of linear structures west of the MK-D excavation area and the presence of qochas in the area, and demonstrates that the domestic areas excavated were raised above the surrounding area (Morrow and Williams 2009). The following section presents a general discussion of three excavated sectors of Mollo Kontu: MK-D, MK-A and MK-E.

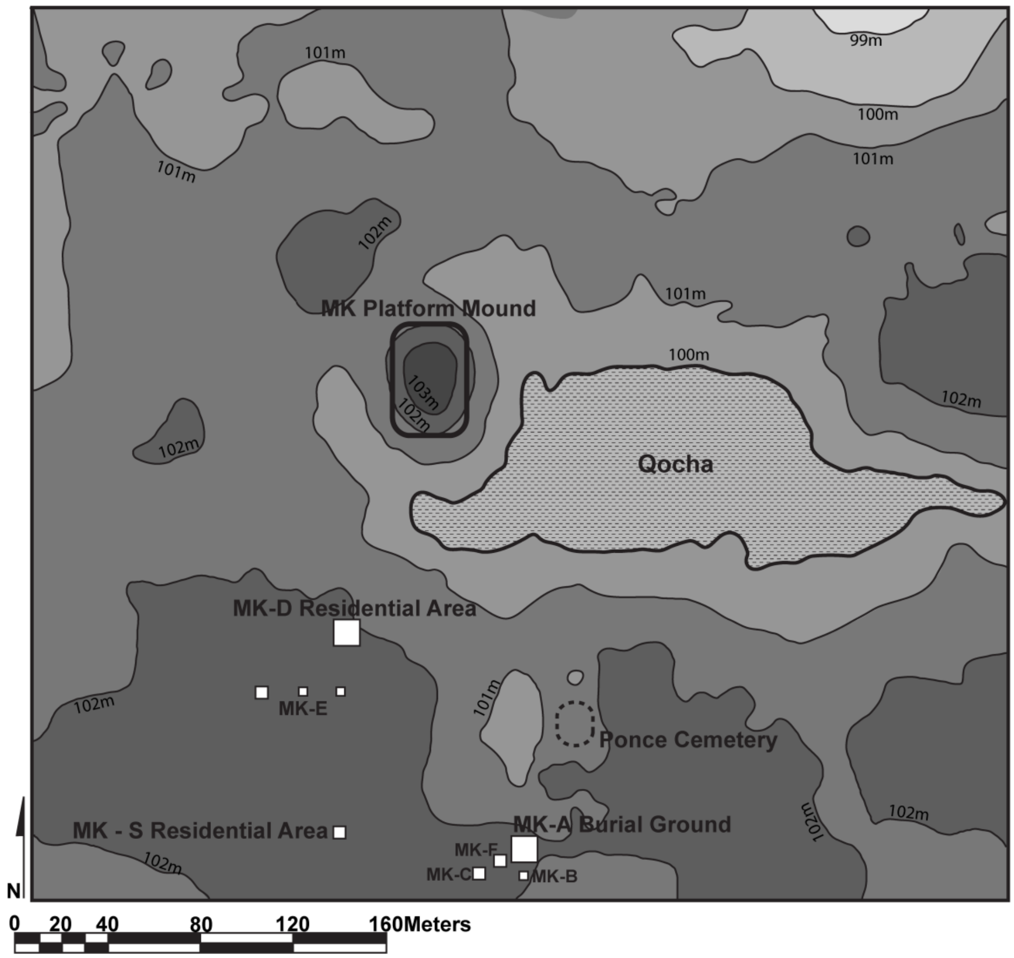

Figure 4-1: Topographic map of Mollo Kontu locating excavation areas for the Proyecto Jach'a Marka (Couture and Blom, in press).

Excavations at MK-D

The MK-D residential area was excavated after finding the remains of a compound wall through the 2004 geophysical survey and 2005 test excavations. Through three field seasons of excavations between 2006 and 2008, the project identified five occupation levels with associated architectural remains in an excavation area measuring roughly 170 m^2 (Augustine *et al.* 2009; Mattox 2011). For the first three occupation levels, three areas delineated by compound walls in this excavated area appear to have been respected even through periods of seeming abandonment. These compound walls follow the general orientation to the cardinal directions characteristic of Tiwanaku. Remains of smaller internal walls were also identified, yet these remains are badly destroyed and do not permit strong interpretations of internal spatial organization.[44]

Excavations in the MK-D sector have uncovered five occupation levels thus far without reaching sterile soil. Though these occupations appear distinct, the latest two occupations (Occupations I and II) are treated as one unit of analysis and discussion as they have been commingled in places by deep modern plowing events. Furthermore, the layer separating Occupations III and IV is thin in certain areas of MK-D, which made it difficult for the excavators to assign some pits to one of the two occupations. In these cases, the pits were assigned to Occupation III-IV. None of the pits from this ambiguous layer were analysed for the present dissertation. This section describes MK-D occupation levels in chronological order, starting with the earliest occupation.

First, a note on the excavation methods is necessary. For excavations done from 2006 to 2008, loci and events were used as units of analysis for excavations in the project's recording system. Units were 2 m by 2 m, and are referred to by their south and west coordinate within the text. The Cartesian grid used is the one devised by the Proyecto Wila Jawira in the 1990s. A unique locus number is given to every excavated segment within the unit. That is, a locus can either be part of a cultural feature or an arbitrary layer; it is an archaeological unit rather than an anthropological one. Anthropological units are later defined by grouping together certain loci to form an event. For example, occupation floors spanning a large area are an aggregation of multiple

[44] For a more detailed description of the internal configuration of MK-D and its occupation levels, see Mattox 2011.

loci spread across many excavation units. Since events are meant to represent distinct human activities, event numbers are not only given to the soil excavated within the units, but also to wall foundations and pit cuts.

Occupation V

Occupation V is the earliest identified occupation level; excavations reached this level in only a small portion of the total MK-D excavated area (see Figure 4-2). The pits identified were not excavated, only delineated. This occupation is defined by segments of a north-south cobblestone wall foundation, the wall's intact adobe material, and wall "melt." A pit cut into the adobe erosion of the wall, but found under the overlaying surface fill that defines the next occupation (i.e. Occupation IV), dates to A.D. 580-670.[45] This date suggests that Mollo Kontu was occupied since at least around the mid-6th century based on an understanding that the MK-D adobe wall needed to be constructed earlier to be abandoned and eroded by late 6th to early 7th century (Couture *et al*. 2010: 76).

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[45] All dates cited for the Proyecto Jach'a Marka in this dissertation are calibrated AMS dates given at 2 sigma range (95% confidence).

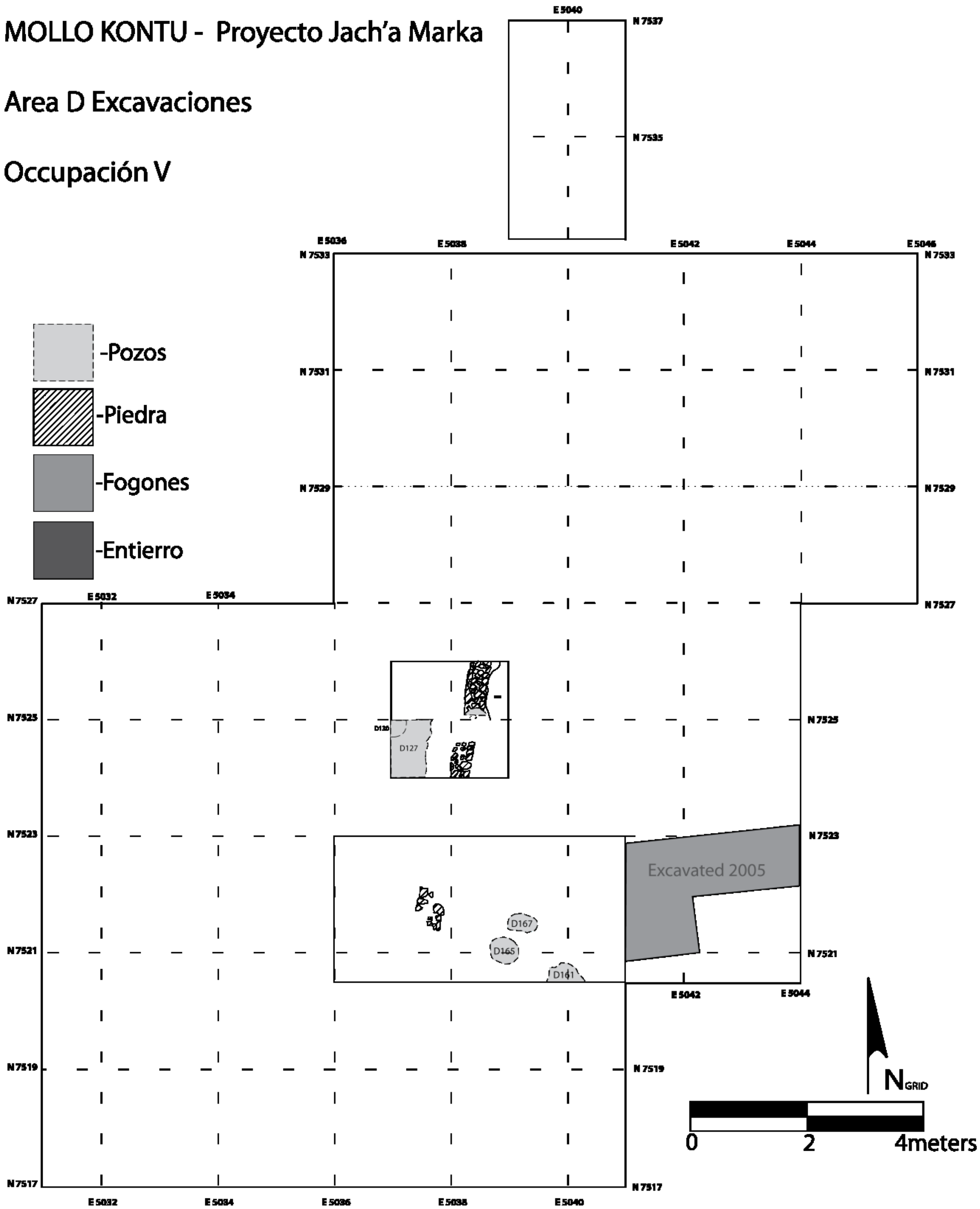

Figure 4-2: Floor plan of MK-D for Occupation V (courtesy of Nicole Couture).

Occupation IV

Both the Occupation V wall and the pit dug into the wall melt were truncated and the entire area filled to form an even surface in what marks the start of Occupation IV (see Figure 4-3). This floor appears to have been built through basket loading which created a mottled surface. This occupation is characterized by a complex series of construction, renovation and destruction of architectural features. Three large walls separate the space into three areas, which may or may not have been used by separate household groups. These walls were not constructed contemporaneously; the east-west wall for example appears to have been built in at least 3 episodes. A number of smaller walls run off perpendicularly from the larger wall sections, suggesting architectural subdivisions within broader large bounded areas. Whether these were indoor or outdoor areas remains undetermined; it was likely fluctuating through time along with architectural modifications. Nonetheless, the activity remains are domestic, and the boundedness of these areas suggests that these were not open spaces for all to use, but were restricted to a household group unit.

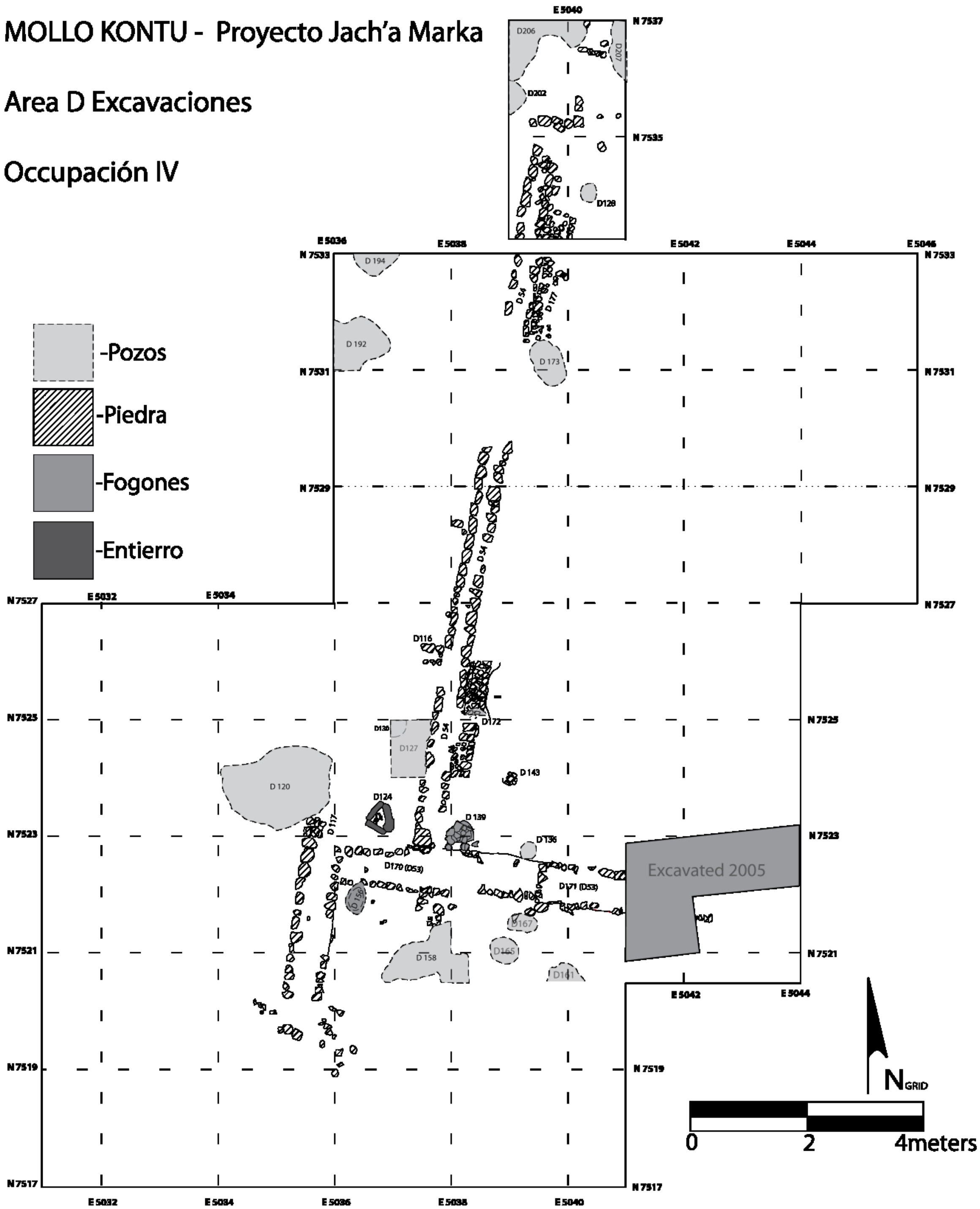

Figure 4-3: Floor plan of MK-D for Occupation IV, note that earlier features are also presented as pale faded features (courtesy of Nicole Couture).

The remains of a possible internal structure are identified within the western portion of the MK-D excavation area, in an area formed by the extension of wall D117 and wall D116, jutting out of wall D54. Within this area, a sub-floor child internment was recovered. This burial consists of three adobe blocks forming a triangular area within which the remains of a foetus or an infant were found. Under the floor covering the burial, excavators also uncovered a large garbage pit, Event D120. The faunal remains from this pit were analysed for the present dissertation.

The eastern zone of Occupation IV consists of the area north of wall sections D171 and D170, and east of D54. Its most notable architectural feature is a series of stones running parallel to the northern section of wall D54. This rectangular area is interpreted as a possible bench or grain-crib (Couture *et al.* 2010: 18; Mattox 2011: 78). Further south, wall D172 juts out of wall D54, though its construction date is later than the construction of D54 based on differences in elevation between the two wall foundations. This wall may have been part of an internal structure. Two features help suggest the presence of an interior division within this excavation area. First is the presence of a 15 cm deep, small, cylindrical pit whose bottom was lined with flat stones (Event D143). This feature has been interpreted as a possible post hole predating the construction of wall D172 (Couture *et al.* 2010: 21; Mattox 2011: 79). That is, D143 would represent an earlier attempt to create an internal structure in the southwest corner of the eastern area of MK-D, which was then dismantled and replaced by a stone-lined wall. The post hole returned a C^{14} date of A.D. 870-1010.

The second feature suggesting that the southwest corner may have been structurally separated from the rest of the area is the presence of a small hearth (Event D139) right at the corner of walls D54 and D170. C^{14} dating places this hearth between A.D. 900 and 1040. The hearth was lined with the fragments of a single broken ceramic jar (*olla*). A layer of burned clay, between 1 and 1.5 cm thick, was encountered at the bottom of the hearth, covered with a dense and fairly homogeneous layer of ash. Topping it off was an oxidized cap of bright orange clay, which suggests that the hearth was covered with soil when still warm, causing the earth to oxidize and 'bake' *in situ*. The eastern zone of Occupation IV is represented in my faunal analysis by Event D173, a garbage pit located in its northwestern area, by the wall and the bench or grain-crib feature.

Finally, the southern sector is the smallest area delineated by the large walls built in Occupation IV. This area is noticeably cleaner in Occupation IV than the other two sectors, taking into account the pits from Occupation III-IV which may or may not be associated with Occupation IV (see Figure 4-5). One notable feature is the presence of another ephemeral hearth (D156) dating to A.D. 770-980 located in a corner between two large walls, similarly to hearth D139 in the north-east sector. Only one substantial garbage pit was uncovered in this area, Event D158, and though it was not excavated in its entirety, its faunal remains were integrated within the present study.

Occupation III and III-IV

Occupation III is separated from Occupation IV by a layer of deposition up to 5 cm thick in certain areas, but much thinner in others. Occupation III is characterized by an increase in pit digging, which seemingly respects the boundaries from the walls built in Occupation IV, and by the construction of new wall segments, one of which does not follow the overall cardinal orientation recognized throughout Tiwanaku (Figure 4-4). Pit content and the behavioural patterns represented by pit digging and wall construction do not suggest a much altered use of space from the previous occupations; therefore, this area is interpreted as a continued broadly domestic use of the space rather than the use of a disaffected area for garbage disposal. Furthermore, the ubiquity of garbage pits within Mollo Kontu and the site at large (see discussion of AKE and Ch'iji Jawira in Chapter 3) hint that garbage may have been part of daily residential life for Tiwanaku residents rather than indicative of periods of abandonments.

Three wall segments (D21, D17, and D38) have been identified within the southwest sector of MK-D. Of these, wall D17 (in unit N7518 E5034) is unusual as it does not follow the overall cardinal orientation characteristic of most Tiwanaku structures, but rather runs northeast-southwest. Wall segment D21 is the most substantial of the wall constructions dating to Occupation III. It runs more or less east-west, though its angle slightly deviates from those of wall segments D170 and D171 in Occupation IV. Finally, wall segment D38 in the southwest corner of MK-D runs east-west and may have formed the corner of a structure with the north-south stone alignment found in unit N7517 E5032.

The placement of the pits that pockmark Occupation III and Occupation III-IV (see Figure 4-5) suggest that the boundaries created by Occupation IV walls may have been respected. Furthermore, Occupation IV features seem to have also been respected as a pit (D114 – not on the map) was dug over the infant burial but the burial was left undisturbed once it reached the feature. If previous separations were respected, then the new wall constructions in Occupation III would create a north-south boundary within the western sector delineated in Occupation IV. The southern area of MK-D remains much cleaner in terms of presence of pits than the northern sector.

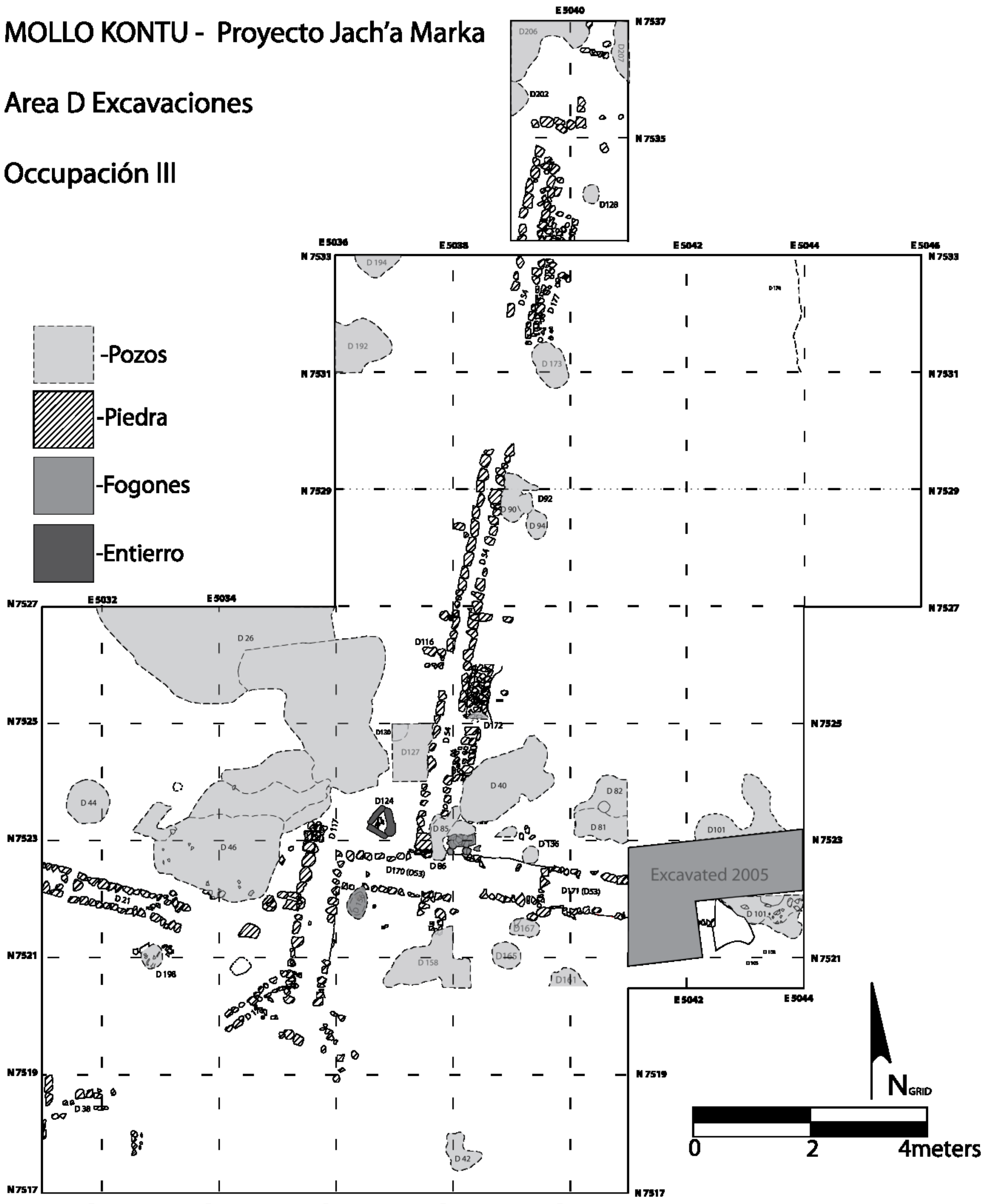

Figure 4-4: Floor plan of MK-D for Occupation III, note that earlier features are also presented as pale faded features (courtesy of Nicole Couture).

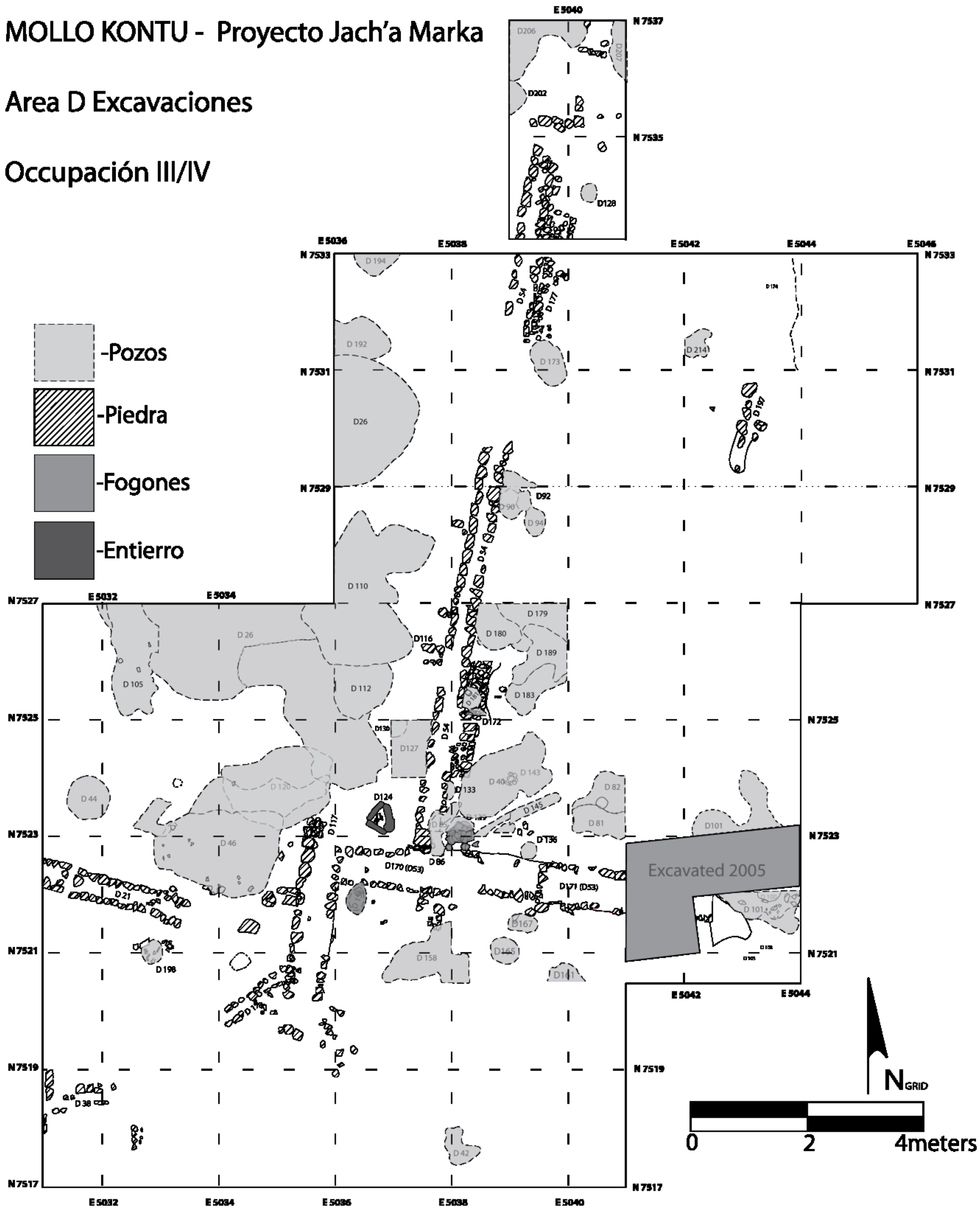

Figure 4-5: Floor plan of MK-D for Occupation III/IV, note that earlier features are also presented as pale faded features (courtesy of Nicole Couture).

A total of six events were analysed from Occupation III, though three of these events (D81, D82, and D83) are actually dumping episodes within the same pit, and thus interpreted as a stratified pit whose strata were analysed individually. Therefore, a total of four garbage pits were analysed from Occupation III: two in the north-east section directly north of wall segments D170 and D171, and two in the western sector, north of wall segment D21.

The stratified garbage pit (events D81, D82, and D83), located in the northeast sector, stands out for its unusual content; it was informally named the “llama pit” as the remains of an articulated 5 month old camelid were found at its base (in event D83). This label is occasionally used in tables and graphs within this dissertation when discussing the combined content of all three events. The pit consists of an ashy fill (D81) and a loose soil fill (D82) which lay over the internment of a complete 5 month old camelid and a suite of semi-articulated camelid remains (D83). Both the earthy matrix of D82 and the ashy fill of D81 cover the skeleton in D83, suggesting that both dumping episodes were fairly temporally contemporaneous. Directly west of the llama pit is Event D40, a wide garbage pit situated in the southwest corner of the northeast sector made up of the compound walls from Occupation IV. Event D40 was dated with C^{14} to AD 880-1020.

On the western side of the north-south compound walls from Occupation IV is event D44, a restricted but deep garbage pit north of wall segment D21. This event was dated through C^{14} at A.D. 810-1010, a result similar to that of D40. Directly east is Event D46, a loosely defined massive midden located in the southwest corner of the western sector, also north wall segment D21.

Occupation I-II

Occupation I-II is the made up of two mixed occupation levels due to modern plowing action. This occupation marks a departure from previous ones in that the large spatial divisions first delineated in Occupation IV, and the orthogonal organization characteristic of Tiwanaku architecture, no longer appear to be respected. The most salient architectural feature is a section of a large seemingly circular wall in the southern portion of the excavation area (Event D7, see Figure 4-6). Orthogonal architectural orientation is nonetheless suggested by the remains of a wall corner (event D10) oriented to the cardinal directions directly west of the circular wall.

The area is littered with garbage pits. Their presence, as argued previously, does not signal the abandonment of the area. In fact, a wall uncovered at the southern edge of the excavation area was built atop a large ash pit (Event D14) suggesting that frequent garbage disposal and architectural construction were roughly contemporaneous at Mollo Kontu. That is, the presence of pit digging for garbage disposal at Mollo Kontu simply reflects a conception of garbage different from our modern sensibilities (see also Couture and Blom, In Press; Mattox 2011; and Vallières 2010).

A hearth and one garbage pit were analysed from this occupation. Event D36 is a fairly large hearth (around 70 cm in diameter) situated in the west sector of the excavation area, dating to A.D. 890-1030. It is bordered with field stones and ceramic sherds. It is not directly associated with architectural features, though it could have been located within the circular structure (D7). Event D71 is a capped ashy fill midden in the northern area of the north east sector of MK-D.

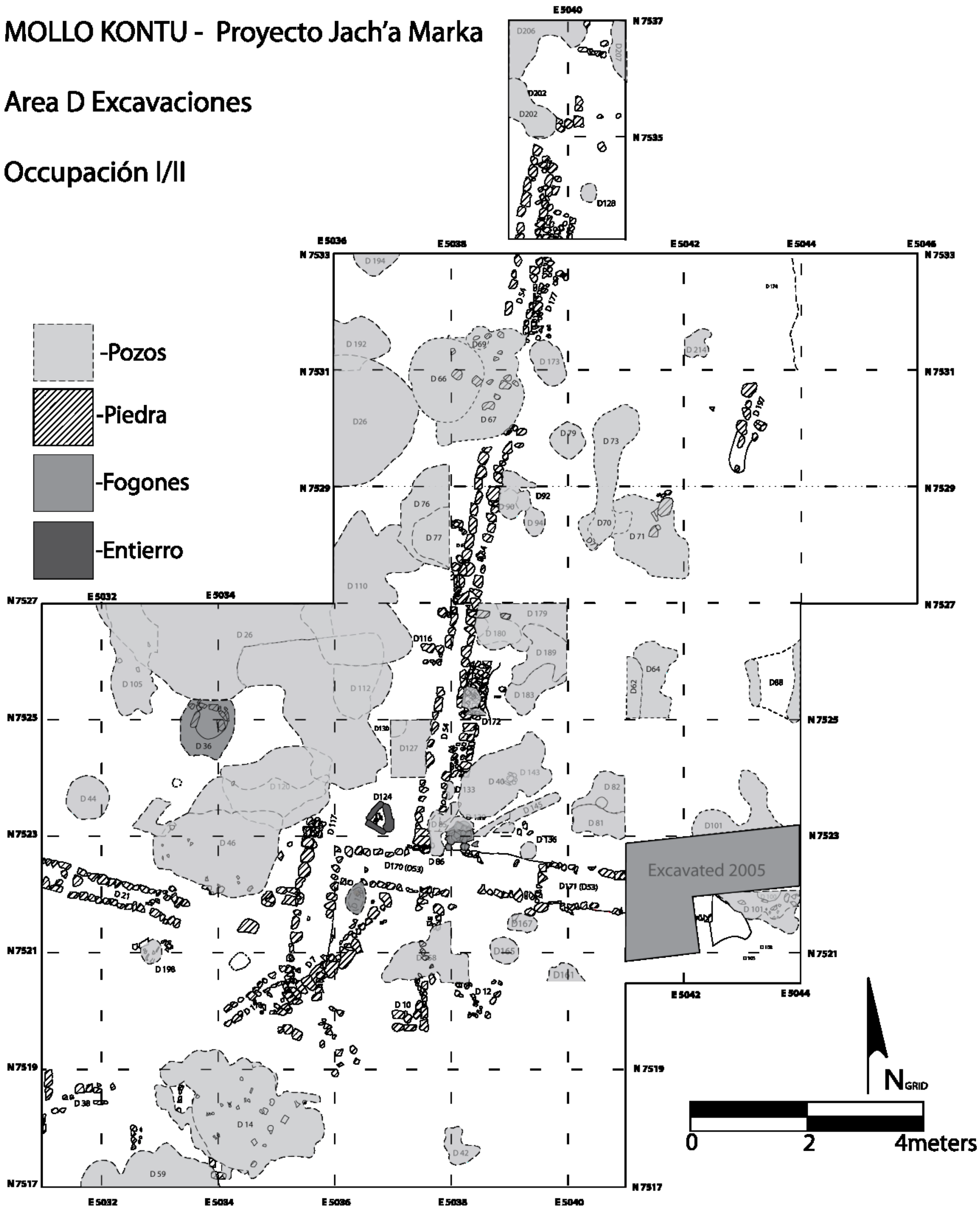

Figure 4-6: Floor plan of MK-D for Occupation I/II, note that earlier features are also presented as pale faded features (courtesy of Nicole Couture).

Excavations at MK-A

MK-A is an area of domestic occupation defined by a high frequency of interred bodies, often placed in elaborate cyst tombs, and an abundance of garbage pits. The geophysical survey performed in 2004 (Couture and Blom 2005; Vining *et al.* 2008) indicated the presence of a large void in the area, interpreted as a possible tomb. Overall, the remains of 11 individuals[46], most of them children, were found over four occupation levels in an area of 80 m^2 (Couture and Blom, in press; Couture *et al.* 2009). The only architectural feature found within this area is the remains of a cobble stone wall associated with a structure of unknown function (see Figure 4-7). Though these features alone do not strongly suggest a residential occupation, the analysis of the content of some of the artefact-rich garbage pits that litter the area suggests a purely domestic occupation. Through the interpretation of the content of the garbage pits, and comparison with those of MK-D, it was concluded that MK-A is part of a broadly domestic context (Bruno and Ramos 2009), perhaps an attached yard (Vallières 2010). The faunal remains of six of those pits were analysed for the present dissertation.

The initial rational behind collecting data from MK-A was to get comparative material from a context thought to be ritual because of its association with elaborate tombs. It was assumed that the content of garbage pits from ritual contexts would be different from pits in residential contexts, if not in what was served, then at least in how it was served, how much of it was served, or how the remains were disposed of. That is, I assumed that the

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[46] Test excavations in 2005 exposed 3 tombs, while 8 more were located in 2006 and 2007 (Couture and Blom, in press).

archaeological signature of ritual events would be different from those of a residential context, since they result from different behaviours.

In total I analyzed material from 6 events, which I briefly summarize here, beginning with those from the oldest levels. The earliest occupation level is represented by Event A10, one of only three pits that cut the earliest surface occupation.[47] This pit is situated in the northeast corner of the MK-A area and was not excavated in its entirety as it continues into the excavation walls. Event A14 is located in the southwest corner of the MK-A excavation area, in the second occupation level. This pit is associated with burial A91, for which we have a radiocarbon date of A.D. 640-710. Event A23, associated with the third occupation level, is located on the southern edge of the southeast quadrant. This pit, also not excavated in its entirety, is stratigraphically associated with burial A34 which dates to A.D. 640-770. Finally, three events from the last occupation level at MK-A were analysed: events A123, A111 and A121. A123 is a small pit located at the eastern edge of MK-A, about a metre northeast of burial A97 which dates to A.D. 650-780. A111 is a very deep pit cutting across many occupation levels. The date that came from Event A111, which starts at the same occupation level as burial A97 is significantly older, at A.D. 900-1040. The cyst tomb may have been constructed and filled at an earlier time but periodically reopened, which would have elevated the beginning of the cut from its original position within the stratigraphy. It is also possible that A111 actually started much higher up in what is now the plow zone. Finally, Event A121 was selected based on its low artifact density. Specifically, it was thought to be a good

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[47] Note that the map in Figure 4-7 is a simplified version of all occupation levels in MK-A, which does not show all the garbage pits that litter this excavation area. Area-wide floor plans were created for MK-A at 10 cm intervals, and are presented in Appendix I.

illustration of the variety in pit size and density at Mollo Kontu, though it would not provide statistically significant trends when analyzed on its own. Since excavation, however, it has been suggested that the plow zone could have destroyed the top part of most events in this last occupation level. That is, it is possible that A121 is only the bottom of a larger pit that has been subsequently destroyed by modern plowing action.

The pit content analysis, including the zooarchaeological data from MK-D and MK-A presented in this dissertation, show no significant differences between the content of these garbage pits and hearth. This is not only confirmed through zooarchaeological analysis, but also through ceramic analysis (see Chapter 7) and paleoethnobotanical remains (Bruno and Ramos 2009) leading to the conclusion that the accumulated assemblages found within pits from MK-D and MK-A were created through comparable behavioural patterns. The architectural differences between the two areas suggest that MK-D and MK-A likely represent varied types of spaces within compounds. That is, compounds would have had both internal living spaces and patios (as seen for example at AKE). It is therefore argued that MK-A was likely not an interior living space, but perhaps an attached yard within a residential compound (Vallières 2010). Given that we still have no idea of the size of a "typical" compound at Tiwanaku, or an idea of their internal division, we can speculate that some included a sort of yard where both dead individuals and refuse were placed.

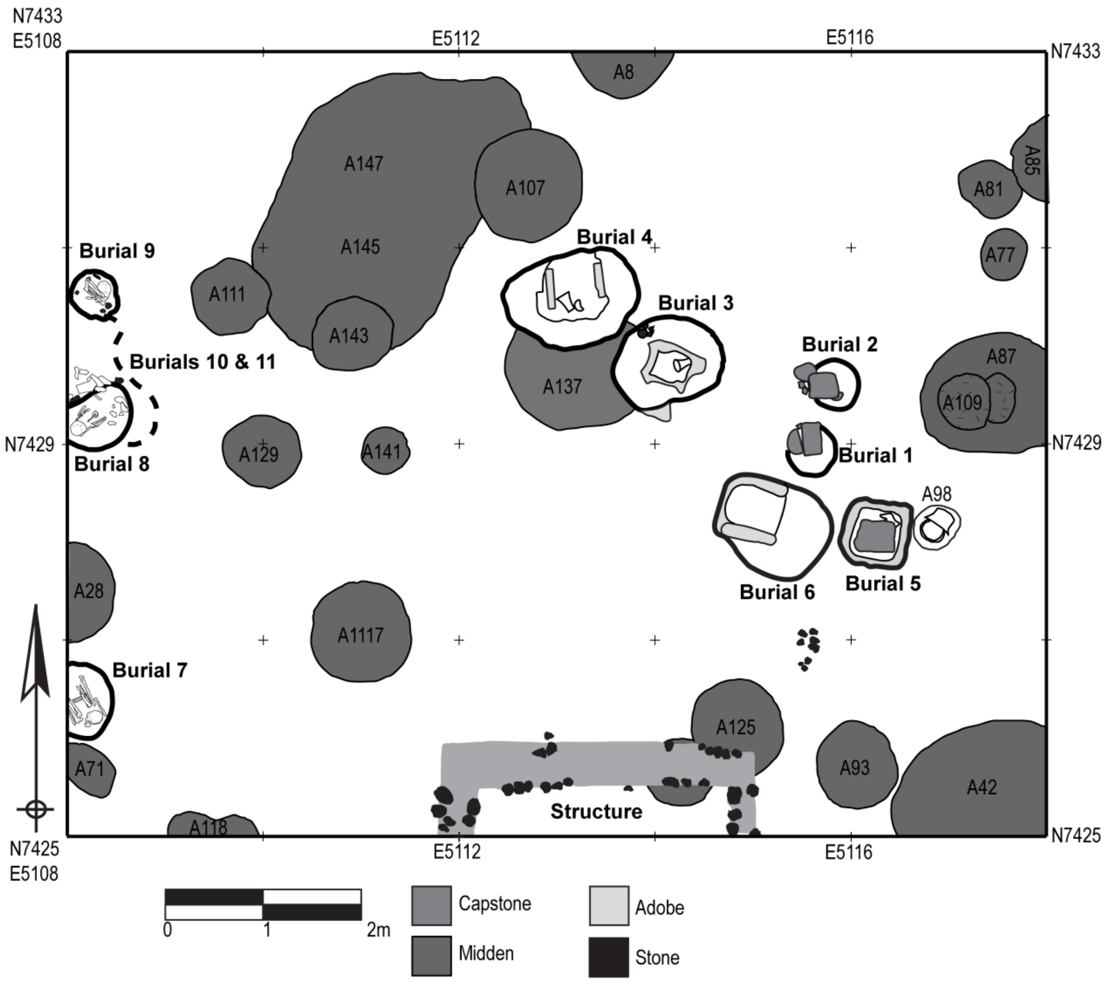

Figure 4-7: Simplified map of the main features in MK-A. Note that not all pits are represented (courtesy of Nicole Couture).

Excavations at MK-E

Preliminary excavations at MK-E (see Figure 4-1) uncovered the presence of a large finely cut andesite block and the remains of a badly destroyed ashlar pavement. These architectural features are usually restricted to the civic-ceremonial core and Puma Punku areas of Tiwanaku. Furthermore, topographic mapping of the area suggests the presence of a U-shaped 30m x 30m depression directly west of MK-E, with the excavated area 'closing off' the depression on its eastern side (Morrow 2009: 58). It is therefore hypothesized through both the presence of finely cut andesite blocks and the surrounding topography that MK-

E could be at the eastern edge of a temple complex. Further excavations would be necessary to confirm the presence of a possible ritual structure there. If indeed there is a sunken court, as suggested by Morrow (2009: 58), this area would be a likely locus for communal feasting events by Mollo Kontu residents, outside of the state structure. Excavations also revealed the presence of a large hearth rich in faunal and ceramic material, which reinforces the association of this area with feasting activities – perhaps representing a feast to mark the ritual closing of the structure. The presence of this possible ritual structure, coupled with the Mollo Kontu Mound, reinforces the argument that ritual activities were not restricted to the monumental district for the residents of Tiwanaku; local neighborhood ritual spaces punctuated the domestic areas.

Discussion

Mollo Kontu was more than just residential and ceremonial structures and domestic garbage pits; the area uniquely features a number of qochas, often culturally modified lake-like features that could have been used alternatively as water tanks, agricultural land, and as water features for pasturing camelids, depending on water levels. The presence of these qochas within Tiwanaku's urban limits suggests that a certain degree of subsistence activities, such as farming and possibly herding, were undertaken there. That is, residents of Mollo Kontu may not have had to travel far, or to rely on an urban redistribution system to acquire camelid and plant products. Furthermore, results from Matthews's (2003: 117-121) survey of the Middle Tiwanaku valley show that the area south of Mollo Kontu, between Tiwanaku's southernmost limits and the Quimsachata Mountain, held few archaeological sites and no raised fields, unlike

Tiwanaku's northernmost edge. The grass on the south side of town, toward Quimsachata, is dryer than on the north side of Tiwanaku where the raised fields would have helped create a wetter environment. The vast expanses directly south of Mollo Kontu could have held camelid herds.

A high number of human remains were encountered in the Mollo Kontu sector, both in the domestic areas and on the Mollo Kontu Mound. Data on cranial modification, caries rates and isotopic studies are discussed to situate Mollo Kontu's residents within the broader bioarchaeological profile of Tiwanaku's population, as was done for neighbourhoods discussed in Chapter 3. Cranial modification styles are not mixed within the residential sector and MK-M as they were in AKE and Putuni; all crania analysed from the Mollo Kontu Mound (MK-M) bore a fronto-occipital style of modification and human remains from the domestic sectors all showed annular modifications (Berryman *et al.* 2009; Couture *et al.* 2010b). Differences between the individuals found on the mound and those buried in the domestic sectors are also evident in their diet. Individuals from the residential sectors of Mollo Kontu had much less caries than those from MK-M; this suggests the individuals buried in the domestic areas of Mollo Kontu consumed fewer carbohydrates from agricultural products and more meat than those from the mound. The isotopic data from Mollo Kontu residents supports the assertion that meat consumption was high; in fact it was significantly higher than most Tiwanaku residents (Berryman 2010: 236). It also suggests low maize consumption and a significant dietary contribution of local C3 plants such as quinoa and tubers. This dietary pattern of high meat consumption and low maize consumption is similar to that established for the three individuals analysed at Ch'iji Jawira. The combined evidence of cranial modifications, dental health, and dietary practices, hints at differences in lifestyles and diet between individuals deposited on MK-M and those interred within the domestic areas of Mollo Kontu's residential compounds.

In sum, Mollo Kontu is a Tiwanaku neighbourhood that presents evidence for at least two ritual structures (MK Mound and MK E), and domestic contexts (MK-D and MK-A) that generally follow the overarching architectural plan of the Tiwanaku urban center. Available radiocarbon dates show that Mollo Kontu was probably one of the oldest continuously occupied neighborhoods established outside of the monumental district. Episodes of construction and renovations at MK-D, along with the presence of garbage pits dense with domestic refuse that respect architectural boundaries of previous occupation, suggest that Mollo Kontu was continuously occupied. A similar argument can be made for MK-A based on its continuous use to bury both garbage pits and the dead in elaborate cyst tomb throughout its occupation levels. Therefore, the Mollo Kontu domestic remains represent the slow accumulation of daily refuse by generations after generations of residents navigating their position within the urban fabric; between the monumental district and its state sponsored ceremonies and the practices of daily life and rituals at the local level.

CHAPTER 5: THE FAUNA FROM MOLLO KONTU: INTRODUCTORY DATA AND TAPHONOMIC CONCERNS

This chapter presents results from the faunal analysis of 17 events from excavation areas MK-D and MK-A. These events represent a total of 14 garbage pits (including a stratified pit containing 3 events), and one hearth. This chapter introduces the faunal assemblages analysed, along with a description of the methods employed. First is a discussion of species composition, where it is demonstrated that camelid remains dominate the assemblages. From then on, most zooarchaeological methods used in this dissertation are performed on camelid bones only. These faunal specimens are then used to test the influence of post-depositional natural processes and destructive cultural processes on the assemblages. The present chapter evaluates the possible influence of differential bone density, bone fragmentation, carnivore activities and weathering on the skeletal element representation in the zooarchaeological assemblage. These tests demonstrate that the faunal remains from Mollo Kontu were minimally affected by post-depositional destructive agents. Furthermore, the fragmentation data presented suggests that even though the faunal material suffered through heavy fragmentation, likely in the food preparation process, the identification of elements was minimally affected. These findings justify further interpretations of the faunal material to get at past cultural processes. That is, they confirm that the patterns identified in the zooarchaeological assemblages of Mollo Kontu are not shaped by post-depositional processes but are accurate representation of what was left behind by the Mollo Kontu residents. The contribution of these data to the investigation of culinary practices is discussed in more depth in Chapter 6.

Species Identification

The species list for the analysed events from Mollo Kontu demonstrates that the vast majority of animals recovered were camelids (see Table 5-1), with over 99% of all identified specimens belonging to the camelid family. Other species present include cervid (deer), human, canids (domestic dogs and/or wild fox), guinea pigs, birds (most fragments were unidentified to species, but one bone was identified to the duck family), and finally one specimen of viscacha. Specimens identified only as Large Mammal are not included in this simplified table but are available in Appendix III. These 'Large Mammals' (LM) are most likely camelids based on the ratio of identified species, but some are possibly from deer. Fish bones are not included in the present zooarchaeological study; analysis of these remains is underway and preliminary results provided by Elizabeth Arratia (2010) are presented in Chapter 7. Furthermore, a subset of the microfaunal remains was removed and analysed prior to the start of the present analysis. Preliminary results for these microfaunal remains give a count of 1 guinea pig bone and 47 bird bones for the aggregated contexts of MK-A, MK-D and MK-M (see Pokines *et al.* 2009; Pokines 2012). A breakdown of species per context is unavailable, but it is possible that certain microfaunal elements were removed from events analysed in the present dissertation. However, given the low Number of Identified Specimens (NISP)[48] of the results, it seems unlikely

[48] The NISP or Number of Identified Specimens is a zooarchaeological quantification method that simply counts the number of bone fragments that had diagnostic features

that their inclusion would drastically affect the percentage of camelids versus other species in the specific assemblages analysed.

Events	Cervid	Human	Canid	Carnivore	Guinea pig	Birds	Viscacha	Camelid
D120	2	2			2			989
D158						1		346
D173	1		1					138
D40					1			71
D44	14							421
D46	1						1	1989
D81	2	1	1					228
D82	1							318
D83								661
D36								92
D71		1		1				305
A10		1						194
A14		1				4		408
A23								219
A123								35
A111					1			395
A121		1		1				6
Total	21	7	2	2	4	5	1	6815

Table 5-1: List of species present in all faunal assemblages analysed at Mollo Kontu (NISP counts).[49]

The second most represented species in the Mollo Kontu assemblages are Cervid (deer) with a total of 21 identified specimens. The low count for Cervid renders any quantitative analysis of their remains statistically insignificant. Nonetheless, a qualitative analysis is possible. Event D44 contains 14 bone specimens attributed to deer, the highest representation within a pit at 3.2% of the event's NISP (n=432). All 14 bone specimens are charred skull fragments, including antlers, cranium and mandible fragments. Though these specimens were not refitted together, it is possible that the higher frequency of deer in this

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which allowed their identification to the species level. For a discussion of the strength and weaknesses of this quantification method see Lyman (2008).

[49] "Cervid" refers to elements identified to a deer species; "canid" refers to specimens identified either to domestic dog or wild fox. The viscacha is a large Andean rodent, similar in size and looks to a rabbit. Human remains were identified in six out of fourteen events in both MK-D and MK-A. These do not display signs of consumption; their presence is likely linked to the destruction of earlier burial contexts, perhaps unearthed while digging garbage pits.

pit represents one smashed and burnt skull. Other occurrences of deer remains in Mollo Kontu are limited to one or two specimens per garbage pit, all in the MK-D residential sector. Their presence suggests that deer were accessible and used in daily contexts, though not exploited regularly.

No event stands out in terms of high levels of species diversity. Events D120 and D81 are the most diversified, with specimens from three non-camelid families, yet this diversity is not indicative of more varied food consumption as both include human remains that were not likely part of the diet. It is possible, but unlikely that the low species diversity noted in the assemblages is in part influenced by the heavy fragmentation of all bone specimens, which can prevent identification to a specific element and species.[50] NISP counts tally only specimens identified to the element, and not the total number of recovered bone specimens (NSP, or Number of Specimens[51]). The majority of recovered bone specimens are not identified to skeletal element due to heavy fragmentation, which destroys element diagnostic features. For the aggregated camelid and large mammal assemblages from MK-D, 35.9% of all counted and weighted bone specimens are identified to the element. This number is higher for MK-A, at 41.4% identified. However, most unidentified faunal specimens are minuscule fragments. The percentage of identified specimens rises considerably when considering the weight of identified versus unidentified specimens. When using weight in grams as a value, 73.6% of the total weight of MK-D faunal assemblages, and 75.9% of MK-A faunal data are identified to skeletal element.

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[50] A more detailed analysis and discussion of fragmentation levels is presented in a following section of this chapter.
[51] The NSP refers to the total tally of bone specimens recovered in the analysed events, no matter whether they can be identified to the species or to the skeletal element.

Therefore, in terms of mass of skeletal material analysed, a majority of bone specimens have been identified to the element, which suggests the NSP is inflated due to heavy fragmentation of the assemblages. That is, it appears unlikely that the low species diversity which characterizes the Mollo Kontu assemblages is the result of heavy fragmentation.

Given the predominance of camelid remains in the species composition of the Mollo Kontu assemblages, the majority of zooarchaeological tests and analyses presented in this dissertation focus only on camelid remains.

Camelid Type Identification

Specimens identified to the camelid category can be affiliated to one of four species of camelids.[52] The South American Camelid family consists of two wild species and two domesticates. The wild species include the guanaco (*L. guanicoe*) and the vicuña (*V. vicugna*), while the two domesticates are the llama (*L. glama*) and the alpaca (*L. pacos*). Ratios of domesticates to wild species within a faunal assemblage suggests subsistence strategies, such as reliance on hunting or herding of domesticated species for daily sustenance, though both could be acquired through exchange or redistribution.

The identification of camelid species within archaeofaunal assemblages is done through dental data and skeletal element measurements. Species differentiation through dental data uses incisor shape. Incisors of both the llama and the guanaco have well developed roots and are spatulate in shape, with enamel covering both the labial and lingual sides. The incisors of alpacas and vicuñas are parallel-sided with enamel restricted to the labial side. Alpacas

[52] There is also the possibility of hybrid species as discussed in Chapter 2.

form well-developed roots through time whereas the vicuña permanent incisors are rootless (Mengoni and Yacobaccio 2006; Wheeler 1982). Incisors are rare in the analysed Mollo Kontu faunal assemblages; only 20 complete specimens were identified. These incisors correspond to llama or guanaco shape.

Measurements of skeletal elements provide a more rounded picture of camelids species representation for the Mollo Kontu assemblages. The four camelid species generally cluster in distinct size categories, though there can be some overlap (see J. Kent 1982). The wild guanaco has the largest skeleton of the camelid species, followed closely by the domesticated llama; alpacas are smaller than llamas, and the wild vicuña is the smallest of the camelid species. I follow Jonathan Kent's (1982) methodology to distinguish camelid species through measurement of skeletal elements. Measurements are taken on complete and fully fused specimens. In the case of long bones, which are often broken at the shaft, measurements are independently devised for fused proximal and distal ends. As is discussed later in this chapter, the Mollo Kontu camelid assemblages are heavily fragmented. Therefore, only a minority of specimens could be identified to a camelid species, mainly small bones such as phalanges.

Kent's technique uses variables (i.e. measurement sites) and a constant to identify a specimen's camelid species. The standard procedure requires the analyst to first compare the specimen measurements to a list of means for these measurements on each of the four camelid species (Kent 1982: Appendix IV.2). If the measurements are closer to means for guanaco and llama, they are then plotted against the equation for "large camelids" to narrow down to which of the two subspecies the specimen belongs. Measurements are plotted against the formula for "small camelids" if they fall closer to mean measurements for alpaca and vicuña. If, however, the measurements fall somewhere between llama and alpaca, that is, between the smaller of the large camelids and the larger of the small camelids, an equation comparing all four camelid species is used (see Kent 1982: Appendix IV.4 to find the 'large,' 'small,' and 'both' equations per element). Tests performed by Kent on the calculations using specimens of known species suggest the calculations for 'large' and 'small' camelids are more accurate than those using all four subspecies.

A total of 79 camelid bone specimens from Mollo Kontu were tested with Kent's (1982) methodology. Table 5-2 shows that a majority of these skeletal elements came from large camelids (i.e. guanacos and llamas, plus the undifferentiated 'large camelid' category), though small camelids (i.e. alpacas and vicuñas, plus the undifferentiated 'small camelid' category) are well represented considering that elements in the domesticate category may include the smaller alpaca. Wild subspecies are represented by 13 specimens assigned to guanaco. These all came from phalanges. As discussed in Chapter 2, it is possible that camelids in the past did not conform strictly to these four size categories. It has been suggested that more species may have existed in the pre-Columbian Andes (Miller and Gill 1990) and the occurrence of camelid hybrids within and between domesticated and wild forms have been documented (Dransart 2002: 64-65; Moore 1989: 126). These hypothesized species raise the possibility that camelids from the Tiwanaku period may not fit into the four size categories devised on modern comparative material. Overall, the camelid species measurements and dental data suggest that the majority of adult animals brought to and consumed at Mollo Kontu were large, in the size range of the llama and guanaco. There is nonetheless evidence for the smaller sized camelids, most likely the domesticated alpaca. The low representation of wild camelids suggests that hunting, or the procurement of hunted animals, was not a common occurrence for residents of Mollo Kontu.

Event	ID #	Element	Guanaco	Llama	Large camelid	Domest.	Alpaca	Vicuña	Small Camelid
A111	4655	2nd ph		1					
A111	4656	2nd ph				1			
A111	4657	3rd ph	1						
A111	4705	d. radul		1					
A111	4706	d. radul			1				
A123	5324	3rd ph	1						
A14	4995	2nd ph		1					
A14	4997	2nd ph					1		
A14	5000	2nd ph					1		
A14	5001	2nd ph		1					
A14	5002	2nd ph			1				
A23	5195	2nd ph		1					
A23	5135	3rd ph	1						
MK-A subtotal			*3*	*5*	*2*	*1*	*2*		
D120	5434	2nd ph					1		
D120	5559	2nd ph		1					
D120	5560	2nd ph		1					
D120	5864	2nd ph				1			
D120	5868	2nd ph			1				
D120	5869	2nd ph	1						
D120	5870	2nd ph				1			
D120	6156	2nd ph				1			
D120	5562	3rd ph	1						
D120	5879	3rd ph			1				
D120	5880	3rd ph	1						
D120	5881	3rd ph	1						
D120	5825	d. radul		1					
D120	5829	p. fem		1					
D44	422	1st ph				1			
D44	431	2nd ph					1		
D44	432	2nd ph				1			
D44	433	2nd ph					1		
D44	349	d. tib					1		
D44	350	p. tib		1					
D46	3047	2nd ph		1					
D46	3048	2nd ph				1			
D46	3189	2nd ph		1					
D46	3339	2nd ph		1					
D46	3502	2nd ph		1					
D46	3503	2nd ph				1			
D46	3504	2nd ph				1			
D46	3683	2nd ph			1				
D46	3684	2nd ph			1				
D46	3685	2nd ph	1						
D46	3686	2nd ph		1					
D46	3687	2nd ph					1		
D46	3688	2nd ph		1					
D46	3925	2nd ph		1					
D46	3931	3rd ph	1						
D81	1266	1st ph			1				
D81	1139	p. MTC		1					
D82	806	1st ph			1				
D82	807	1st ph			1				
D82	808	1st ph		1					

Event	ID #	Element	Guanaco	Llama	Large camelid	Domest.	Alpaca	Vicuña	Small Camelid
D82	809	1st ph		1					
D82	810	2nd ph			1				
D82	811	2nd ph					1		
D82	812	2nd ph			1				
D82	813	2nd ph		1					
D82	814	2nd ph				1			
D82	815	2nd ph					1		
D82	820	3rd ph			1				
D82	821	3rd ph	1						
D82	822	3rd ph			1				
D82	823	3rd ph	1						
D82	824	3rd ph	1						
D82	825	3rd ph		1					
D82	827	3rd ph	1						
D82	766	d. radul			1				
D82	767	p. MTC			1				
D83	1907	1st ph			1				
D83	1480	2nd ph			1				
D83	1475	d. hum					1		
D83	1891	d. hum					1		
D83	1475	p. hum							1
D83	1891	p. hum							1
D83	1497	p. MTC		1					
D83	1521	p. MTC			1				
D83	1539	p. MTC		1					
D83	1474	scp			1				
MK-D subtotal			*10*	*19*	*17*	*9*	*9*	*0*	*2*
MK TOTAL			**13**	**24**	**19**	**10**	**11**	**0**	**2**

Table 5-2: List of results for all specimens tested with Kent's (1982) camelid species differentiation technique for the Mollo Kontu assemblages.

Camelid Bone Density

The presence or absence of certain skeletal elements within an archaeological assemblage can be influenced by their bone density. That is, the absence or low representation of certain bone elements may not be the result of cultural patterns but an artifact of their lower chances of post-depositional survival due to low bone density. Bone elements within a single skeleton have differential densities, and certain physiological aspects of species, such as their locomotion, will affect how dense or porous skeletal elements are (see Lyman 1994 for an in-depth discussion of the physiological factors affecting bone density). Since uneven density is rooted in the biological make-up of specific species, density data from modern skeletons can be used to test for the correlation of bone density to skeletal element representation of archaeological samples. The following discussion demonstrates that the Mollo Kontu faunal assemblages contain a good proportion of low density skeletal elements, suggesting that skeletal element patterns are not solely shaped by post-depositional processes.

Peter Stahl (1999) calculated the bone density of domesticate camelids (such as llamas and alpacas), while Luis Alberto Borrero (1990) created a density index for the wild guanacos. Stahl's (1999) density data was used for the present analysis, since measurements indicate that the Mollo Kontu faunal sample is composed primarily of domesticates. Stahl (1999) presents his data in two formats, the $VD_{LB/DT}$ (the standard Volume Density) and VD_{SA} ("shape-adjusted" Volume Density). The $VD_{LB/DT}$ data was taken for comparative purposes to demonstrate that Stahl's data is congruent with previous bone density studies on other ungulates. However, the $VD_{LB/DT}$ data calculations do not take into account the shape of the bone at its scan site. Instead, it assumes that the site scanned is a square, which produces less precise readings on irregular bones such as the pelvis. Stahl (1999) created the shape-adjusted measurements to rectify this issue. In this dissertation, I use VD_{SA} measurements to test the possible correlation between bone density and the skeletal element representation found in the faunal assemblages of Mollo Kontu. Density is measured at numerous scan sites throughout each bone element. Following Lyman (1994), the maximum density value for each skeletal portion was plotted against the %MAU[53] calculated for the skeletal element representation of the same element for every event analysed (see Appendix V for the bone density graph for every assemblage analyzed).

A regression line that represents the tendency of the data and the coefficient of dependence value (r^2) is added to the graphs for every scatter plot of density data against %MAU. The coefficient of dependence (r^2) is the Pearson coefficient (r) squared. It is a way to calculate the quality of the regression line by looking at the dispersion around it. It is often presented as a 'percentage level of explanation' where r^2 gets multiplied by 100 to infer the level of influence that x values have on y values. Relationships are depicted more realistically this way than with the Pearson coefficient; for example, $r = 0.4$ would be considered a moderately strong relationship between the variables, whereas the $r^2 = 0.16$, and thus only 16% of the y-axis values have been influenced by the x-axis values (see Shennan 1997: 142-144 for a more in-depth discussion of correlation coefficients). The scatter plots presented in Appendix V for the different events at Mollo Kontu vary from a negative correlation between density values and skeletal part representation, to a moderately positive relationship, with the highest percentage level of explanation at 33% for Event D158. Looking at the fragmentation extent and intensity of D158, it appears that this event did suffer from heavy fragmentation levels which could

[53] MAU stands for Minimum Animal Unit. The MAU is calculated by counting the number of specimens with overlapping skeletal markers for each skeletal element, which implies they come from two different bone specimens, then dividing this number by the number of this element usually present in a complete skeleton. Often the MAU will be normed into %MAU to make comparisons between assemblages of different sizes. This is done by multiplying all MAUs by 100 then dividing them by the highest MAU of that assemblage.

gloss over a more diverse set of skeletal frequencies as identifiable skeletal markers are lost through fragmentation.

Most measurements used by zooarchaeologists (such as MNI, MNE, MAU, and %MAU[54]) are measures derived from the analyst's decisions on which attributes to take into consideration in the analysis of faunal material (e.g. age at death when available, how much of a diagnostic attribute needs to be present to be considered overlapping, etc.). Furthermore, derived measurements are affected by aggregation of faunal assemblages. For example, the MNI for species will be different if one adds together the MNI results from two garbage pits or if the MNI is recalculated with the data from the two events (see Grayson 1984; Lyman 1994, 2008; for discussions of quantification in zooarchaeology). Because of these issues inherent in derived measurements, it may be preferable to use the bone density data at the ordinal level (Lyman 2008). Bone density measurements can also be used as an ordinal scale, though they provide accurate measurement in grams per square centimetre. The main goal of density measurements is to know that one skeletal element is denser than another skeletal element from the same animal, and therefore more or less likely to survive. It is not as imperative for interpretive purposes to know the precise differences between scan sites. Therefore, one can compare the rank order of an

[54] The MNI (Minimum Number of Individuals) indicates the minimum number of individuals necessary to account for the skeletal element based on the identification of overlapping diagnostic features and the side of elements. The MNE (Minimum Number of Elements) counts the number of overlapping specimens based on presence of diagnostic features without taking side into account. The MAU takes the MNE number and divides it by the number of this element usually present in a complete skeleton. All three quantification methods require decisions from the analyst. When determining the minimum number of elements present one can, but is not required to take into account the age, sex or size of the animals represented by the skeletal elements. The greater the number of criteria used, the higher their values will be. For a more detailed explanation of zooarchaeological quantification methods and their strengths and weaknesses, see Grayson (1984) and Lyman (1994).

element's density value to its rank in the assemblage, and calculate their relationship using Spearman's Rank Order Correlation Coefficient (r_s), also known as Spearman's rho.

An advantage of rank order correlations is that they do not overemphasize outliers. For example, in the case of South American camelids, the density value of mandible (VD_{SA}=7.23 g/cm^3) is significantly higher than all other skeletal elements, with the vast majority of the skeletal elements varying between values of 1 to 3.5 g/cm^3. Therefore the relationship between bone density and skeletal element representation will be heavily influenced by the representation of mandibles in the assemblages. This issue is corrected by using an ordinal scale.

The Spearman's rho results are given as a number between 1 and -1, where 1 is a perfect positive correlation between the rankings of x and y, -1 is a perfect negative correlation between the rankings of x and y, and 0 means there is no relation between the x and y values. Sample size influences the likelihood of a completely random sample to still present a strongly positive or negative correlation. As a result, the significance of the Spearman's rho needs to be appraised with the calculation of its p-value, which takes sample size into account.

All analysed Mollo Kontu events were tested with Spearman's rho (r_s) to see whether their faunal signatures reflected density-mediated attrition (see Table 5-3). First the VD_{SA} values for each element were paired with the element's %MAU, just as it was done for the bone density plot scatters. Results for event D158, which exhibited the strongest density-mediated attrition in the bone density scatter plots (see Appendix V), show a non-significant but positive relationship between density and skeletal element representation by going from a percentage level of explanation of 33% to a rank order coefficient of 0.177 and a p-value of 0.359. However, through the Spearman Rank Order Correlation calculations, two events are identified as significantly influenced by density at the 5% level, Events D82 and A123.

Events	Spearman Rho	p-value
D158	0.18	0.359
D173	-0.26	0.170
D120	0.12	0.543
D40	-0.07	0.739
D44	0.22	0.249
D46	0.26	0.172
D81	0.02	0.938
D82	0.39	0.039
D83	-0.15	0.426
llama pit	*-0.10*	*0.601*
D36	0.03	0.862
D71	0.09	0.655
A10	-0.11	0.584
A14	-0.07	0.707
A23	0.06	0.773
A123	0.46	0.013
A111	0.01	0.962
MK-D	**0.20**	**0.296**
MK-A	**-0.01**	**0.972**

Table 5-3: Spearman rho correlations between Stahl's VDSA bone density data and %MAU values for all assemblages.

Overall, these data suggests that the faunal assemblages from Mollo Kontu were not significantly altered by density-mediated attrition. Consequently, the quantification of bone specimens from these events, and the zooarchaeological patterns extracted from the faunal remains, can be confidently used to discuss cultural and natural processes involved in the acquisition, preparation and discard of these animals.

Bone Fragmentation

Fragmentation of faunal specimens can be the result of both natural and cultural processes. In either case, fragmentation affects the identification of skeletal elements and quantification measures, whether derived (i.e. MNE, MAU, MNI) or primary counts (i.e. NISP) (see Lyman 1994, 2008; Marshall and Pilgram 1993). During analysis, fresh breaks were singled out and refitted when possible to minimize the inflation of NSP and NISP. These breaks are incurred during excavation and post-excavation manipulation and storage, and are easily recognized by their distinctive color. Since it was not possible to refit all fresh breaks, a small portion of the fragmentation data represents post-excavation fragmentation. This section demonstrates that skeletal elements from Mollo Kontu are intensely fragmented; this fragmentation is likely the result of concerted action by its residents rather than post-depositional factors such as trampling of elements, as even dense skeletal parts such as the mandible show high levels of breakage.

In investigations of fragmentation within a faunal assemblage, two aspects are of particular interest: the *extent* of fragmentation and the *intensity* of fragmentation (see Lyman 1994: 333-338 for an in-depth discussion). The extent of fragmentation refers to the percentage of bone specimens within the total assemblage that are complete, or the percentage of specimens that are fragmented. To calculate the percent completeness, complete bone elements are counted and multiplied by 100, then divided by the NISP for this skeletal element in the assemblage. Since the specimens are either complete or fragmented, one can also read the data as percent fragmented. That is, a percent completeness of 25% translates into a percent fragmentation of 75%. This measure suggests the proportion of bones that have been fragmented within an assemblage, but does not demonstrate the *intensity* of the fragmentation. That is, it does not take into account whether bone elements are broken in two or in ten pieces. If every bone were broken in two, one would get a percent completeness of zero. Yet this would not necessarily represent an assemblage that has been intensively processed and fragmented for marrow extraction for example. In order to have an idea of the intensity of fragmentation, analysts use the NISP:MNE ratio.

Since the MNE is derived from the NISP (or primary data), the NISP will always be greater or equal to the MNE. A ratio of NISP to MNE suggests the average number of fragments per number of elements identified through overlapping bone specimens. For example, if you have 6 rib fragments that include 2 rib heads, the MNE for ribs is 2 and the ratio is 6:2 or 3:1, which indicates that ribs are fragmented on average in three parts if fragmented equally. Fragmentation patterns for every bone element can be identified through this ratio. The higher the ratio is, the more intense the fragmentation. A ratio of 1:1 indicates either no fragmentation, or that the number of fragments is equal to the MNE of the element (for example, if mandibles are represented by three coronoid processes, both the MNE and the NISP will be 3). Lyman (1994: 337) warns that complete elements should be taken out of the NISP and MNE numbers as they would skew the ratio of fragmentation. Thus one needs to read the NISP:MNE ratio in conjunction with the element percent completeness to have a better understanding of element fragmentation. For example, in MK-D 11% of the thoracic vertebrae were discarded whole and the 89% fragmented elements were roughly broken in 6.7 fragments, a high degree of fragmentation (see Table 5-4).

	MK-D		MK-A	
Element	**% comp**	**NISP:MNE**	**% comp**	**NISP:MNE**
Crania	0	77.6	0	41
Mandible	0.5	4.9	0	5
Atlas	5	3.5	0	2.5
Axis	6	3.1	0	1.5
Cerv	3	5.4	0	4.25
Thor	11	6.7	1	6.6
Lumb	4	9.25	1	6.2
Rib	2	6.4	0.4	4.4
Sternum	65	3	0	1
Sacrum	0	8.25	0	6
Caudal	38	1	0	1
Scapula	3	8.3	0	9
Hum	5	3.4	0	3.5
Radul	3	8.2	0	4.9
MTP	2	5.7	0	6.8
1st Phal	44	2.1	11	1.95
2nd Phal	73	5.8	70	1.4
3rd Phal	84	2.5	75	1
Pelvis	0	6.1	0	7.4
Femur	3	5.5	0	9.2
Patella	100	1	50	1
Tibia	2	7.1	0	3.1
total:	7		2	

Table 5-4: Percent completeness and NISP:MNE ratios for MK-D and MK-A faunal assemblages.

Results presented in Table 5-4 for the fragmentation levels of faunal elements recovered from the MK-D and MK-A sectors show that the percent completeness is overall very low at Mollo Kontu, between 7% complete in MK-D, and 2% complete in MK-A. One important caveat to the calculation of fragmentation intensity and extent is that an extensively fragmented element is less likely to be identifiable and may not be incorporated in the NISP count for that element (e.g. Marshall and Pilgram 1993). This is especially true for long bone shaft fragments. Some are easily identifiable throughout the shaft, like metapodials, whereas small fragments of a tibia without any distinctive features could just as well be from a femur. These fragments are relegated to the long bone fragment category and "erased" from the tibia NISP. However, the percentage of identified (NISP) versus non-identified (NSP) fragments based on weight of specimens, as presented earlier in this chapter, suggest that a majority of specimens were identified to the species and skeletal element, notwithstanding the complications of heavy fragmentation of the faunal assemblage. That is, the low levels of fragment identified recognized in the Mollo Kontu faunal assemblages when using counts (NISP:NSP ratios) mainly represents high levels of unidentified very small (i.e. light) fragments of bones. Comparison of weight of identified to the species versus weight unidentified to the species suggest that larger bone fragments were consistently identified to the species.

Carnivore Activities

Carnivores can also influence skeletal element representation within archaeofaunal assemblages. The identification of their influence on assemblages is the subject of various actualistic studies[55] (e.g. Cruz-Uribe 1991; Fisher 1995; Lyman 1994; Marean and Spencer 1991; Mondini 2002; Stiner 1994, 1991). Common effects of their activities on faunal assemblages include the destruction of weaker bone elements or features such as long bone articular ends, and the dispersal of elements outside of their disposal area. A common

[55] Actualistic studies are modern-day experiments done with the goal of making inferences about the past or to recognize the effects of various cultural and natural processes on archaeological material.

marker for carnivore activity is the presence of tooth scoring and pitting on the bone surface. However, low incidence of carnivore damage does not necessarily equate low incidence of carnivore action on the assemblages. Indeed, actualistic studies comparing carnivore den accumulations in the Argentinian *Puna* to human accumulations showed that although there is more evidence of carnivore gnawing in the den accumulations, the percentage of gnawed bones remains very low (Mondini 2002; see also Haynes 1983 for examples from North America and Southern Africa). In the Mollo Kontu faunal assemblages analysed, only one specimen could be confidently identified as affected by carnivore gnawing, though a few others showed potential carnivore damage. Nonetheless, the impact of carnivores on the skeletal representation within faunal assemblages still needs to be assessed.

The presence of carnivores within the residential neighborhood as shown in the species list (both non-descript carnivores and canid) is a good indicator that certain types of carnivores could have had access to the bones. Canid remains were also recovered in the MK-E sector (Couture *et al.* 2007) and at the base of the Mollo Kontu Mound (Couture et al. 2008; Mendoza 2008; Vallières et al. 2009). Furthermore, coprolites from bone-eating carnivores were identified in Event D46. The canid remains and coprolites suggest that domestic dogs were kept at Mollo Kontu and were likely taphonomic agents. Still, although the presence and influence of wild canid species such as foxes could not be excluded, their influence on the content of garbage pits within walled compounds would not have been as strong as that of the domestic dogs.

The influence of domestic dogs on an assemblage is difficult to ascertain precisely, especially when bone elements have meat and tendons still attached, because dogs leave little damage on bones compared to larger carnivores that have been the subject of actualistic studies (such as hyenas and great African cats) (see S. Kent 1981). This reinforces the argument that the low presence of carnivore scoring on bone specimens does not necessarily reflect a lack of carnivore influence on the bone assemblages. Their influence needs to be assumed, but cannot be proven or disproven. Though they do not always leave traces on the bones, dogs and other carnivores frequently destroy the porous and bone grease rich articular end of bones. By destroying those ends, they effectively remove the most identifiable part of a bone element and leave only the stronger shaft fragments to the analysts. However, bone density results presented in the previous section, which test for the preponderance of stronger shaft portions over less dense articular ends, demonstrate that carnivores had minimal effect on bone element representation.

It is also possible that certain elements were thrown straight to the dogs and never thrown back in the garbage pits. In modern ethnoarchaeological observations of Andean herding groups, dogs are fed scraps of meat, potato skins, and occasionally a mixture of chuño (freeze-dried potatoes) in water and fat (Miller 1979: 84). They also receive the bones from the meals once they have been picked clean by the consumers. This means that dogs could be a dispersal agent, dragging away bone specimens from the consumption and discard zones (ibid.; see also Aldenderfer 1998: 101; S. Kent 1981, 1993). It is not known whether feeding bones to the dogs would have been common in Tiwanaku times, or whether they were fed something else, if fed at all. Yet dogs are scavengers who could rummage through the numerous garbage pits around and remove select specimens. Dogs could ingest certain elements and/or bring them far from the discard sites. The removal of bone specimens away from their discard location by carnivores is difficult to assess since the faunal data analysed for this dissertation is limited to garbage pits and one hearth, locations unlikely to be where carnivores accumulated gnawed specimens. Dispersal away from the analysed assemblages would not leave a strong archaeological signature as it results only in absence of bone specimens within pits.

Overall, canid activities likely had some impact on the skeletal element frequencies recovered in the analysed pits. Though they did not destroy weaker bone features beyond recognition, dogs could have removed bone specimens from the garbage pits and dispersed them throughout the site. Furthermore, it is possible that residents of Mollo Kontu fed certain bone elements directly to their dogs, influencing the discard patterns recovered in the garbage pits. This possibility is evoked in my interpretation of skeletal element frequencies in the next chapter. A more detailed analysis of bone accumulations or dispersal on floors may allow the discovery of dog-related dispersal patterns and differential discard in future studies.

Bone Surface Modifications

The condition of the bone surface is assessed and recorded to determine the accuracy of bone element identification and the recognition of modifications such as cutmarks and carnivore damage. Heavy weathering of a specimen's surface can impede identification to element by eroding diagnostic elements and obscure the analysis of cutmark and other types of modification. In the case of the Mollo Kontu faunal remains, the effects of weathering are minimal on the majority of bones, though certain bone specimens have suffered from heavy weathering. Weathering data can suggest whether bones were left out in the open for long periods of time or whether they were buried quickly (see Behrensmeyer 1978 and Lyman 1994). Such an analysis is presented in Chapter 6 in the interpretation of discard patterns.

To record the different weathering stages, I used the categories devised for the York system, a zooarchaeological database (Harland *et al*. 2003). In this system, "texture" refers to the effects of weathering on bone. The texture scale goes from 1 to 4, where 1 represents very little flaking or erosion of the exterior surface of the bone, and 4 represents poor preservation; the element is still recognizable, but over 50% of its surface is flaked off. A ranking of 2 refers to good preservation, solid but with a lack of "fresh" appearance, while 3 means that the surface is solid in places, but up to 49% of the surface may be flaky.

The percentage of elements in the Mollo Kontu assemblages that show the heaviest type of weathering (stage 4) is minimal (see Figure 6-15 in Chapter 6). This suggests that the assemblages did not suffer great loss of specimens in the span of time between their original discard and excavation because of poor preservation of bone elements. In fact, all assemblages contained at least 70% of bone specimens associated with stages 1 and 2. Results of the analysis of Mollo Kontu faunal assemblages are therefore not impeded by data loss due to poor preservation.

A puzzling and frequent bone surface modification found in our assemblage is recognizable as a cement-like, often grey matrix coating part, or all of an element, and usually containing debris such as rocks, ceramics sherds, and/or bone fragments (see Figure 5-1). Most of this matrix is impossible to remove, thus sometimes two specimens are “glued” together. This matrix both hinders element identification and increases the weight of assemblages when a large portion of the bone specimens are covered by it. We do not know how it is formed but Katherine Moore (pers. comm.) suggests these mineral were deposited on the bones from water pooling in the pits and precipitating the minerals around the bones.

Figure 5-1: Example of bone covered in cement-like grey mineral matrix, with stuck bone and ceramic debris.

Summary

The mammalian and avian assemblages from Mollo Kontu are composed almost exclusively of camelid remains, with the occasional inclusion of deer, rodents, and canids. The camelids are mostly domesticates, with a preference toward the larger llama. The influence of density-mediated attrition on these camelid remains was tested using two different methods. The standard way of plotting %MAU values against volume density data for each element, combined with the coefficient of dependence for each scatter plot, was first used and showed that only Event D158 showed moderate and significant bone density attrition. The correlation between bone density and frequency in the assemblage was also tested through a Spearman rho using the same data, but ranked as ordinal scales. This method showed that D158 was positively but not significantly influenced by density-mediated attrition. Furthermore, two events (D82 and A123) were significantly and positively affected by density mediated attrition. Since Event D82 is one dumping event within a stratified pit containing a total of three events (D81, D82, and D83) that included the remains of a well-preserved 5 month old camelid, and because the aggregated assemblage from the pit showed no significant bone attrition based on density measures, the correlation of D82 with bone density attrition may not represent a natural taphonomic process, but rather may be the result of a particular disposal behavior.

Heavy fragmentation of the assemblages is demonstrated through the extent and intensity of fragmentation data. These high fragmentation levels from MK-D and MK-A influence the choice of quantification measures used in the various zooarchaeological tests presented within this dissertation. Fragmentation can affect the degree of identifiability of bone elements, thus erasing the presence of certain elements within our quantification. Nonetheless, the percentages of identified fragments versus non-identified suggest that identifiability has only been moderately affected when using weight of fragments as a quantification method. That is, the sample of identified specimens should be relatively representative of the assemblage left at the time of deposition.

The effects of carnivore attrition have also been discussed. The most likely influence would be from domestic dogs whose presence was confirmed at Mollo Kontu. However, there is only a very low incidence of tooth scoring and pitting in the faunal assemblages. This is not unexpected as actualistic studies of carnivores, and dogs in particular, demonstrate that these species leave low incidence of marks on bones. The influence of dogs on the Mollo Kontu assemblage is more likely related to dispersal. Bones fed to the dogs may not end up in a garbage pit, but would more likely be stranded around the living space by the dog. Therefore, the effects of carnivore attrition cannot be demonstrated, only assumed. Since results from bone density tests demonstrate very little attrition of weaker bone elements and features (a signature of carnivore damage), it is argued that the presence of dogs would principally affect the frequency of bone elements or fragments that would eventually reach the analysed garbage pits. That is, dogs would have acted as dispersal agents by either scavenging within the pits, or through the dog feeding practices of Mollo Kontu residents.

Finally, the weathering data does not suggest a strong taphonomic influence on the Mollo Kontu assemblages, nor does it massively obscure the recognition of surface modifications such as carnivore damage and cutmarks. The recognition of modifications is impeded by the occasional presence of a cement-like matrix, which coats faunal specimens. Overall, however, the bone density data, the analysis of the extent and intensity of fragmentation, the discussion of carnivore activities, and the bone surface modifications suggest that the camelid assemblages from Mollo Kontu can be confidently interpreted as mostly the result of human behaviour. Having determined that, the next chapter focuses on the interpretation of faunal remains to shed light on the acquisition, preparation, consumption and discard behaviour that form part of Mollo Kontu residents' culinary practices.

CHAPTER 6: CAMELIDS AND CULINARY PRACTICES AT MOLLO KONTU

Camelid acquisition, preparation and discard are the three aspects of the more complex system of cuisine most easily recoverable from archaeofaunal data. The meals prepared and ultimately discarded were also consumed, though the act and context of consumption (e.g. where, or with whom), as well as the composition of individual dishes remain elusive at Mollo Kontu. The assemblages analysed here are all garbage pits, save one hearth, and do not lead to an easy recognition of consumption and preparation areas. Furthermore, garbage pits are accumulations of the remains of varied dishes, menus, and occasions, from one or more households. That is, their analyses only illuminate broad consumption trends rather than the minutia of dishes and recipes. Other archaeological correlates of cuisine at Mollo Kontu, including individual diet, plant and fish consumption and serving ware are addressed in Chapter 7.

This chapter follows camelids through the chaîne opératoire of cuisine, starting with camelid acquisition. That is, in the first part of this chapter, I investigate herding strategies used and animal redistribution systems in place at Mollo Kontu. Results from mortality profiles and analysis of pathological specimens suggest that the animals acquired by Mollo Kontu residents had been raised primarily for their meat, rather than for the exploitation of secondary products such as wool, and their use in caravan transport. This pastoral strategy has no analog in the ethnographic record of the Andean region, or in the ethnohistorical records of the Inkas. Results from skeletal element frequencies suggest that the camelids consumed at Mollo Kontu arrived whole and likely alive at the compound. Combined with the presence of very young animals, these data suggest that the Mollo Kontu residents likely had control of their own herds, rather than receiving live animals through state redistribution. An overabundance of ribs when using %weight as a quantification method may indicate the indirect redistribution of meat on ribs, perhaps in the form of dried ch'arki.

In the second part of this chapter, I investigate the food preparation patterns with a focus on cutmark placement and fragmentation. This allows for the illustration of the way a camelid was first quartered into primary packets then further processed to be incorporated into meals. The preparation techniques identified are shared between MK-A and MK-D which suggests a shared knowledge. These patterns are, in some cases, distinct from modern butchery and preparation patterns and no contemporaneous Tiwanaku butchery data is available to date for comparisons between neighbourhoods.

Finally, in the third part of this chapter I investigate refuse disposal through contextual information on pit composition, burning data and weathering analysis. I argue that large pits do not necessarily represent the remains of large food events at Mollo Kontu, as there is no correlation between pit size (in liters of soil) and density of faunal material. This contrasts with the interpretation of garbage pits in the Akapana East 1 sectors of Tiwanaku and supports the argument presented in Chapter 4 that Mollo Kontu was permanently settled neighbourhood. The refuse of Mollo Kontu are an accumulation of daily meals and gatherings. Analysis of burning signatures within assemblages suggests that pits contained refuse from hearths, though it is possible that their contents were also periodically set ablaze.

Food Acquisition

Where food comes from is not just important in economical and political terms; it can also have a symbolic or emotional importance for the consumer (e.g. Weismantel 1988). Food received as a gift or payment, food raised through one's hard work, food from one's native land, local food, exotic food, all are aspects of food that are often meaningful. If the daily ingestion of certain foods really is the fundamental core of identity, conformity and resistance as Smith argues (2006: 480), then what you ingest, and where it came from, is significant.

The present section on the acquisition of animal resources by residents of Mollo Kontu uses multiple lines of evidence to argue that the majority of the meat ultimately consumed at Mollo Kontu came from the herd of its residents. First, the results of the species list presented in Chapter 5 are revisited to address the acquisition of wild resources. Following this, the majority of the analyses presented in this chapter are focused on the interpretation of zooarchaeological patterns found for domesticated camelids.

A discussion of mortality profile is aimed at identifying the herd management strategies. That is, mortality profile models used by zooarchaeologists on fauna from sedentary societies focus on the identification of animal husbandry specializations (such as herding for meat production and for secondary products such as dairy, traction, transport and wool). The result from mortality profiles at Tiwanaku present a preponderance of juvenile camelids, including a fair number of crias (0 to 12 months old camelids) and old animals (6 years old or older). These patterns suggest variable pastoral strategies with a strong focus on meat production. Furthermore, the presence of crias suggests Mollo Kontu was a producer site. That is, its residents owned camelid herds outside of state control.

The variable nature of pastoral management for the animals acquired by Mollo Kontu residents is reinforced by a discussion of pathologies found on the bone specimens. These suggest that certain animals ultimately consumed worked in llama caravans during their lifetime. Furthermore, the presence of certain pathologies indicates a choice by pastoralists to keep an injured or sick animal alive rather than culling them for their meat. The method of distribution of these camelids is in part inferred through the interpretation of skeletal element frequencies. As mentioned in the introduction to this chapter, they suggest that animals arrived complete and likely alive to the domestic compound rather than as already butchered meat packets. This is further reinforced by plotting the skeletal element frequencies against their food utility values, a zooarchaeological model that predicts butchery, transport, and sharing strategies. The lack of positive or negative correlation between element frequencies and their food utility suggests that complete animals (made up of both high, medium, and low utility skeletal parts) were processed within the domestic sectors of Mollo Kontu.

Species Acquired

The breakdown of species represented in faunal assemblages provided in Chapter 5 (see Table 5-1) illustrates the diet breadth, including the incidence of wild (e.g. guanacos, vicunas, deer, and other small mammals and bird) and domesticated animals (e.g. llamas, guanacos, and guinea pigs). This section is the first step into the overall line of inquiry of this chapter. Given that hunted and domesticated animals are likely to be acquired through different channels, this section first focuses on the procurement methods for the wild animals identified in the Mollo Kontu species list. The following sections will then develop a multi-step analysis of the zooarchaeological assemblages to uncover how residents of Mollo Kontu acquired the domesticated animals that form the bulk of their meat consumption.

At Mollo Kontu, almost all of the bones identified are from the South American camelid family. Further tests reveal that the camelid bones came primarily from domesticates and large camelids (see Table 5-2). A fair number of specimens could only be assigned to intermediate size categories (i.e. "large camelids," "small camelids," and "domesticates"). Since the large and small categories do not rule out the two wild subspecies, it is possible that the Mollo Kontu assemblages contain a higher frequency of wild animals than specifically identified. However, of measured specimens, 45 of the 79 specimens (or 57%) are directly associated with domesticates, while a low number of specimens is directly associated to guanacos (13 out of 79, or 16%). Vicuña specimens are absent. This suggests that a majority of the specimens in the "large camelid" categories probably represent llamas, while camelids in the "small camelid" category likely represent small alpacas rather than bigger than average vicuñas. Overall, these data suggest that Mollo Kontu residents ate meat mainly from domesticated animals, both llamas and alpacas.

The acquisition of guanaco is suggested only through the presence of lower limb elements (i.e. second and third phalanges). Since measurements to determine camelid species need to be taken on complete bone elements, or complete long bone ends, a high proportion of all bones measured are phalanges as these were less frequently fragmented in the Mollo Kontu assemblages. Therefore, it is possible that other guanaco elements are included in the faunal assemblages, but remain unidentified to camelid species due to fragmentation. However, it is also possible that the only guanaco elements that reached Mollo Kontu were their lower digits. If the latter case were true, it would suggest that guanacos were not consumed, but rather that the phalanges were brought to the site attached to pelts. The presence of only lower digits is commonly interpreted as archaeological evidence for the presence of pelts (e.g. Wing 1972), though there is cultural variability in pelt making. Indeed, Miller's (1979: 48) ethnographic observations of Peruvian camelid herders mention that the last step of dismemberment for domesticated camelids is the removal of the phalanges from the pelt.

Trapping and hunting animals was not a dominant form of meat acquisition at Mollo Kontu. Residents of Mollo Kontu had access to wild resources, including large mammals such as deer and guanaco but also smaller games like rodents and birds. This suggests that the Tiwanaku elites may not have instituted prohibition such as sumptuary laws against hunting in contrast with the later Inka customs (see deFrance 2009a). Yet the bone specimens recovered of these wild animals are few. Hunting was clearly not a major preoccupation for the people of Mollo Kontu; most of the meat consumption came from domesticated camelids. Wild meat supplementing the diet of Mollo Kontu residents was acquired through trapping small animals, such as aquatic birds and viscachas (see also Pokines 2012; Pokines *et al.* 2009).

Mortality Profiles and Herding Management Strategies

Mortality profiles are a breakdown of the age-at-death of animals making up faunal assemblages. These data are compared with models to infer the economic character of herding practices and redistribution patterns in different historical and prehistoric contexts through faunal remains. Mortality profiles can be used to identify if the site was a producer site, a consumer site, or both; mortality profiles can also be used to identify the pastoral strategy used by the producers (e.g. Crabtree 1989, 1990, 1996; Maltby 1994; O'Connor 1989; Payne 1973; Reid 1996; Reitz 1986; Sandefur 2001; Siracusano 2004; Stahl 1999; Wapnish and Hesse 1988; Zeder 1991). That is, mortality profiles suggest whether the residents of a site engaged in pastoralist activities (i.e. producer site), or acquired meat through exchange or redistribution (i.e. consumer site); furthermore, they test whether the pastoral strategy reflects an economic emphasis on particular products such as meat, use of animals as pack animals, or wool in the case of South American camelids. Mortality profiles produced by Webster (1993) for the combined areas of the Putuni sector, Akapana pyramid, and Akapana East contexts suggests that animals consumed at Tiwanaku were predominantly juveniles.[56] The Mollo Kontu data presented in this section is congruent with Webster's findings. This suggests that camelids at Tiwanaku were raised primarily for their meat.

Producer sites usually present a more natural age of death profile than consumer sites, although the former might be missing the more economically important age groups if they produce for a market economy as opposed to a

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[56] Mortality profiles from Tiwanaku sites by Webster (1993) and Park (2001) are discussed in more detail in Chapter 8. The age-at-death of the majority of animals recovered is between 0 to 3 years old.

subsistence one (e.g. Wapnish and Hesse 1988). A natural age at death profile includes the presence of neonatal animals since infant mortality is especially high for camelid crias during their first few months of life as discussed in Chapter 2. The presence of animals of an economically optimal age depends, therefore, on if optimal animals are distributed from the producer to a consumer site, or whether they are raised to feed the producer group, as is the case in modern ethnographies of Andean pastoralist groups (see Chapter 2). In turn, consumer sites should have a greater preponderance of optimal age animals. What an 'optimal age' is depends on the producers' pastoral strategies (see Crabtree 1990 for examples).

Pastoral strategies presented in Chapter 2 for camelid herding in the Andes, and their archaeological correlates, include a focus on wool production, meat production, a mixed wool and meat strategy, and a focus on camelids as pack animals. The mortality profiles for wool, pack animals, and mixed meat and secondary product strategies are similar, with an emphasis on keeping animals alive well into adulthood. The most significant difference in terms of mortality patterns between all strategies is with herds aimed at meat production. Mortality profiles for herds favouring meat production would present a strong proportion of juvenile animals, although a number of females would also be kept into adulthood for herd reproduction (see Wing 1975). This strategy is similar to that based on wool production, when producers choose to cull young males as juveniles to prevent their aggressive tendencies. However, models of camelid pastoralism based on ethnographic material reflect a post-colonial socio-political situation that is not analogous to the pre-colonial past. Pastoral strategies aimed at feeding urban residents, whether through state redistribution, pastoral specialization, family herds or markets, may leave markedly different mortality profiles. The ethnohistorical records for Inka herding strategies cannot be used for analogy either as there are no large Inka urban contexts comparable to Tiwanaku. To work around this issue, it is useful to look at urban meat provisioning in non-Andean contexts.

Melinda Zeder's (1991) investigation of the role of animal economic specialization in state formation in Mesopotamia suggests the concurrent use of both direct and indirect distribution of animal products within urban contexts. While the state provided the army, religious personnel, and families of royal affiliation with animals distributed through up to three levels of horizontal administrative levels (i.e. indirect distribution), commoners and other specialists had to get meat through personal links to herders, or by owning animals themselves (i.e. direct distribution). Zeder (1991) proposes that direct distribution would present a more diverse archaeofaunal record, particularly in terms of age at death within species, as animals provided by the herders would generally follow herd management priorities, while indirect distribution would be more standardized. Zeder argues that it would be in the provisioner's interest to meet distribution requirements efficiently by favouring animals with great meat yields and/or with the highest nutritional value per edible portion. That said, "low cost" (i.e. older or injured animals), flavour, and exoticism could also be important factors in producer and consumer choices (Zeder 1991: 38).

This model is based on a case study with multiple domesticate species (sheep, goats, cattle and pig). That is, it relies on the qualities and uses of different species to build interpretations on distribution systems. For example, sheep raised for their wool would present an older mortality profile while pigs raised for their meat would be culled at a young age as they reached full body size. In the case of the prehispanic Andes, both direct and indirect distribution would involve camelids as they are the only large domesticates in the region. However, since camelids provide a variety of products, this lack of species diversity in the Andes complicates our interpretations of the mortality profiles with respect to the investigation of distribution systems. That is, age-at-death data from faunal assemblages can be an aggregation of different pastoral strategies. Nonetheless, the Mesopotamian case study demonstrates that urban contexts would likely present multiple distribution systems.

There are two ways to identify the age at death of animals in archaeological contexts to construct mortality profiles: through the fusion schedule for the bone elements of that particular species, and through eruption and wear patterns on dentition. Both methods have inherent problems as they are based on element-specific characteristics. For example, Pamela Crabtree (1996) notes that age data from Middle Saxon pig mandibles greatly vary from age data extrapolated from the fusion stages of certain epiphyses. The differences in the Saxon assemblages reflect differential carcass treatment for juvenile and adult pigs within the settlement. That is, young pigs were consumed at the site, while adult pigs were slaughtered off-site and exchanged without their heads. This example demonstrates that the interpretation of mortality profiles should take into consideration both epiphyseal fusion and dentition age data. The data for epiphyseal fusion identified in the Mollo Kontu faunal data is presented next, followed by a presentation of the Mollo Kontu age data as identified through dental eruption and wear patterns. Both type of age-at-death data are interpreted in terms of their significance for herd management strategies.

Epiphyseal fusion data

Two studies of epiphyseal fusion times for camelid bone elements are used to analyse the Mollo Kontu faunal remains (Wheeler and Mujíca 1981; Kent 1982). These sometimes provide markedly different fusion schedules for certain elements; in such cases, the oldest fusion time is used so as to not inflate the number of young animals. Aged specimens are categorized as either “cria,” “cria/juvenile” (neo/juv), “juvenile” (juv), “sub-adult” (s-ad), “juvenile/adult” (juv/ad), or “adult” (ad).[57] The cut off age between cria and juveniles is at 16 months; the transition from juvenile to adult is marked at 3 years since many elements fuse at those key periods. However, these are neither cultural categories, nor are they based on other biological milestones, such as reaching sexual maturity or optimal weight. The “cria/juv” intermediary category includes specimens showing the fusing process underway but not fully complete for elements fusing around 16 months ,[58] along with unfused specimens whose epiphyses fused before the age of three. Specimens with an epiphysis in the process of being fused, for a fusion time scheduled at around the age of three, are included in the sub-adult category. All fully fused elements with a fusion time before the 3 year old cut off were assigned to the “juv/ad” category.

[57] These are based on the categories created by Lairana (2008). Note that I have renamed Lairana’s “neonate” category “cria” in order to emphasize that this category includes animals up to 16 months old. The word ‘neonate’ is often associated with animals only a few months old.
[58] Fusion is neither precise, nor overnight, and there is a time period where the fusion suture is still visible and thus considered “fusing.”

A challenge to the production of age profiles includes skeletal elements with early fusion schedules, as they do not provide for accurate age profiles once fused. For example, an unfused camelid acetabulum can be confidently put in the cria category as it fuses around 1 year, but a fused example is more difficult to categorize. In fact, it could come from an animal aged anywhere from a year and a half to fifteen years old. A fused camelid acetabulum therefore would be categorized as juvenile/adult. Consequently, a high number of aged specimens are included in the broader categories of juvenile/adult or cria/juvenile. This issue is further compounded by the high levels of fragmentation found within the Mollo Kontu faunal samples; age assessment is more precise with a complete specimen, as most bone elements bear more than one fusion point, each fusing at different times. Due to the fragmentation levels of the assemblages at Mollo Kontu, most bone and teeth specimens recovered did not have any age indicators. In order to have a sufficient sample size for comparison, age profiles are presented as aggregate data for each analysed sector in Figure 6-1 and Figure 6-3, rather than for individual events.

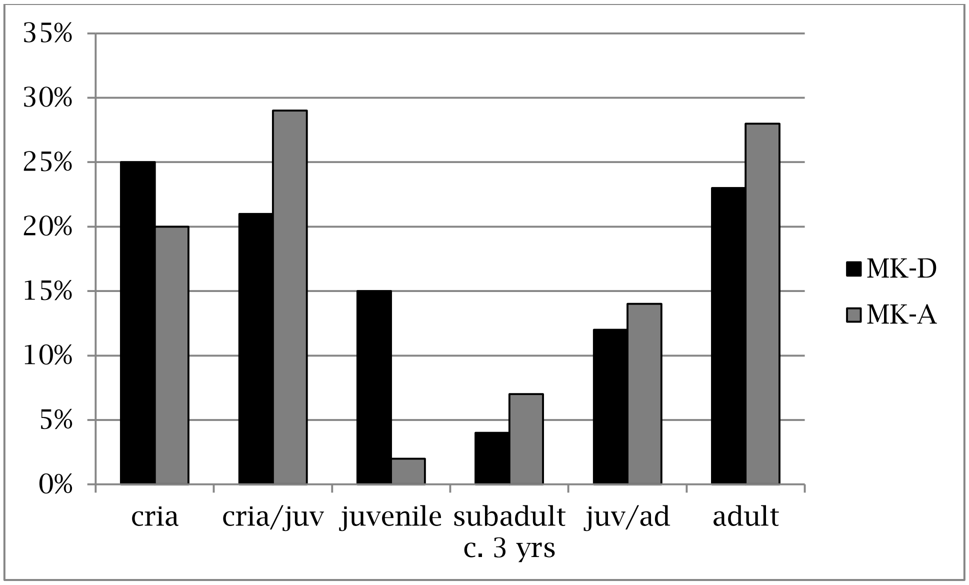

Figure 6-1: Percentage of elements for each age categories based on element fusion for MK-D and MK-A.

While Figure 6-1 provides a breakdown of the counts for all age categories, Figure 6-2 aggregates definite and intermediary categories to visually compare the ratio of crias, juveniles (including counts for cria/juv, juv, and s-ad) and adults (made up of juv/ad and ad). Results show that Mollo Kontu residents had access to a good portion of young animals (3 years old and less) compared to adult animals (3 years old and up),[59] with percentages that average around 60% for animals 3 years old or younger. The greater proportion of young animal is quite significant, in particular since first two categories combined only represent 3 years of an animal's life whereas the last category includes animals ranging from 3 to 14 years old. Such a mortality profile that emphasizes both crias and juveniles suggests that these animals were culled for their meat, though a proportion of the crias could result from high infant mortality rates. This interpretation as a management strategy focused on meat production is

[59] Keep in mind that the "juv/ad" category included in the "Adult" portion could include juvenile animals and thus could lessen the representation of mature animals in favour of younger ones.

reinforced by a comparison with analysed faunal contexts from the site of Pachamachay, in Peru. Pachamachay was interpreted as a meat producing center based on mortality profiles of 56% juvenile camelids (Wing 1975: 306). Given that the rates of juvenile animals to adults at Mollo Kontu are slightly superior to those of Pachamachay, the interpretation of Mollo Kontu mortality profiles as representing a meat producing herding strategy appears secure.

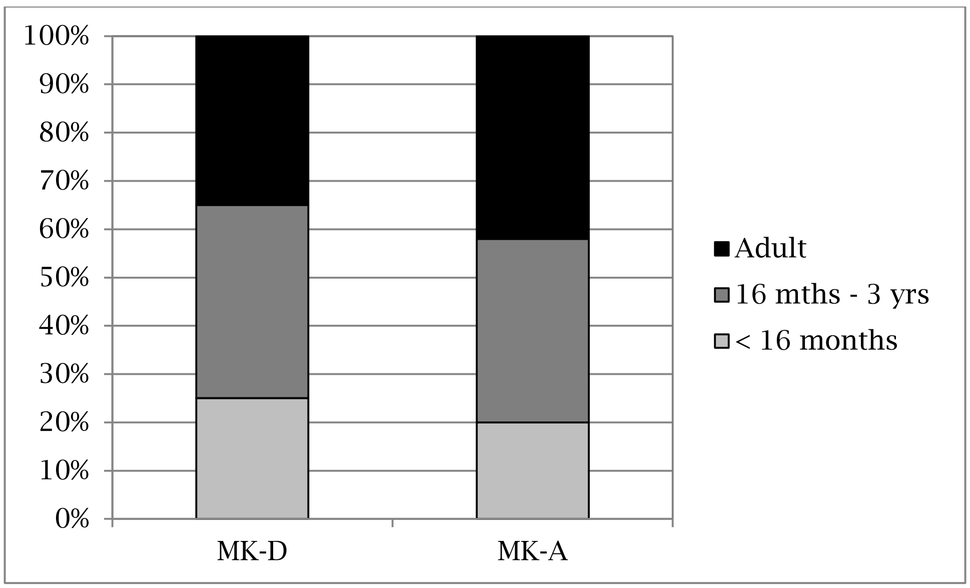

Figure 6-2: Proportions of age groups based on element fusion for MK-D and MK-A, where "<16 months" includes only the cria category, "16 mths – 3 yrs" includes cria/juv, juv, and s-ad, and "Adult" includes juv/ad and ad.

Dental eruption and wear data

As mentioned above, epiphyseal age data should be analysed in conjunction with tooth wear and eruption. Figure 6-3 illustrates the age patterns recovered from dental data for both sectors of Mollo Kontu. Both sectors are aggregated to get a representative sample since only 71 specimens could be used to assess age at death using dental data at Mollo Kontu. Similar to age categories based on epiphyseal fusion, age data based on teeth wear and eruption patterns is not always precise (see Wheeler 1982 for wear and eruption patterns). In cases of broad age range, the oldest age possible was usually recorded (i.e. 36 months). It is therefore possible that some cria or juvenile specimen might be underrepresented in Figure 6-3. Some of the teeth of older animals are also problematic for giving precise age range. In particular, the third molar shows a stable wear pattern from age 6 until death (e.g. Wheeler 1982). Five specimens belong to the "6 years and above" age category. These were placed in the 6 years category, which accounts for the spike in the 6 years old category in Figure 6-3. In reality, five out of seven placed in that category could be anywhere on the spectrum from 6 years old and up. Nonetheless, the dental data reinforces the pattern noticed with epiphyseal fusion, with a strong representation of animals 3 years old or younger.

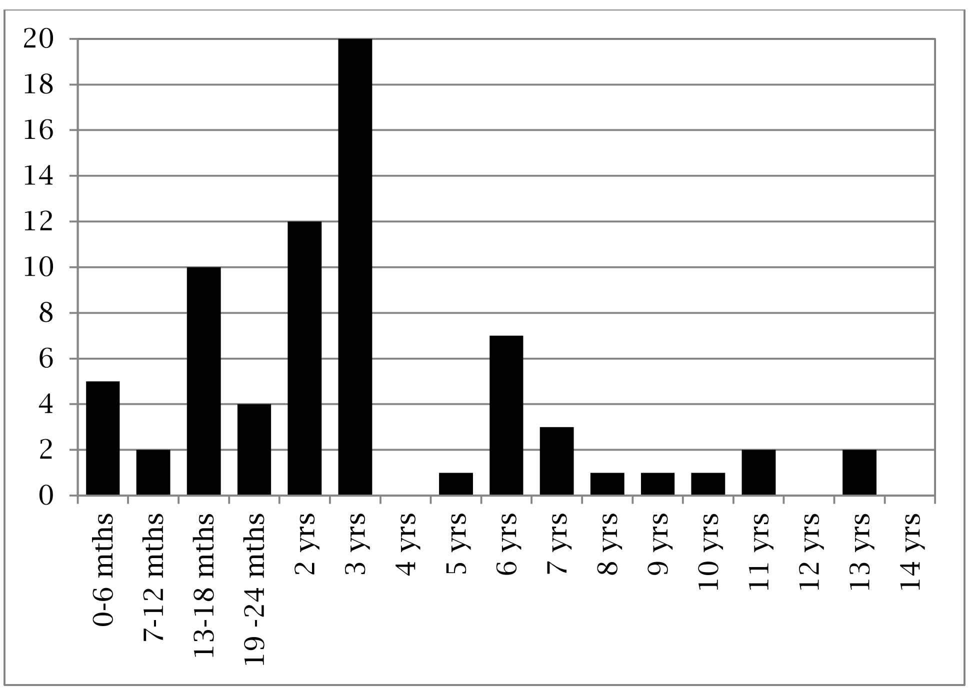

Figure 6-3: Count of age groups for all Mollo Kontu assemblages based on dental eruption and wear patterns, total n=71.

The teeth wear and eruption data shown in Figure 6-3 reinforces the importance of younger animals evidenced by the epiphyseal fusion data. It also demonstrates that a portion of the animals consumed at Mollo Kontu lived well into adulthood. Though these data need to be interpreted with caution due to the small sample, roughly 10% of the aged specimens come from animals 12 months old or younger (7 out of 71 specimens), 25% are 5 years old or older (18 out of 71), leaving 65% of aged specimens between the ages of 12 months old and 4 years old.

The presence of the very young and very old is in line with natural herd profiles and can suggest that Mollo Kontu was a producing site (e.g. Wapnish and Hesse 1988), although the variability in age could also be interpreted as direct distribution between Mollo Kontu residents and some pastoral specialists using Zeder's (1991) model. There is a definite emphasis on the consumption of juvenile animals. The culling rates for juveniles far exceed the mortality profiles suggested by ethnographic analogy of modern camelid herders. This emphasis on the acquisition and consumption of optimal age animals (i.e. between 1.5 to 3 years old) in terms of meat production can be interpreted in different ways. For instance, it can be evidence for indirect redistribution of standardized animals by the state, similar to the Mesopotamian case study (e.g. Zeder 1991). Yet the non-negligible presence of crias and older adults (from 6 to 13 years old) suggest direct distribution either through household relations with pastoral specialists, or through herd ownership. In all cases, the Mollo Kontu data suggest a mixed pastoral strategy that primarily emphasizes meat production, but also allows for the exploitation of camelids for their wool or as pack animals.

Pathologies

While my analysis of the age-at-death data shows that herding strategies were primarily focused on meat production, the presence of older animals coupled with data on pathologies suggest that camelids were also exploited for their use as pack animals. Pathologies can also illuminate aspects of camelid life histories and the relations between pastoralists and their herds. For example, healed pathologies suggest that sick animals were cared for rather than immediately culled for consumption. Furthermore, certain pathologies can be identified to strengthen the assertion that older camelids were used as pack animals (deFrance 1996, 2009a). For example, high representation of certain pathologies on the foot elements and on thoracic vertebrae, often in the form of exostoses (new, abnormal nodules of bone growth as seen in Figure 6-5), could suggest injuries related to working as cargo animals.

Pathologies such as lesions and deformities on bones and teeth can have various aetiologies (i.e. causes or origins), such as infection, trauma, congenital predispositions and degeneration. The aetiology of a lesion on an isolated specimen is often impossible to determine; furthermore, a high number of diseases do not leave any traces on the bones (see Baker and Brothwell 1980). The fragmented nature of Mollo Kontu's faunal assemblages does not allow for interpretations of life histories of an individual animal, in contrast to bioarchaeological analyses of paleopathology performed on mostly complete skeletons.

Table 6-1 presents the list of pathologies identified in the Mollo Kontu assemblages. The general distribution of pathological elements in the camelid skeleton is also represented visually in Figure 6-4. Most pathologies are variations on exostoses (i.e. irregular bone growths; see FiguresFigure 6-5,Figure 6-7 andFigure 6-8) found on ribs, vertebrae, phalanges, and in one case on a radio-ulna. Note that "lipping" as described for vertebrae in Table 6-1 refers to a specific condition where exostoses are found on the epiphyseal edges of vertebrae (see Figure 6-8 for examples). Exostoses can result from many causes and their extrapolation is difficult, if not impossible without the complete skeleton.

Event	**Element**	**Pathology**
A111	rib	deformation (widening) of, and osteoses on, the tubercule
A111	carpal	exostoses on the edge of the articular end of the pisiform
A23	rib	deformation (widening) of, and osteoses on, the tubercule
A23	rib	depression on the tubercule
A23	1st thoracic	lipping on the proximal epiphysis
A23	1st thoracic	lipping on the proximal epiphysis
A23	7th cervical	lipping on the proximal epiphysis
D120	rib	inactive lesions (woven bone) on the ventral surface of the neck and shaft
D158	3rd Phalanx	abnormal pitting and notch on dorsal side
D40	cervical	exostoses on the edge of the articular facet
D40	thoracic	porosity on the proximal epiphysis
D46	femur	deformation of the distal shaft (abnormally flat on the side)
D46	mandible	inactive lesions (woven bone) on the labial side of the alveolar bone at 4th premolar
D46	Radio-ulna	exostoses on edges of proximal radius epiphysis and on the anconeal process
D46	rib	mild exostoses on tubercule
D46	1st Phalanx	exostoses on shaft
D46	1st Phalanx	mild exostoses on shaft
D46	metacarpal	mild exostoses on condyles
D46	rib	mild exostoses on tubercule
D46	maxillary	abnormally large canine socket
D46	1st Phalanx	exostoses on shaft
D46	cervical	deformation (widening) of spinous process
D81	cervical	deformation (widening) of the articular facet
D83	cervical	deformation (widening) of the articular facet

Table 6-1: List of pathological specimens in the Mollo Kontu assemblages.

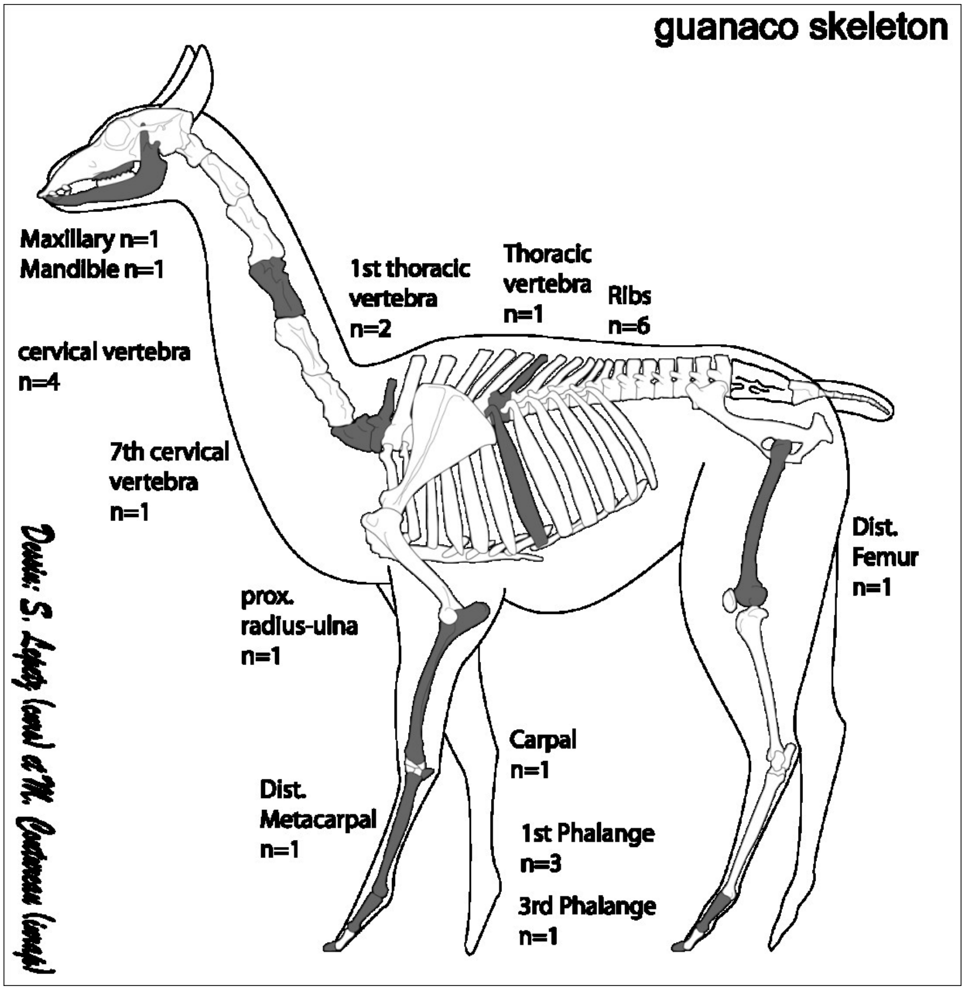

Figure 6-4: Location of pathologies from Mollo Kontu assemblages, image by S. Lepetz and M. Coutureau, modified from http://www.archeozoo.org/fr-article50.html.

Some of the exostoses may have caused some discomfort or pain for the animals though it is difficult if not impossible to ascertain. Therefore the presence of exostoses cannot be securely interpreted as demonstrations of herder tolerance and care for hurt animals. Pathologies that are more suggestive of this are the possible case of osteoarthritis found on the elbow joint of the radio-ulna (see Figure 6-7), and the rib and mandible with inactive (i.e. healed) lesions suggestive of an infection that was later cured, either by itself or through the care of the herders (see Figure 6-6). The diagnosis of osteoarthritis requires the presence of at least three out of four changes in the bone morphology (grooving of the articular surface, eburnation, extension of the articular surface, and/or peripheral exostoses) (Baker and Brothwell 1980: 115), but their presence, save the heavy peripheral exostoses, cannot be confirmed through reexamination of the photographs. Nonetheless, the specimen's exostoses are substantial enough to speculate that the animal was likely limping and was no longer useful as a cargo animal, if it was in fact used for this purpose during its lifetime. The inactive lesions on the rib and mandible suggest that these animals were sick at some point, but kept alive rather than culled. This demonstrates the investment and care of the herders for their animals, and the value they put on live animals, not only as meat providers. No specimens showed signs of fractures prior to their post-mortem fragmentation.

Figure 6-5: Examples of exostoses on two 1st phalanges and a carpal from Mollo Kontu.

Figure 6-6: Examples of inactive lesions (or "woven bone") on a mandible and on a rib from Mollo Kontu.

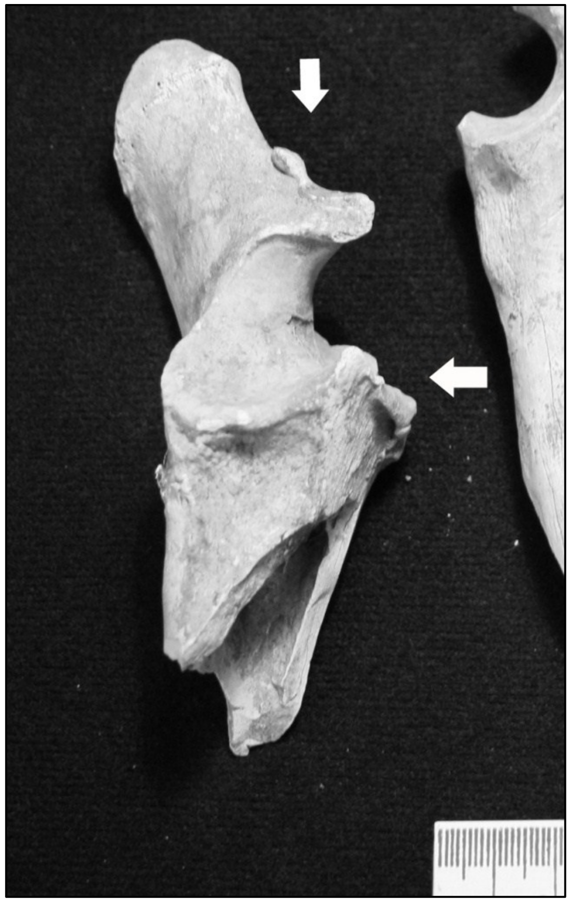

Figure 6-7: Radio-ulna from Event D46 showing exostoses at the elbow joint.

The majority of pathologies identified are exostoses and deformations of features, principally found on ribs (especially rib heads), vertebrae and lower limb elements, such as phalanges and metapodials. These may suggest that certain animals worked as pack animals, with heavy loads on their backs and potential foot injuries on trips. Susan deFrance (2009a) suggests that exostoses to the phalangeal shaft could be the result of an injury similar to the 'false ring bone' pathology described for draught horses.[60] These injuries, identified only in draught horses to date, are often caused by the concussion of the foot on an uneven terrain resulting in a tear in the periosteum and subsequent formation

[60] See Baker and Brothwell (1980: 120) for a more in-depth description of the various "ring bone" pathologies in draught horses.

of exostoses at the location of the tear. Exostoses on three first phalanges (see Figure 6-5 for a picture of two examples) could suggest that some of the animals ultimately consumed at Mollo Kontu had worked in caravans during their lifetime.

Work as pack animals is further suggested by the heavy lipping found on thoracic and 7th cervical vertebrae, at the juncture of the neck and the back (Figure 6-8). Furthermore, widened, flattened articular surfaces on rib heads and cervical vertebrae, and/or light peripheral exostoses (see Figure 6-9 for examples) suggest strain on the back of these animals. Webster (1993:255) interprets two ribs whose facets bore peripheral exostoses as caused either from carrying heavy cargo, putting weight on the rib joint, or were stress marks from cinching weight around the waist of the animal. It is difficult to posit a direct cause to single elements but the presence of 5 ribs with these lesions in a faunal assemblage, which contains other pathologies suggestive of cargo work, could be used to argue for the occasional consumption of animals that were no longer useful as pack animals.

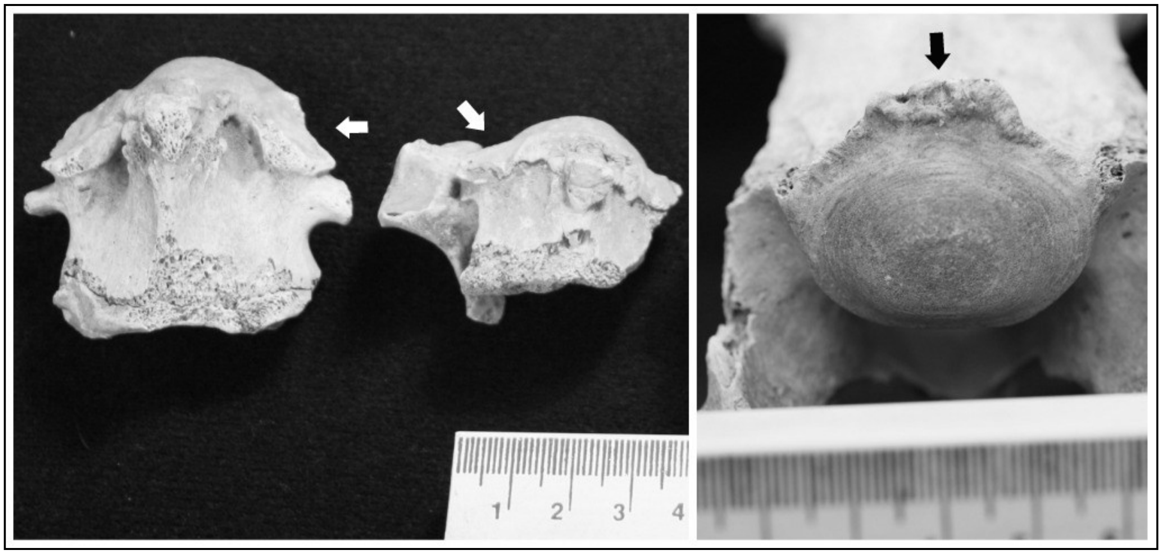

Figure 6-8: Examples of "lipping" on two 1st thoracic vertebrae and a 7th cervical vertebra from Mollo Kontu.

Figure 6-9: Examples of a deformed rib tubercule (above a healthy rib head) and a deformed cervical vertebra articular facet.

Skeletal Element Frequencies

Skeletal element frequencies are used to identify whether certain elements of an animal are more represented than others within an assemblage. In the case of Mollo Kontu, it is used to determine whether meat was redistributed in butchered packets or whether all parts of a skeleton reached the domestic compounds. Investigations of skeletal element frequencies were initially devised to determine whether an assemblage was human-made rather than created by carnivores, and whether the assemblage represented a home base of a kill site in hunter-gatherer sites (e.g. Binford 1978, 1981), but they are now further applied to a more varied set of questions and social settings.

In the context of modern camelid pastoralism, animals can be killed and butchered at the producer site, or brought live to the consumer site where it will be killed and butchered; in either case, the entire animal is brought back to the consumption site (Miller 1979: 24). Redistribution of meat as ch'arki would leave a different skeletal element frequency pattern. For example, a model of exchange between ch'arki production and consumption sites was developed based on skeletal part frequencies at Chavín de Huántar[61] (e.g. Miller 1979; Miller and Burger 1995; see Stahl 1999 for a critique); differential representation of cranium and lower limb elements was used to trace the meat distribution from a ch'arki producing site to the consumption site. Marked differences in skeletal part frequencies between assemblages can also suggest unequal redistribution of meat packets, where those of higher status get the more valued 'cuts' of meat than commoners. The skeletal element frequencies based on skeletal element

[61] The 'ch'arki effect' is described in more detail in Chapter 2.

weight percentages indicate that camelids arrived complete to the Mollo Kontu domestic sector.

Skeletal element frequencies are dependent on the quantification methods selected by the analyst; in this section, I quantify the skeletal element frequencies for Mollo Kontu in two distinct ways: 1) through counts, using %MAU, and 2) through bone weight expressed in percentage of the total assemblage. Typically, the skeletal part frequencies are tabulated using %MAU. This quantification method is based on ethnographic analogy for transport strategies of large carcasses in hunting situations (see Binford 1978: 67-72, 1984: 50-51; and Lyman 1994: 227). It involves the identification of the element with the highest MAU, which is then given the value of 100%, and all other element frequencies are put in percentage form compared to the MAU of that element. This method works on the assumption that if all parts of all animals were brought to the "home base," then all skeletal part frequencies should be represented equally and the graph should read 100% for all elements. If certain elements were not brought back, their absence will be noted compared to the elements present.

The major problem with using MAUs to look at skeletal element representation is that high degrees of fragmentation (such as that found in the Mollo Kontu assemblages) impair the recognition of diagnostic zones of the elements from which MNE, MNI and MAU are calculated. The use of NISP as a quantification method has been suggested to palliate to this problem (Grayson 1984; Lyman 2008). Yet NISP counts are also dependent on fragmentation, as elements are not equally identifiable once fragmented and assemblages are not all equally fragmented.

A solution to the fragmentation problem inherent in the quantification methods used when tabulating skeletal part frequencies is to use the weight of identified elements, which is less likely to be inflated by variable fragmentation levels. High levels of fragmentation render unidentifiable the diagnostic features necessary for the calculation of derived measurements based on the presence of *overlapping features*, such as MNE and MAU. Bone specimens such as skull and long bone shaft fragments can nonetheless be identified to the element through other attributes such as curvature, texture and thickness. This means that in assemblages with a high degree of fragmentation the NISP for elements will be high, but the derived counts will be low due to the destruction of diagnostic features. The use of total fragment weight for each skeletal element mediates between derived measures and NISP. By using weight as an unmodified count (i.e. primary data; see Reitz and Wing 1999: 170), the bias from heavy fragmentation is greatly reduced.

With the weights tallied for every skeletal element in an assemblage, these weights are then transformed into proportions of the total assemblage expressed in percentage. The advantage of using weight compared to any of the 'Minimum number' quantification methods (i.e. MNI, MNE, or MAU) is that weight will not be affected by aggregation of faunal data from multiple assemblages.[62] That is, percentage weight data can be simply added when combining faunal assemblages from different context rather than recalculated for overlapping features as is necessary when using derived measurements.

[62] See Grayson (1979, 1984) for a discussion of the effects of assemblage aggregation on derived measurements.

Weight is affected, however, by the presence of adult versus neonatal bones, as the latter will be much lighter than mature bones.

In derived measurements such as the %MAU, the data is presented so that a complete skeleton would have each skeletal element represented at 100% MAU. The situation is different when using percentage of weight data; in a situation where one complete skeleton is weighted, certain skeletal elements such as would be heavier than the weight of lighter bones. For example, the combined weight of the ribs represent around 8% of the total weight of a llama skeleton while the hyoids for the same animal only represents 0.1% of its total weight. This means that all graphic representation of weight abundance from faunal assemblages also needs to present data on the average percent weight expected in a complete skeleton. For this reason, the average percent weight of all bone elements from two comparative llama skeletons, calculated and provided by Dr. Katherine Moore (pers. comm.) is included in Figure 6-11. For some skeletal elements I used broad element categories. For example, I combined the weight of metacarpals and metatarsals into 'metapodials'[63] and did not tally carpals nor tarsals individually, but rather presented them as two units.[64]

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[63] For metapodials, though the distinction between metacarpals and metatarsals is important, especially for interpretations, these elements were joined together in the figures because the elements can only be differentiated by their extremities. The shafts of metapodials cannot be separated into metacarpals and metatarsals, but they are easily assigned to metapodials as they are very distinctive. In the end, it was deemed more accurate to have weight data including shaft portions, even if it meant that the front and back limbs would not be separated. They are separated in the %MAU data since extremities are used as diagnostic for counts.

[64] The category of isolated teeth is problematic. The weight of teeth from the comparative skeletons are part of the total weight for either mandible or maxilla, whereas archaeological teeth specimens are often found loose and can be difficult to assign to mandible or maxilla. Therefore, the weight for mandible and maxilla (or cranium) from the faunal assemblages would rarely include teeth, unless recovered still

Given the high degree of fragmentation identified for the Mollo Kontu faunal assemblages (see Chapter 5), it is argued that the percentage weight of skeletal element parts presents a more accurate depiction of the bone elements discarded by the residents of Mollo Kontu. However, as this quantification technique is uncommon within zooarchaeological analysis, results from both the more common %MAU and from %weight analyses (see Figure 6-10 and Figure 6-11)[65] are discussed conjointly.

Skeletal part profiles for Mollo Kontu camelid assemblages are quite different depending on the quantification method used. The most striking difference between the skeletal element frequency results provided by the two quantification methods is in the relative proportion of ribs in the assemblages; ribs are under-represented using %MAU and over-represented when using %weight data (see Figure 6-10 and Figure 6-11). This suggests that either ribs were less likely to be distributed as a meat packet to Mollo Kontu residents, or that there was a redistribution system in place that allowed for greater access to meat on ribs. This disparity between the results from these two quantification methods is attributable to the high fragmentation level of ribs compared to their ease of identifiability when fragmented. That is, the MAU calculation for ribs is usually based on the presence of rib heads or rib ends, as rib shaft fragments do not present diagnostic features that would allow for the recognition of overlapping features. Overall, the %MAU data displays much more pronounced disparities in frequencies of elements (keeping in mind that if the assemblage

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embedded in the jaws. This issue is alleviated by the fact that teeth are infrequent at Mollo Kontu. Therefore, the omission of isolated teeth from weight counts should not drastically affect the quantification.

[65] Figure 6-10 and Figure 6-11 compare the skeletal element representation for the aggregated assemblages of MK-D and MK-A. Individual graphs for every assemblage are presented in Appendix VI.

was one complete skeleton, every element would be represented by 100% MAU), whereas the skeletal part frequencies calculated through %weight follows generally the weight distribution found within an animal as illustrated by the %weight of the comparative skeleton included in Figure 6-11. That is, the %weight data suggests a more natural representation of skeletal parts at Mollo Kontu, or at least one suggestive of entire animals coming in and staying, rather than an episodic distribution of certain elements.

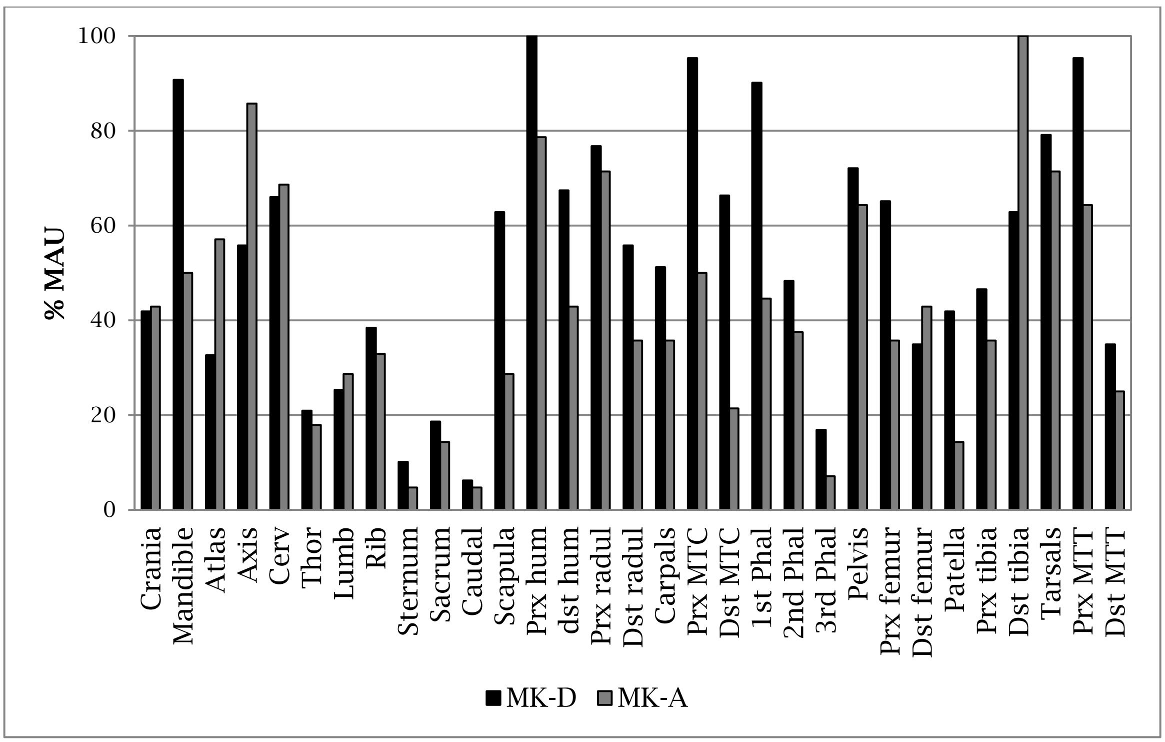

Figure 6-10: Skeletal part frequencies using %MAU for the aggregated assemblages of MK-D and MK-A.

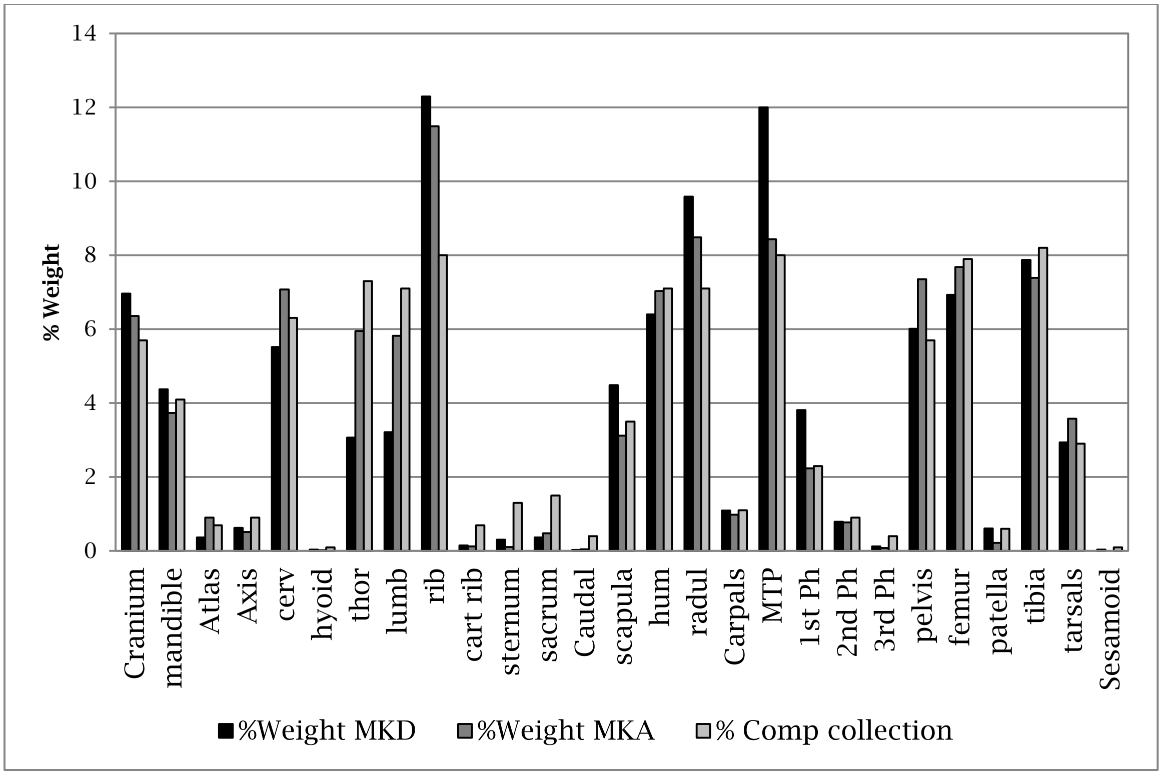

Figure 6-11: Skeletal part frequencies based on percent weight for the aggregated assemblages of MK-D and MK-A.

There are disparities and similarities in the skeletal element frequencies illustrated through the two quantification methods. Disparities reinforce the argument that in the case of highly fragmented assemblages such as those of Mollo Kontu, %weight data presents a more accurate depiction of skeletal part frequencies. Indeed, the most salient differences in representation between the two methods are for bone elements whose fragments are easily identifiable to the element but whose total surface would not present many diagnostic features necessary for identifying overlapping fragments. For example, as discussed above, when using %weight as a quantification method both MK-D and MK-A show a greater presence of ribs than would be expected if only complete animals were brought into the compound. This over-representation of ribs coupled with the incidence of cutmarks on ribs and vertebrae could represent a distribution of ch'arki made of the ribs on top of a more self-sufficient meat provisioning system.[66] Furthermore, there is a sharp difference in the presence of mandibles between MK-D and MK-A when looking at the %MAU data, but the difference is erased when looking at the weight data. Mandible fragments are often identifiable by their internal texture and shape that accommodate teeth. The representation of crania goes from less than 50% of expected representation in a complete skeleton when using %MAU to a slight over-representation when using %weight. Cranial fragments, particularly those of the braincase, are easily identifiable though they rarely present diagnostic features.

The similarities in skeletal element frequencies using both quantification methods suggest that these trends are more than the effect of distinct quantification methods. In the case of the Mollo Kontu assemblages, the under-representation of the sternum, sacrum and caudal vertebrae need to be interpreted. The under-representation of sternum vertebrae may be related to the butchery methods involved in their removal and association with fast spoiling entrails. Miller's (1979) ethnographic work shows that sternum vertebrae are the first to be removed in carcass processing as their removal allows entry into the ventral cavity. Sternum removal is related to the exploitation of innards and muscle mass attached to the sternum portion, so it is possible that the sternum ends up being processed quickly with the fast spoiling entrails. The association of sternebrae with the processing and consumption of fast spoiling entrails, internal organs, blood and brain could suggest a different role in the cuisine of the Mollo Kontu residents than the

[66] Cutmarks are discussed within the Food Preparation section of this chapter. See Moore (1989: 198-199) for a discussion of the association of ch'arki and rib representation and cutmarks.

other skeletal elements. Perhaps the killing of an animal by a household involved multi-household feasting on these easily spoiled parts. Perhaps the 'recipe' for preparing these meals also called for the pulverisation of the sternebrae for added bone grease content. On the other hand, it is also possible that the sternebrae was thrown to the dogs, animals that could easily crush and digest these small porous bones.

The low representation of sacrum in the faunal assemblages from Mollo Kontu could be associated with either preparation techniques or discard of this element to domestic dogs. Cutmark data suggests that much effort was made to separate the sacrum from the ilium in the pelvic area, yet nearly no sacral vertebrae end up in the garbage pits. Perhaps there was a selective feeding of the sacrum to domestic dogs, since the likely effects of domestic dogs would be on the dispersal of bone elements. Or, as is also speculated with the sternum, the methods of preparation for this element might be more destructive than those used on other skeletal elements.

As for the under-representation of caudal vertebrae using both %MAU and %weight, a possible explanation is that these could remain attached to the pelt rather than being discarded with meal remains as they are often left in the skin when defleshing an animal (see next section). Caudal vertebrae could also be left in a specialised leather tanning area if such a place existed, or be discarded wherever the leather was being worked. That is, if the piece of leather in which the caudals were left in was being transformed into sandals by someone watching over the camelids in the puna area, the tail section could be just abandoned there.

In sum, the discussion of skeletal part frequencies suggest that using percentage weight per elements is a better indicator of element presence or absence when assemblages are highly fragmented, as is the case for the Mollo Kontu faunal assemblages. The %weight data presented in Figure 6-11 demonstrates that most skeletal elements are following a distribution expected for a complete skeleton. There are exceptions, however; ribs are over-represented and could suggest a ch'arki redistribution system, while certain axial elements (notable the sacrum, sternebrae and caudal vertebrae) are under-represented.

Food Utility Indices

The skeletal element frequencies presented in the section above are plotted against the food utility index for these elements to see if over- and under-representation of particular skeletal elements is correlated with their nutritional content. Food utility indices (FUI) were developed in conjunction with the interpretation of skeletal part frequencies with the goal of understanding transport strategies for large animals from hunting sites to base camps in hunter-gatherer societies (see Binford 1978; Metcalfe and Jones 1988). These indices attribute number values to skeletal elements based on a calculation of the many nutrients they contain.[67] Using this baseline, the analyst plots the skeletal element frequencies against their utility value to see if a site contains primarily high or low utility elements. Utility indices can also be used to identify differences in social status between households in cases where there is a redistribution system. The correlation between sharing and social status is

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[67] Whether the utility index takes into account the bone marrow, the bone grease content, along with the meat and tendons is at the discretion of the researcher who produces the index.

based on the assumption that households with greater representation of elements of high food utility would be of higher social status than households with a preponderance of low utility elements.

One important caveat to utility indices is that tastes rarely synch with utility. That is, what constitutes a prized cut of meat is culturally constructed (e.g. Marciniak 2005). Personal experience eating meals with Ecuadorian workers has taught me that the best part of a fish is its cheeks, and that getting the guinea pig's head on your plate is a special treat because the ears are a delicacy; in spite of this, crania never rank highly in utility.

Given that data from FUI are plotted against skeletal element frequencies, the same issues of quantification methods raised in the section above are applicable to the present discussion. The correlation between food utility and skeletal part frequencies has been tested using both %MAU data and %weight data from the Mollo Kontu assemblages. Both quantification measures suggest insignificant correlations between the distribution of skeletal elements within the garbage pits and these elements' nutritional utility.

The %MAU data from each Mollo Kontu event has been plotted against the Food Utility Index (FUI) devised by Aldenderfer (1998: 105, table 4.16) for llamas as is common practice in zooarchaeological analysis.[68] Results show a negative though often insignificant correlation with utility data. That is, using %MAU most garbage pits show low presence of high utility elements. The scatter points are situated far from the regression line, however, which suggests that there is a fair amount of mid-level utility bones. Therefore, the FUI data

[68] See Appendix VII for FUI graphs for every Mollo Kontu faunal assemblage analysed.

plotted against the %MAU of Mollo Kontu assemblages suggest a low representation of high utility elements (especially ribs) and a variable presence of mid and low utility elements. As such, there is no strong correlation between utility and skeletal part frequencies using %MAU.

Events	Spearman Rho	p-value
D158	-0.04	0.445
D173	0.15	0.282
D120	-0.07	0.388
D40	0.14	0.295
D44	-0.06	0.407
D46	-0.04	0.441
D81	0.34	0.086
D82	-0.27	0.138
D83	0.34	0.086
llama pit	*0.28*	*0.128*
D36	-0.12	0.322
D71	0.10	0.344
A10	0.40	0.049
A14	0.27	0.140
A23	0.37	0.065
A123	0.02	0.476
A111	0.22	0.186
MK-D	0.09	0.365
MK-A	0.40	0.052

Table 6-2: Spearman Rho correlation between utility values for llama skeletal parts and weight for camelids in every assemblage.

The correlation between food utility and skeletal part frequencies has also been tested against %weight data. This quantification method is not devised to be used in a scatter plot graph. Therefore, both the FUI data and %weight data from Mollo Kontu were transformed into ordinal scales and tested with the Spearman Correlation Coefficient as presented in Table 6-2.[69] The only significant correlation (i.e. p-value ≤ 0.05) between utility and skeletal part

[69] See the discussion of bone density in Chapter 5 for a more detailed explanation of the use of the Spearman Correlation Coefficient.

representation is a positive correlation from Event A10. The rest of the faunal assemblages vary between weak, non-significant, positive and negative trends. This suggests that the distribution of skeletal elements within garbage pits at Mollo Kontu do not represent a consistent consumption of either high or low utility elements. Instead, the representation of skeletal elements within pits suggests the consumption of camelid with varied food utility.

From these analyses of species acquired, mortality profiles, pathologies, skeletal element frequencies and their relation to food utility, some important trends emerge regarding meat acquisition practices for Mollo Kontu residents. The first is the near complete reliance on domesticated camelids. The animals that reached the compound are primarily composed of animals 3 years and younger which suggests a herding strategy aimed at meat production. There is however, a fair representation of mature adults and crias younger than 12 months; a variability which suggests that the camelids consumed were acquired through indirect distribution (i.e. through contact with producers or independent herding rather than through a state redistribution system). This is reinforced by the presence of certain pathologies that suggest some of the older animals consumed may have worked in llama caravans in their lifetime. Furthermore, the high presence of animals younger than a year old is reminiscent of a producer site. The skeletal element frequencies suggest that the camelids consumed at Mollo Kontu arrived complete, and therefore likely alive, at the residential compound. All these lines of evidence lead me to argue that Mollo Kontu residents were self-reliant camelid herders. The %weight data for skeletal element representation suggest an over-abundance of ribs at the site, which possibly signals the concurrent acquisition of ch’arki from a different redistribution system, though this remains speculative.

Food Preparation

The following section is about cooking. It is about the *savoir-faire* of the cook who knows what to do with the ingredients gathered; how to cut this, how to grind that, how to mix a sauce, and so on. It is about the smells and the recipes, about the “tried and true” techniques, and the ones that need adjustments. It is, in short, about the many things that cannot easily be recreated from an archaeological context. In terms of zooarchaeological analysis, the focus with respect to food preparation is on the transformation of camelids from live animals to meals. Archaeologically speaking, this translates into investigations of butchery patterns as seen in fragmentation and cutmark data on bone material. Although bone grease and marrow were likely desired ingredients, it should be remembered that faunal remains are used as correlates for the meat, internal organs, blood and fat that do not preserve in the archaeological record. Even though organs, blood and fat are rarely discussed archaeologically, they were likely integral part of meals as well as meat. For example, Murra’s (1956: 25) ethnohistorical accounts of Inka lifeways mentions a “dumpling” made of sacrificial llama blood and maize flour, and gifted to foreigners in Cuzco during ceremonies as a token of loyalty and citizenship. This foodstuff and its distribution would be invisible archaeologically. In short, what can be extrapolated through the investigation of animal bones is but one part of culinary preparation.

Chapter 2 presented ethnographic and ethnoarchaeological data on modern pastoralists' culinary preparation techniques in the Andes, including ch'arki production, meat boiled in stews and soups, roasting of particular elements (such as ribs) and the use of a pachamanca, a type of earth oven. Of these techniques, only roasting is archaeologically detectable through unequally distributed burning patterns on naked unprotected bone ends exposed to the fire. It is not possible to differentiate bones boiled or heated from uncooked bones with the naked eye (e.g. Moore 2008, 1989; Koon *et al.* 2010).[70] Therefore, explorations of meat preparation techniques necessitate the use of multiple lines of evidence, including analysis of cooking pots and implements,[71] along with the butchery patterns. In the following section, I discuss modern Andean butchery practices as detailed in the ethnographic and ethnoarchaeological record of the region. This forms the basis for the interpretation of the cutmark and fragmentation patterns identified in the Mollo Kontu faunal assemblage. These Mollo Kontu butchery patterns are compared to those of modern Andean groups given that there is no similarly detailed study of cutmarks and element fragmentation from archaeofaunal assemblages in the Andean region. Finally, burning on the Mollo Kontu specimens is discussed to assess possible evidence for roasting. Most of the burning identified on bone specimens, however, is caused by discard rather than cooking behaviours as is discussed in the last part of this chapter.

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[70] Koon *et al.* (2010) demonstrated that bones that have been heated at a low temperature, indicating cooking (either boiling or roasting), could be identified using a Transmission Electron Microscopy (TEM) based approach. This approach was not used in the present study however.
[71] An analysis of ceramic vessels and their implications for culinary practices at Mollo Kontu is presented in Chapter 7.

Modern Butchery Patterns

Modern butchery techniques are presented first to provide a comparative base for interpretations of cutmarks and fragmentation patterns. Miller (1979: 39-68) observed a number of butchery episodes during his ethnoarchaeological fieldwork in Peru, and detailed the usual steps taken in carcass dismemberment and processing. In his study, Miller mainly emphasizes the similarities across butchery episodes, but also notes that each of the butchery episodes observed was slightly different.

<u>Primary meat packets</u>

The butchery sequence starts with a ventral slit from neck to anus, followed by a cut on the posterior surface of the right foreleg through the articulation between the carpals and the proximal end of the metacarpal in order to break up the joint. The sternum is the first skeletal section to be removed from the carcass, done by cutting through the costal cartilage, and removing the sternebrae along with the abdominal muscle. After the viscera are dealt with in various ways, and the blood has been collected for the preparation of blood sausages, the carcass is cut into “primary packages,” described below. These are divided up into “secondary packages” for further processing later in the butchery sequence.

To remove the forelimbs, the butcher slits through the muscle between the last and penultimate ribs, and then detaches each rib head from the vertebrae by cutting and prying at their point of articulation (Miller 1979: 44). Great care is taken to make sure that the rib heads will not break. This is done up to the second rib, at which point another slit is cut through the attachment between the scapula and the vertebral column. This way, a packet consisting of the ribs (save the first and last ones), scapula, humerus and radio-ulna is detached from the carcass with none of the bones broken. The hind leg packet includes half of the pelvis split in two at the pubic symphysis and cutting out the ilium from the sacrum. This releases the entire leg and half of the pelvis from the carcass, again without fracturing any bones.

The neck is removed from the body from the 1st thoracic vertebra, including the attached first rib. The head is detached through an incision between the atlas vertebra and the occipital condyles. The vertebral column is kept in one segment from the 2nd thoracic to the sacrum, or cut in two at the joint between the 11th and 12th thoracic. The caudal vertebrae are not generally removed from the tail skin. Finally, the metapodials and phalanges are removed from the skin as it is laid out to dry.

These primary packets are usually carved out on the household patio or in the field, to be brought home later. It is possible that a direct or indirect distribution system would distribute meat in similar packets, if the animals were not brought complete and alive to the households.

<u>Secondary meat packets and preparation techniques</u>

The preparation of primary meat packets into more manageable cuts for cooking (i.e. secondary meat packets) is performed at the household level. Carcass butchery and preparation are part of daily practices and therefore they can be variable within and between groups, much like every cook tweaks their techniques within a given set of shared practices. As such, it is not expected that the preparation techniques of modern Andean pastoralists would be the same as those used by residents of ancient Tiwanaku. In fact, it is possible that the preparation methods of the Mollo Kontu residents would be different from those of other Tiwanaku neighbourhoods depending on how this knowledge is disseminated. That is, conceptions of 'appropriate' meat portions (both primary and secondary meat packets) may be linked to broadly shared ideas about the body or camelid physical constitution. Nonetheless, it is useful to describe the preparation techniques witnessed by Miller (1979: 53-68) for investigating possible stability and diversity of processing methods.

In Miller's (1979) ethnoarchaeological case studies, the processing of the head involves the separation of the mandible from the cranium by cutting through muscles at the temporal-mandibular joint and snapping the mandible out of its attachment using a rope. The mandible is then split in two at the symphysis or along its body, and cut again at the juncture of the mandibular body and ascending ramus. The tongue is then removed. The cranium is split in multiple sections and the mandible and cranial fragments, including the brain, are boiled with the elbows, knees and feet (Miller 1979: 56). Vertebrae are cut off from one another between the vertebral centra, then split in two (Miller 1979: 56-57). Lumbar vertebrae are split from front to back with their dorsal spine snapped off; thoracic dorsal spines are also snapped off, but their centra are generally left intact. As with the primary butchering methods, these observed secondary butchery methods varied from one episode to the next (Miller 1979: 57).

Ribs are roasted over the fire and left complete or snapped in two during consumption. Sternebrae are separated and boiled, but not fragmented. The meat is stripped off the scapula, and then the entire bone is cut into five portions. The distal end is separated from the blade, and the blade is split into four portions. These pieces are then boiled (Miller 1979: 59). Each side of the pelvis is divided into five or six portions once the femur head is carefully cut out of the acetabulum.

All long bones get broken into at least four parts: the proximal end, two shaft fragments, and the distal end (Miller 1979: 61). These major blows create four smaller meat packets, though in reality they also break the bones into many smaller pieces held together by meat. The humerus is separated from the radio-ulna by cutting through muscles around the semi-lunar notch. The first row of carpals remains attached to the distal end of the radio-ulna, forming the elbow. The femur and tibia are separated with a knife between their articular surface, and the patella is cut away from the distal end of the femur. Because the femoral proximal and distal ends contain a good deal of bone grease, they are split in two after their separation from the shaft. The first row of tarsals remains attached to the distal end of the tibia forming the knee. The phalanges are separated from the metapodial by cutting between the metapodial condyles and the first phalanges articular end. The metapodials are then cut in two while the phalanges are boiled whole.

The patterned ways modern Andean groups butcher and prepare camelid resources would leave certain traces on the bones in the form of cutmarks and bone breakage. These traces are archaeologically recognizable. A detailed look at cutmarks and fragmentation patterns is presented in the next sections, and compared to the modern patterns just presented. They suggest both similarities and differences between modern and Tiwanaku techniques, and homogeneity between MK-D and MK-A assemblages. This in turn is used to suggest that there was a 'customary way' to envision the butchery process at Mollo Kontu.

Cutmarks on Mollo Kontu bone specimens

The analysis of cutmark placements on bones is a useful way to get information on meat preparation, in terms of both carcass dismemberment and the cuts of meat used for meal preparation. Preparation techniques extrapolated suggest a picture of the path from living animal to part of a meal. However, cutmark studies are not without their drawbacks and circumspection is required in interpretations (see Lyman 1994 for a critique). In particular, absence of cutmarks does not mean absence of butchery. Indeed, actualistic studies and ethnoarchaeological work show that butchered bones often display a surprisingly low incidence of cuts even when heavily butchered (see Fisher 1995 for examples). However, this does not negate the importance of the study of cutmarks; cuts found demonstrate forceful butchery action as well as more refined meat removal techniques.

Three types of cutmarks are left on archaeological camelid bones: 1) defleshing marks, 2) dismemberment marks, and 3) meat stripping marks (Moore 1989:195-199). Defleshing marks result from removing the skin off the carcass. They usually cut across bone elements on the wrist, ankles and nose. Dismemberment marks are the result of butchery actions aimed to sever ligaments and joints, and are often found on the elbow, the sacrum and the ilium. Certain bones are not only cut in the dismemberment process, but also broken off, such as the femoral head. Finally, removing the flesh off the bones frequently creates stripping marks on the linea aspera on the posterior side of the femur, and on the deltoid crest of the humerus.

Moore (1989: 198-199) interprets cutmarks on the vertebrae and ribs of certain archaeological specimens from her research at Panaulauca, Peru, as possible indications of ch'arki preparation as they do not correspond to any of the three types of marks (i.e. defleshing, dismembering and stripping). Ethnoarchaeological work on the preparation of dried meat demonstrates that the neck and rib sections of large carcasses are often dried for storage on the bone (Binford 1979; Miller 1979). This dried meat preparation technique is more akin to Stahl's (1999) description of chalona and makes ch'arki archaeologically visible. Moore (1989) argues that the cuts found on the ventral, medial and dorsal sides of ribs could be the result of preparing ch'arki for consumption. As will be demonstrated below, similar cuts were found on the ribs and vertebrae of the Mollo Kontu assemblages.

In this section, I present a detailed cutmark analysis of the faunal assemblages from Mollo Kontu. I first demonstrate that the bone specimens found in the garbage pits and hearth of the MK-D and MK-A sectors of Mollo Kontu show very similar incidences of cutmarks per element. This is used to suggest that residents of both areas went through similar butchery processes, that is, they had a shared knowledge of how to 'appropriately' butcher an animal. Furthermore, similarities in incidence of cutmarks per elements justify conjoining cutmark data from both areas in the subsequent analysis of cutmark patterns. The following detailed description of the cutmark data includes comparison with modern examples to identify similarities and differences in the choices made between residents of Mollo Kontu and modern pastoralists. The interpretation of these patterns remains limited but further cutmark analyses on faunal remains from Tiwanaku sites would allow seeing if the patterns identified on the Mollo Kontu fauna were widely shared by Tiwanaku residents.

Element	Cutmark count MK-D	Element NISP	% Cut MK-D	Cutmark count MK-A	Element NISP	% Cut MK-A
Cranium	19	698	3	3	123	2
Mandible	17	186	9	5	35	14
Hyoid	10	27	37	2	4	50
Cervical	54	389	14	21	121	17
Thoracic	25	218	11	12	93	13
Lumbar	43	269	16	14	81	17
Rib	83	1159	7	39	237	16
Sternum	1	17	6	0	2	0
Sacrum	4	33	12	0	6	0
Caudal	1	8	13	1	2	50
Scapula	20	187	11	5	36	14
Humerus	33	132	25	6	39	15
Radius	38	221	17	11	49	22
Carpals	16	111	14	4	19	21
MTP	33	511	6	9	109	8
1st Phal	21	221	10	6	44	14
2nd Phal	5	107	5	0	23	0
3rd Phal	2	32	6	0	4	0
Pelvis	32	190	17	13	52	25
Femur	21	137	15	13	55	24
Patella	1	18	6	0	2	0
Tibia	32	181	18	7	44	16
Tarsals	23	139	17	12	37	32
LB frags	38	2948	1	18	423	4
Total:	572	8139	7	201	1640	12

Table 6-3: Tally of cutmarks per element in MK-D and MK-A and the percentage of the assemblages' elements that show cutmarks.

Table 6-3 presents counts of cutmarked specimens for MK-D and MK-A. These counts are compared to the total NISP for each element and are transformed into percentages to suggest whether certain elements may have been more intensively processed. The hyoid shows the highest frequency of signs of butchery in both MK-D and MK-A assemblages, but small sample size could also be the issue in the case of MK-A (n=4). Hyoid cutmarks suggest tongue removal (Moore 2008). The high cutmark counts on both front and hind upper leg bones suggest animals were dismembered in a similar way to the method described by Moore (1989) for the Panaulauca assemblages. The frequency of cuts diminishes starting from the carpals and tarsals. The metapodials and phalanges are low utility elements (see Aldenderfer 1998) that may not have been favoured for meal preparation.

The percentages of cutmarked specimens per element for MK-D and MK-A are contrasted in Figure 6-12. Overall, the pattern observed is strikingly similar between both areas.[72] These similarities are validated through a Spearman Rank Order Correlation test. The order from elements most often to least often displaying cutmarks between the two areas is positively correlated at $r_s=0.7797$ with a p-value of 0.000004. This suggests that the preparation techniques used in both areas were similar; the following analysis of cutmark placement will therefore incorporate data from both areas.

[72] Note that the incidence of cutmarks on caudal vertebrae was not included as the sample size is very small and thus overrepresented the importance of cutmarks on the tail.

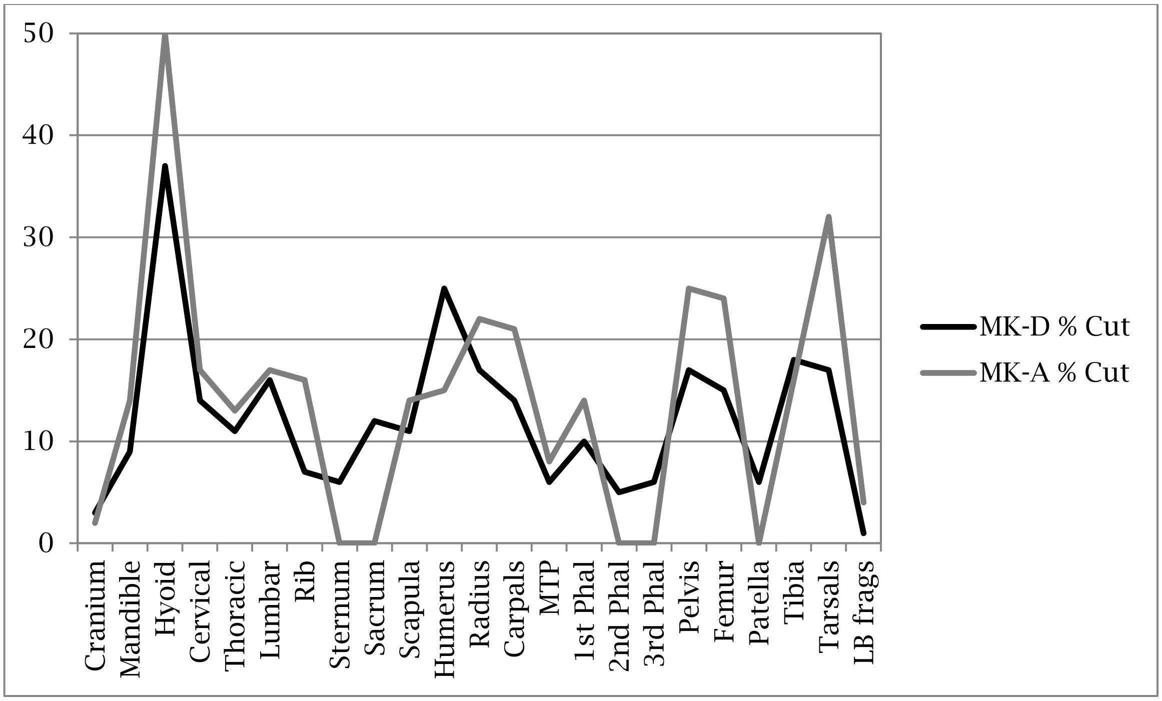

Figure 6-12: Percentage of elements displaying cutmarks in areas MK-D and MK-A.

The interpretation of cutmarks for the purposes of investigating cuisine needs to go beyond the broad tally of cutmarked specimens per element. The location of cutmarks on each skeletal element can suggest patterns in butchery and preparation techniques. The general location of cutmarks (often only separated as proximal end, shaft and distal end) for the Mollo Kontu faunal assemblages is compiled in Table 6-4, along with the estimated force behind the cut (categorized as "deep" or "shallow" cuts), and directionality when identifiable. The identification of a cut as deep or shallow is somewhat subjective as those are not independent categories, but different stages on a continuum. In this case, a cut is considered deep if it is easily noticeable with the naked eye or on a photograph,[73] whereas shallow cuts refer to light cuts or

[73] These could also fit Fisher's (1995) definition of a "saw mark" where a repeated sawing movement creates a deeper cut. However, Fisher's definition also includes closely spaced parallel marks, whereas in the case of the present study "deep" cuts were

scrape marks[74] often associated with periosteum removal (e.g. Fisher 1995: 18-19). These different cutmarks may suggest different processing or butchering techniques. That is, deep cuts could suggest a focus on creating particular meat portions, even if it necessitates cutting through heavy tissue masses such as tendons or muscles. Shallow cuts suggest the removal of the meat and skin from the skeletal element. These suggestions are, admittedly, debatable as heavy butchery can leave little to no trace on the bones. However, even if the visible cutmarks represent only a sample of the total butchery activities, the recorded cutmarks are still evidence of butchery and preparation practices that require interpretation.

Element	Location	incidence	deep	shallow	horizontal	vertical	diagonal	indeterminate	worked
Cranium	*max/nose*	11	4	7	5	2	4		
	back (occ & presphenoid)	5	4	1	2	1	2		
	Braincase	6	1	5			2	4	
Mandible	*Asc. ramus (labial)*	12	4	8	7	1	5		2
	Asc. ramus (lingual)	3	3		2		1		
	body (labial)	4	2	2		1	3		
	body (lingual)	2		2			1	1	
	body (indet.)	2	1	1		1	1		
Tooth	*Tooth*	3	2	1	3				
Hyoid	*Hyoid*	12	9	3		5	7		
Atlas	*art. Facet*	3	2	1	3				
	Ventral	1		1		1			
	Dorsal	3		3	1			2	

sometimes single cuts on the element. "Deep" cuts in this case could therefore include chop marks.
[74] These were described as "scratches" in my field notes.

Element	Location	incidence	deep	shallow	horizontal	vertical	diagonal	indeterminate	worked
Axis	*art. facet*	1		1			1		
	ventral	3	2	1	1	2			
	dorsal								
Cervical	*ventral*	7	3	4	1	4	1	1	
	dorsal	6	3	3	1	3	2		
	art. facet	66	36	30	37	5	8	7	
Thoracic	*ventral*	8	3	5	4		4		
	spinous proc.	16	7	13	4	1	10	4	
	art. facet (sp. proc.)	8	8		8				
	art. facet (rib semifacet)	6	4	2	1		5		
Lumbar	*ventral*	4	3	1	1	1	2		
	spinous proc.	11	6	5	3	2	2	3	
	art. facet (sp. proc)	13	8	5	8	1	1	3	
	trans. proc.	29	9	21		8	14	8	
Ribs	*head/neck*	41	32	12	27	1	17	2	
	shaft	75	37	41	37		36	15	3
Sternum	*sternebra*	1	1				1		
Sacrum	*ventral*	3	2	1	1		3		
	dorsal	2		2			1	1	
Caudal	*ventral*	1	1				1		
	dorsal	1		1		1			
Scapula	*distal end*	6	6		4	1	3		
	blade	20	10	11	5	6	12	2	
Humerus	*head/neck*	8	7	1	5		4	1	
	lateral tuberosity	4	3	2	4				
	shaft	12	8	5	7	2	7		
	caudal epicondyles	15	8	7	9	3	7	1	
	cranial distal end	7	6	2	4		5		
Radio-Ulna	*olecranon proc.*	13	10	7	10		7		
	proximal end of radius	13	10	2	9		5		

Element	Location	incidence	deep	shallow	horizontal	vertical	diagonal	indeterminate	worked
	shaft	21	10	17	10		11	3	
	dorsal distal end	2	2				2		
	palmar distal end	2	1	1	1			1	
Carpals	*1st row**	15	13	3	9	2	7		
	*2nd row**	5	5		2	2	2		
Metacarpal	*proximal end*	6	6		4	1	1		
	shaft	4	3	1	2	2	2		
	distal end								
1st Phalanx	*proximal end*	6	4	2	3		3		
	shaft	18	8	10	14		6		1
	distal end	8	6	3	3	1	4		1
2nd Phalanx	*proximal end*	2	2		2				
	shaft	3	2	2	1		2		
	distal end	1	1		1				
3rd Phalanx	*3rd phalanx*	2	2		1	1			
Pelvis	*Acetabulum*	9	9		4	2	3		
	ilium	23	11	8	10	4	13		
	pubis	8	7	2	2	5	3		
	ischium	4	3	2	4		1		
Femur	*head/neck/less. troch.*	9	7	2	4	1	3	1	
	greater troch.	3	1	2		1	2		
	shaft	20	14	8	8		12	1	
	patellar troch/ cranial distal end	1	1		1				
	condyles/ caudal distal end	2	2		1		2		
Patella	*patella*	1	1				1		
Tibia	*proximal end*	6	4	2	5		1		
	tibial crest	2	2				2		
	shaft	23	13	10	9	3	13		
	distal end	4	3	1	4	1			

Element	Location	incidence	deep	shallow	horizontal	vertical	diagonal	indeterminate	worked
Metatarsal	*proximal end*	4	2	3	2	1	1		
	shaft	6	4	3	4	1	3		
	distal end	2	2		1		1		
Metapodial	*shaft*	9	4	5	2		7		
	epicondyle	3	3	1	3		1		
Tarsals	*1st row**	32	24	8	25		12		
	*2nd row**	3	3		3		1		

Table 6-4: Tally of cutmarks locations on bone elements presented with tally of presence of deep and shallow cuts, the directionality of cuts, and the incidence of cuts on worked bones.

Although presence of cutmarks was recorded in the field, the depth and directionality of the cuts were not. This analysis relies on high-resolution photos of cutmarks taken in the field. The “indeterminate” category is included in directionality for cuts on small fragments and rare specimens that were not photographed in the field. Recorded cutmark directionalities are approximations and work better on some elements than others. To assess directionality of cutmarks, the bone is visualised lying on its caudal side (or medial side for ribs, and basal side for cranium[75]) with the distal end facing the butcher. Then, if the cutting motion necessary to produce the cutmarks required a lateral movement, the cutmark is categorized as a horizontal cut; if, however, the cutting motion went from proximal to distal in a straight line, the cutmark is vertical. Both were counted in instances where a specimen displayed cutmarks

[75] Directional nomenclature is illustrated and published in Von Den Driesch (1976: 15-16). In simple terms, ‘caudal’ refers to the side of bone elements that would be seen when looking at an articulated skeleton from the back. The cranial side would be the side seen from the front. The medial side of ribs faces toward the organs, as opposed to the lateral side. For the skull, the side under the chin is called the basal side, while the top of the head is called the dorsal side.

from multiple directionalities. This explains why the tallies of deep and shallow cuts, or the tallies of the four types of directionality, do not match with the incidence of cutmarks for the area of the element.

The majority of cuts on the cranium are located on the nose and maxillary. These cuts are mainly horizontal and diagonal, and suggest defleshing of the head by cutting around the mouth and nasal cavity. Horizontal cuts were also found directly on tooth, at the juncture of the teeth and the gum line, suggesting those were done through the same movement as the horizontal marks on the maxillary. The "braincase" category refers to the frontal and parietal bones. Many shallow cuts have indeterminate directionality as the braincase is heavily fragmented. These cuts, coupled with the fragmentation data provided in the next section, could relate to brain extraction. The "back" category includes deep cuts to the occipital condyles and to the presphenoid bone located at the very back of the palate. While the former is likely due to removal of the head, and perhaps the killing blow (see Flannery *et al.* 1989: 83), the latter is more difficult to interpret. Deep cuts on the presphenoid would require the mandible to be removed first, in order to reach that area. These cuts may be related to the removal of the tongue.

The cluster of cutmarks found on the labial side of the ascending ramus[76] suggests that an important part of carcass processing was the removal of the mandible from the cranium. These cuts seem to be quite specific in their directionality in that a horizontal motion is preferred, although diagonal movements are also used frequently. This suggests a sawing motion to cut off the jaw muscles. Cutmarks on the mandibular body are mostly diagonal, with a

[76] This category in Table 6-3 also includes the coronoid process.

mixture of deep and shallow cuts. In terms of culinary practices, while the mandible *per se* is without many nutrients, cutmarks on the mandible could be associated with tongue removal. Deep cuts on the hyoids and presphenoid reinforce the suggestion that Mollo Kontu residents put much effort into recovering the tongue. Mandibles are frequently found modified into "mandible tools" at Tiwanaku sites.[77] These tools are made up of the coronoid process and a worked portion of the ascending ramus and mandibular body. Therefore, the proper removal of mandibles without breaking the coronoid process would require careful sawing off of the mandibular muscle attachment. This contrasts with Miller's (1979: 54) description of mandible removal; in his ethnoarchaeological observations, pastoralists broke the mandible off at the ascending ramus.

The atlas and axis vertebrae were analysed separately from the rest of the cervical vertebrae to investigate the potential removal of the head from the neck at the base of the skull. Six out of a total of 32 atlas fragments bear cutmarks, a low number that seems to correlate with the low incidence of cutmarks on the occipital condyles. That is, there is evidence for cutting through the base of the skull, but it was either done infrequently or rarely left any marks on the bones. A greater importance may have been given to separating the cervical vertebrae from one another, as suggested by the high incidence of deep horizontal cuts on the cervical articular facets. This correlates well with modern ethnographic cases where the neck is cut into smaller pieces by cutting between the vertebral centra (Miller1979: 56).

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[77] A discussion of mandible tools is presented later in this chapter as part of the worked bones section.

The thoracic and lumbar vertebrae do not show such consistent attempts to separate the vertebrae, as is the case for cervical vertebrae. However, they do show a similar percentage of cut to uncut specimens, along with a diverse range of processing activities. Thoracic vertebrae are heavily cut on their spinous process. A fair amount of deep horizontal cutmarks on the articular processes at the caudal end of the spinous process suggest an effort to sever the spinal cord from the ventral side of the spinal column. This is similar to the processing techniques for cervical vertebrae, only performed less frequently. The difference in articulating facet cut frequencies between the cervical vertebrae and the lumbar and thoracic ones might be related to their overall length. Cervical vertebrae are much longer than both lumbar and thoracic vertebrae. Therefore, if specific packet sizes were sought after, the frequency of cuts to the spinal column would affect a lesser number of thoracic and lumbar vertebrae. Cutmarks on the spinous process of both thoracic and lumbar vertebrae result from detaching the high quantity of back meat from the spinal column.

Both the rib shafts and transverse processes of lumbar vertebrae are heavily processed with deep and shallow cuts, with primarily diagonal cuts on the vertebrae, and both horizontal and diagonal cuts on ribs. This suggests a horizontal filleting movement going across the trunk of the animal, cutting both the rib shafts and the lumbar transverse processes. This may have been done on fresh meat, or in an effort to detach dried ch'arki from rib portions. The rib necks and heads are also heavily cutmarked; this is likely related to the detaching of the ribs from the thoracic vertebrae.

Cuts to the vertebrae and ribs could be related to processing dried meat (see Moore 1989:198-199). This would be congruent with the fragmentation level of the vertebral column. The high fragmentation of bones left in ch'arki[78] is suggested by Browman's (1989: 263) description of the flattened head ch'arki sold in Bolivian Aymara markets. That is, it seems likely that the production process or preparation of ch'arki made 'on the bone' would result in high fragmentation levels, especially on vertebrae which can be hard to remove from the meat due to their irregular shape.

Ethnographic material from modern Andean pastoralists suggests that the disarticulation of the pelvic area would leave marks on the sacrum and the ilium (Moore1989). While the sacrums from the Mollo Kontu assemblages are not heavily cutmarked, the ilium is by far the most cutmarked area of the pelvis. This suggests that separating the sacrum from the pelvis was an important step in the dismemberment of a carcass. The cutmarked ilium specimens display a similar proportion of deep and shallow cutmarks, which suggests that though deep cuts could indicate intense butchery, shallow cuts are not necessarily representative of more delicate procedures.

The acetabulum is less frequently cutmarked, but the cutmarks present are deep. This suggests that considerable effort was put into detaching the femoral head from the pelvis, which contrasts with examples of modern butchery techniques where the femoral head was broken off rather than disarticulated (Moore 1989). Furthermore, the fragmentation data for femurs do not show a consistent pattern of breaking off the femoral head. Femurs are

[78] Though Stahl (1999) makes a strong point of differentiating ch'arki from chalona, other researchers use the word ch'arki for both desiccated meat off the bone and on the bone (see Miller 1979 and Browman 1989, for example). It is not clear whether modern and ancient consumers of dried meat made the distinction between the two types and thus the word ch'arki will include Stahl's (1999) description of chalona in this dissertation.

more often cut on the proximal ends (particularly on the femoral head and neck) than on the distal ends. The greatest proportion of cuts is found on the shaft. These cuts are mostly deep, and are likely related to meat removal.

If cutmark concentrations around the extremities of long bones point to joint disarticulation, then the hind leg was removed at the juncture of the pelvis and the femur. There is no strong concentration of cutmarks near the other hind leg joints (i.e. tibia and metatarsal), but there is a concentration of deep horizontal cuts on the first row of tarsals (i.e. calcaneus, astragalus, and fibulare). This suggests that the hind leg packet was split at the ankle, perhaps between the first and second row of tarsals. The tibial shafts were heavily cut, but the metatarsals and the phalanges were not as heavily processed. The majority of the meat on the hind leg is located around the femur and the tibia, which explains the greater emphasis on meat removal on these skeletal elements. Miller (1979: 39-40) demonstrates how butchers from various areas have strong but distinct ideas concerning how to separate the ankle. The butchers from Tuqsa argue, for example, that the ideal cut is between the two layers of carpals and tarsals, thus leaving the upper row with the tibia and the lower row with the metapodial. Moore (1989) also suggests that cutmarks around the ankle, such as those seen at Mollo Kontu, are associated with defleshing the animal. This is certainly possible and would not negate the suggestion that it was also the area where the hind leg stopped as a conceptual meat package.

In terms of the fore leg, the cutmark data suggests that the elbow is the focus of dismemberment activities. The distal end of the humerus is significantly more cutmarked than the proximal end. The emphasis on cutting off the elbow joint is reinforced with the cutmark locations for the radio-ulna; there are 26 cutmarks on the proximal end of this element (combining the olecranon process and the proximal end of the radius) compared to only 4 cutmarks on the distal end. Furthermore, there is another clustering of cutmarks below the distal radius, on the first row of carpals. As is the case for the tarsals, the carpals data shows that the fore leg ankle was likely disarticulated between the first row of carpals (i.e. pisiform, scaphoid, cuneiform, and lunar) and the second row of carpals (i.e. magnum, trapezoid, and unciform). The latter are occasionally cutmarked, along with the proximal end of the metacarpals.

The upper part of the fore limb packet has yet to be addressed with cutmark data. In a number of zooarchaeological and ethnoarchaeological studies, the scapula is considered as part of the axial meat packet (see Aldenferder 1998; Beaule 2002; Rose 2001), though the discussion of Miller's (1979) butchery data puts the scapula and the majority of the ribs with the forelimb. If the scapula is left with the axial skeleton during primary dismemberment, then its distal end should bear marks related to the removal of the fore leg at the humerus and scapula joint. The scapula's blade display more cutmarks, particularly on the lateral edges. These deep cuts could be the result of detaching the scapula from the torso of the animal. The distal end of the scapula presents deep cuts that are mirrored by a good incidence of mostly deep cutmarks on the humeri proximal ends (n=12). Therefore, it appears that the separation of the humerus and the scapula was a desired outcome. However, it is not known whether the scapula was detached from the axial skeleton first and then separated from the humerus, or whether the cutmarks on the blades relate to secondary butchery during the processing of the axial skeleton.

The data for the lower fore and hind limbs are analysed conjointly since phalanges and metapodial shaft fragments were not identified as fore or hind elements. Metapodial shafts (including data from metacarpals and metatarsals, along with the indeterminate metapodial shafts) do not show a high incidence of cutmarks, in contrast to other long bones. The 1st phalanges are more frequently cutmarked than the 2nd and 3rd phalanges. This discrepancy between the phalanges is replicated in the fragmentation data (see Table 6-5 in the next section), which show that the lower phalanges are rarely fragmented by comparison to the 1st phalanges. Furthermore, 1st phalanges were often chosen as raw material for bone tools,[79] though the purpose of these tools remains unclear. A plausible explanation for the incidence of cutmarks on the phalanges is that they are the result of a desire to keep as raw material, rather than processing for culinary purposes.

The presentation of detailed cutmark data on the Mollo Kontu faunal assemblage allows for the recognition of patterned behaviours and potential desired outcomes. For example, in contrast with modern analogues, the Mollo Kontu butchers carefully removed the mandible from the cranium and the femoral head from the pelvis. The reason or meaning behind these choices, and how common throughout Tiwanaku these would be, remain elusive. Comparative studies of faunal material from the city and other Tiwanaku sites will provide insight into the strict adherence to these butchery practices or their variability. Furthermore, the identification of diagonal cutmarks on rib shafts

[79] See the section on bone tools discussed in the disposal section of this chapter.

and vertebral transverse processes suggest the possible processing of ch'arki meat on the bone.

Although the vast majority of bone specimens recovered at Tiwanaku belong to the camelid species, other species were identified; a total of four non-camelid specimens were also cutmarked. A cutmarked guinea pig occipital condyle suggests decapitation. The small size of guinea pig precludes the need to dismember into meat packets for manageability, as is the case for camelids. Removal of the head would more likely be a culinary practice related to meal preparation (i.e. recipe) or serving. Another cutmark was identified on the humerus fragment of a mid-sized bird. This specimen suggests that though the majority of the Mollo Kontu diet consisted of camelid meat, birds and small animals were occasionally hunted and consumed.

Finally, a canid tooth and a rib bore cutmarks (see Figure 6-13). The presence of cutmarks on canid remains is puzzling as there are no recorded instances of dog consumption at Tiwanaku to date. It is not known whether these specimens are from wild (i.e. fox) or domestic (i.e. dog) species, but the domestic context suggests that these specimens are from domestic dogs.[80] The cuts are shallow and few; two shallow cuts were found at the gum line of a canine tooth, and a single short cutmark was found on the shaft of a rib. The texture of the canine root suggests the animal was an older adult, hinting that the animal may have lived as a household companion though not precluding the possibility that the tooth belonged to an older fox trapped by hunters. The cutmarks on the tooth at the gum line level may suggest defleshing the animal

[80] As discussed in Chapter 5, there are a number of clues to the presence of domesticated dog at Mollo Kontu.

at the cranial level, perhaps to keep the pelt. The cut on the rib could be indicative of processing for food, though this should not be used as definitive proof of dog consumption.

Figure 6-13: Cutmarks found on canid remains; right: rib, left: canine tooth.

Fragmentation

Having just covered butchery patterns through cutmark analysis, our discussion of the preparation techniques exemplified in Mollo Kontu's faunal assemblages turns to the bone fragmentation that often occur during initial butchery and meal preparation. That is, in terms of illuminating culinary practices at Tiwanaku, an investigation of fragmentation patterns by skeletal elements can suggest particular processing methods such as which elements were exploited for their bone grease content, or how certain bones were processed to better fit in the cooking and serving vessels (e.g. Moore 1989; deFrance 2010). In this section, I discuss data on the extent and intensity of fragmentation of all skeletal elements presented for each Mollo Kontu analysed contexts. I demonstrate that all assemblages share comparable data on the intensity of fragmentation for each element. That is, there are recognized patterns of fragmentation levels for certain elements that will be distributed across contexts, such as intense cranial fragmentation, likely to access the brain, and high vertebral fragmentation reinforcing their association with ch'arki preparation.

As discussed in chapter 5, the extent of fragmentation is high at Mollo Kontu with most assemblages having less than 10% of their total content left non-fragmented (see Table 6-5). Events D82 and D83 display %completeness data over 10%, but these two events are part of a stratified garbage pit (the 'llama pit') containing the remains of a semi-articulated 5 month old camelid. The presence of this complete skeleton inflates the %completeness numbers. Generally speaking, the 'llama pit' does appear to contain more non-fragmented specimens than the other Mollo Kontu garbage pits and hearth. The bones that are fragmented, however, are as intensively fragmented as those from other assemblages. The disparity in the extent of fragmentation data between the 'llama pit' and other assemblages suggests a mixture of meat preparation techniques with complete and heavily fragmented specimens. This section describes the intensity of fragmentation per element to suggest ways Mollo Kontu residents may have prepared skeletal portions for incorporation into daily meals, and how fragmentation may have related to animal butchery.

Based on ethnographic analogy with modern Andean pastoralist groups, the fragmentation of bone elements likely happened during the meal preparation process rather than during the carcass butchery episodes. Miller's (1979:53) ethnographic observations of contemporary butchery practices suggest that although bones were left relatively intact during the carcass' primary dismemberment into meat packets, most bones were subsequently broken during the cooking process. In these observations, there is no suggestion of intense epiphysis fragmentation related to bone grease extraction. This likely relates to the fact that extensive boiling was the favoured method of cooking. This technique releases bone grease directly into the broth (see Miller 1979: 71).

Miller's (1979) observations suggest that modern processing of camelid meat for use in stews and soups fragments nearly all skeletal elements, save the caudal vertebrae and the phalanges that are not consumed. Table 6-5 provides the % completeness (extent of fragmentation) and NISP:MNE (intensity of fragmentation) data for all elements in every analyzed Mollo Kontu assemblage.[81] In accordance with Miller's observations, phalanges are rarely fragmented; on average, they are split into two pieces when they are fragmented. The rare caudal vertebrae identified were fragmented, however.

[81] See the fragmentation section of Chapter 5 for a discussion of these two measures.

Event	D158		D173		D120		D40		D44		D46		D81		D82		D83	
Element	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**
Crania	0	31	0	19	0	38.3	0	1	0	18	0	40	0	28	0	28	0	23.7
Mandible	0	4	0	0	0	3	0	4	8	5.5	0	4.5	0	2	0	5.5	0	3
Atlas	0	1	0	1	0	2.5	0	0	0	2	0	4	0	1	0	2	100	1
Axis	0	2	0	2	0	7	0	1	0	0	0	2.5	0	1	0	2	50	1
Cerv	0	4	0	3	0	4.3	0	4	0	5.3	0	4.9	0	4.3	0	4	37	3.8
Thor	0	3.5	0	4	3	3.1	0	4	0	5	1	9	0	3	14	6	55	2.8
Lumb	0	7.5	0	6	0	7.6	0	8	14	6	0	0	0	7	0	2.7	32	2.6
Rib	0	8.8	0	8.25	0	8.1	0	4.5	13	4.1	0.3	2.6	2.5	5	2	4.2	6	2.9
Sternum	0	0	0	0	0	2	0	0	0	0	60	2	0	0	100	1	78	1
Sacrum	0	0	0	0	0	6	0	2	0	2.5	0	4	0	4	0	1	0	9
Caudal	0	0	0	0	0	1	0	0	0	0	100	1	0	1	0	1	100	1
Scapula	0	32	0	5	0	5.7	0	0	10	9	2	4.4	0	8	0	1	5	11.4
Hum	0	4	0	4.5	0	3.4	0	4	0	4	0	2.9	0	5	0	1.5	33	6
Radul	0	10	0	3	0	8.75	0	4	0	2.9	0	6.4	0	4.5	8	5.5	25	6
MTP	0	12	0	5	0	5.3	0	8	2	5.4	0.5	5.6	0	7	7	6.5	23	3.9
1st Phal	0	1.4	20	1.3	33	1.8	0	1	39	2.3	54	2	20	1	45	1.5	94	1.1
2nd Phal	20	2	0	0	59	2.25	0	0	82	2	85	1.7	50	1	83	2	79	3
3rd Phal	50	2	0	0	100	1	100	1	50	1	100	1	100	1	89	1	100	1
Pelvis	0	5	0	15	0	6	0	3	0	3.5	0	5.9	0	4	0	2.5	0	4.3
Femur	0	3.5	0	2	0	3	0	2	9	3.7	0	5.1	0	3.5	0	5	14	4.75
Patella	0	0	0		100	1	0	0	100	1	100	1	100	1	0	0	100	1
Tibia	0	5	0	2.5	0	3.2	0	3	0	3.2	0	5.9	0	2.5	0	5	12	5.75
total:	0.9		0.8		5		2		10		5		3		12		21	

	D36		D71		A10		A14		A23		A123		A111		MK–D		MK–A	
Element	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**	**% comp**	**NISP: MNE**
Crania	0	5	0	15	0	11.5	0	9	0	28	0	2	0	17	0	77.6	0	41
Mandible	0	1	0	2.6	0	2	0	3	0	4	0	1	0	3.7	0.5	4.9	0	5
Atlas	0	0	0	1	0	1	0	1	0	2	0	0	0	2	5	3.5	0	2.5
Axis	0	0	0	1.33	0	2	0	1.25	0	0	0	0	0	2	6	3.1	0	1.5
Cerv	0	3	0	4.5	0	3.3	0	4	0	3.2	0	2	0	7.75	3	5.4	0	4.25
Thor	0	3	0	8	0	1.2	0	2.25	0	2.25	0	0	3	4.6	11	5.3	1	6.6
Lumb	0	1	0	3.4	0	3.25	4	4.8	0	5.5	0	1	0	3	4	9.25	1	6.2
Rib	0	3	0	5.8	0	2.1	0	4.3	2	3.4	0	4.3	0	3.4	2	6.4	0.4	4.4
Sternum	0	0	0	0	0	1	0	0	0	0	0	0	0	1	65	3	0	1
Sacrum	0	1	0	1	0	0	0	3	0	0	0	0	0	3	0	8.25	0	6
Caudal	0	0	0	0	0	0	0	0	0	1	0	0	0	1	38	1	0	1
Scapula	0	1.5	0	2	0	5	0	17	0	8	0	0	0	2	3	8.3	0	9
Hum	0	2	0	2	0	2.25	0	3.7	0	4.5	0	0	0	2.5	5	3.4	0	3.5
Radul	0	3.5	0	2	0	4	0	5	0	7	0	1	0	3.6	3	8.2	0	4.9
MTP	0	2.5	0	10	0	9	0	9.75	0	5.7	0	5	0	5	2	5.7	0	6.8
1st Phal	50	1	0	1.6	13	1.4	9	2.5	17	1.25	0	1	17	1.7	44	2.1	11	1.95
2nd Phal	100	1	33	2	0	0	83	2	67	1	0	0	50	4	73	5.8	70	1.4
3rd Phal	0	1	0	1	0	0	0	0	100	1	100	1	100	1	84	2.5	75	1
Pelvis	0	2	0	4	0	6	0	4	0	3.3	0	1	0	5.4	0	6.1	0	7.4
Femur	0	2	0	3	0	2.7	0	2.1	0	3.5	0	1	0	7.7	3	5.5	0	9.2
Patella	0	0	0	0	0	0	0	1	0	0	0	0	100	1	100	1	50	1
Tibia	0	1.5	0	8	0	4	0	2	0	2	0	1	0	3	2	7.1	0	3.1
total:	5		0.4		1		3		2		3		2.6		7		2	

Table 6-5: Intensity and extent of fragmentation per element in all assemblages.

All assemblages share comparable intensity of fragmentation values per element, except for Event D44, which shows a much higher percentage of complete ribs and lumbar vertebrae.[82] A few trends are particularly noteworthy. First, the cranium is consistently heavily fragmented. This reinforces the cutmark data described in the previous section suggesting the frequent removal and probable consumption of the brain at Mollo Kontu. Second, the vertebrae from the Mollo Kontu assemblages are often more fragmented than Miller (1979) described in his ethnoarchaeological study, particularly for the lumbar vertebrae. Although the high fragmentation levels of vertebrae could result from post-depositional fragmentation, the elevated fragmentation could also represent breakage during ch'arki production. This interpretation is supported by data on rib fragmentation. The NISP:MNE data for Occupation IV events (D158, D173, and D120) display more intense rib fragmentation than other events. This may suggest a greater reliance on ch'arki meat, or a change in preparation practices for ribs during that time period. The third trend I observed is that the intensity of fragmentation for the scapula is not consistent between events. I do not think, however, that this variability in fragmentation relates to differences in food preparation practices but rather due to the fragility of the thin scapula blade.

In terms of what the fragmentation data can suggest about breakage to fit into the culinary equipment used at Mollo Kontu, the main pattern identified is that broadly speaking most elements were reduced to small pieces that would be easily fitted into narrow-necked cooking pots and into tazons, the deep but

[82] Event D83 was excluded from this comparison as it consists primarily of a complete skeleton.

small dish used for food consumption at Tiwanaku. There does not seem to be, however, any size standardization by elements. This apparent lack of size standardization is only tentatively suggested as specimens were not consistently measured in the present zooarchaeological analysis. Instead, the suggestion that skeletal elements were not broken in portions of standardized size is based on the observation of photographs of all specimens analysed in the field. For example, a look at photographs for ribs from all Mollo Kontu assemblages shows no obvious attempt to break ribs to a certain length (see Figure 6-14), unlike the standardization in rib fragment lengths noted in Wari assemblages for the purposes of fitting into the cooking vessels (deFrance 2010). Nonetheless, the intensity of fragmentation data suggests that most elements would have been broken in fragments small enough to fit into the Tiwanaku culinary equipment.

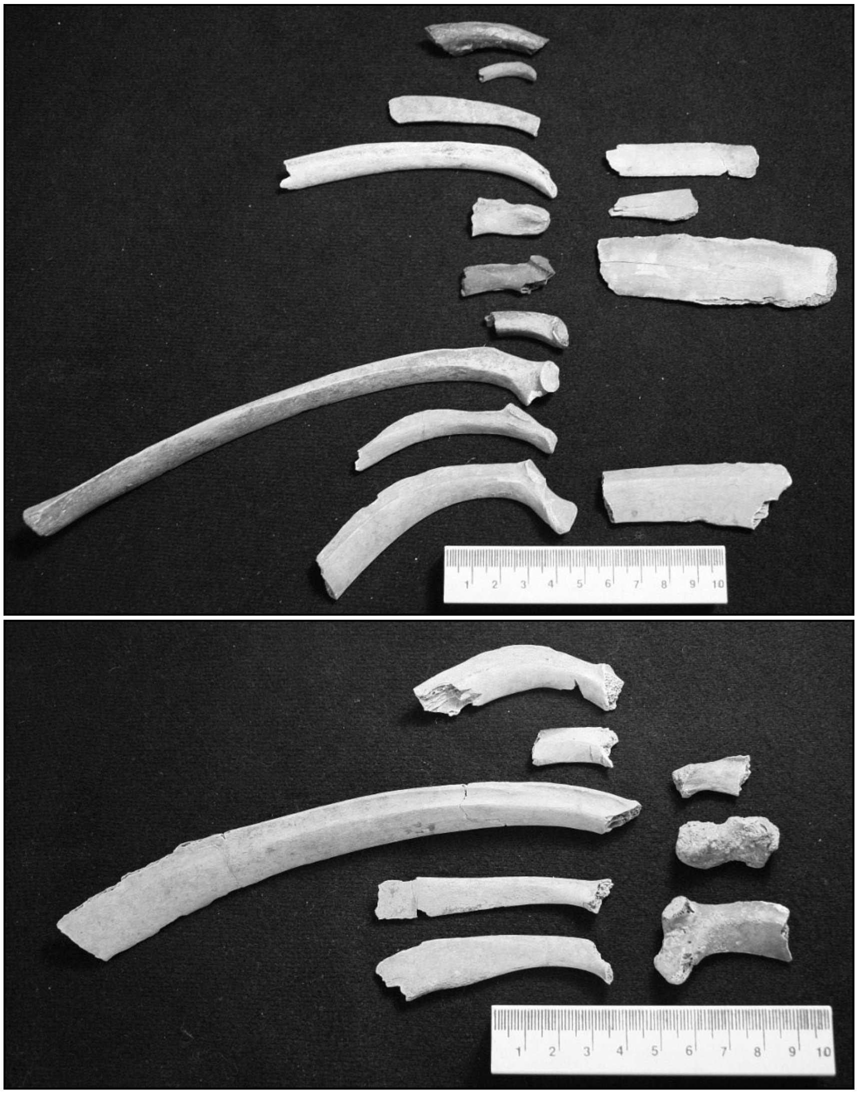

Figure 6-14: Rib specimens showing range of fragment size and variable breakage of rib heads; above: examples from Event A14, below: examples from Event D120.

Burning Related to Food Preparation

Following the discussion of butchery and preparation techniques through cutmark and fragmentation analysis, the final part of this investigation of food preparation practices through zooarchaeological remains focusses on the identification of cooking practices. Cooking techniques in modern Andean pastoralist groups leave little traces on the bone with the exception of roasting. Boiling and low heat cooking do not leave noticeable traces on bones (e.g. Moore

2008, 1989; Koon *et al.* 2010). Although bones may sometimes look burnt during cooking, the burnt area is often restricted to just the thin membrane covering the bone (the periosteum), which can be scrapped off to show an undamaged bone (see Moore's 1989 example with the pachamanca). The bones recovered in archaeological samples would not show burns to the periosteum and would look exactly like unprocessed bones. Roasting meat on the bone, however, leaves burning marks on small, localised areas free of meat, as meat effectively insulates the bone from open flames (see also S. Kent 1993: 348 for an ethnoarchaeological study on the effects of boiling and roasting on charred bone distribution). In light of these identification issues, the analysis of cooking practices is limited to the identification of bone specimens with small, localized burning. A total of 27 bone specimens from the Mollo Kontu assemblages are recorded as having both burnt/charred and unburnt areas. This represents roughly 0.4% of the total NISP for both areas. This type of burning was not restricted to any particular elements, unlike ribs in Miller's (1979) ethnographic example. Roasting may have been part of the culinary repertoire at Mollo Kontu, but the evidence for it is scant.

Bones were likely burned after consumption; in his ethnoarchaeological study, Miller (1979: 88) notes that although camelid bones were not burned in the cooking process, 57% of bones in middens were charred or calcined. Therefore the ratios of unburnt, burnt, charred and calcined specimens for every assemblage is discussed in the following discussion on discard practices. Burning post-consumption would effectively erase any evidence of roasting. Miller's study is important in terms of our interpretation of burned bone recovered from archaeological contexts at Tiwanaku. That is, it appears that the burning patterns found on bone specimens recovered from Mollo Kontu are not likely the result of cooking techniques, but rather the result of disposal patterns.

Refuse Disposal

Refuse disposal is a behavioural pattern that we have easy access to, yet one that often gets glossed over even though most artefacts recovered in archaeological contexts are ultimately discarded trash. Marciniak (2005) describes refuse disposal as an "intrinsically social practice." As he posits,

> Along with other everyday activities, [refuse disposal practices] are part of *habitus* (Bourdieu 1977; Hodder 1982). They are executed through constant repetition and routinisation and are dependent on categorisation and classification of particular substances. Consequently, neither deposition as such nor refuse disposal is only a mundane and utilitarian kind of activity (2005: 76; italics in original).

The action of disposing of material within one's residence does not follow explicit, rigid social regulations; rather it is lived – executed differently between individuals. Miller's (1979: 92) ethnographic observations on housekeeping behaviours, for example, suggest a great diversity of attitudes towards cleanliness in the pastoralists' households, with some cleaning up the garbage strewn on the floor only "when necessary," some sweeping once a week, and one case where the floors were cleaned once a day and the picked up garbage buried under the floor. Though no rules overtly govern garbage disposal, there are usually customary ways to act, social parameters. For example, in modern western urban centers there is often citywide garbage disposal management; nonetheless, certain neighbourhoods are cleaner than others. This suggests that acceptable everyday practices related to garbage disposal can be variable between areas within a commonly shared space. And it is the accumulation of these everyday actions that we see in the archaeological record when we look not only at the content of garbage pits or middens, but at the context as well.

Context of Discard

This first section sets up contextual information about discard behaviour. That is, it introduces pit morphology and location within the excavated areas, and investigates the relation between pit size and the density of faunal material within. The latter information is used to assess whether these pits represent the remains of sporadic feasting events or whether they are indicative of long term accumulation of domestic refuse.

The pits are amorphous; they are irregular in shape, depth and width, ranging in size from very small to massive.[83] This variability in form is characteristic of garbage pits from both MK-A and MK-D. The spatial distribution of pits in MK-D does not suggest any "off limit" zones for digging garbage pits,[84] although they could be said to cluster by occupation levels. MK-A consists of a string of garbage pits mixed with mortuary features, with no apparent care to separate one from the other. Excavator field notes and personal communications suggest that some pits were capped by a hard, and perhaps baked layer of soil in both MK-D and MK-A. This could indicate that the garbage was burned *in situ*, but this detail was not consistently recorded. Data

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[83] See Chapter 4 for floor plans illustrating the irregularities in shape of the pits. Variable width and depth is demonstrated in the following discussion by a tally of the liters of soil excavated for each analysed pit (see Table 6-6)
[84] Figure 4-6 in Chapter 4 shows the location of most garbage pits for MK-D.

on bone burning as suggestive of burning pit content is presented later in this chapter.

As a first step in the investigation of discard patterns, I compared the density of faunal material between the 13 analysed garbage pits and the one hearth (D36) in order to test if larger pits represent the remains of neighborhood-level feasting events as proposed by Janusek (2009). The hypothesis is that garbage pits dug up and filled from the remains of feasting events, which are distinguished from household meals in part by the quantity of food consumed (e.g. Dietler 2001; Hayden 2001), would present a higher density of faunal material than pits created to discard the remains of daily meals. The density of material per pit is calculated by comparing the density of faunal material with the litres of soil removed from the events during excavation. During excavations, the excavators recorded the number of 10 litre buckets needed to empty each locus. Table 6-6 shows the number of liters of soil per event excavated, the NSP and the weight of the bone specimens in those events, and the density of bone specimens per event using both counts (NSP) and weight. The ratios of counts or weight in grams represent the amount of bone specimens that were found per litre of soil excavated. Weight was used as a measure to counter the effects of high fragmentation. There is a strong correlation (r_s=0.7571, p-value=0.00054) between the results calculated with NSP and with weight data. That is, the density results extrapolated through ratios of NSP counts to bucket counts are correlated with the density of bones extrapolated through ratios of weight in gram to bucket counts. For interpretation purposes, it can be difficult to say what a significant difference between the ratios is; for example, is a difference of 5 grams per litre significant or not? Nonetheless, these ratios provide us with an impression of garbage disposal habits.

Events	Litres excavated	NSP	NSP ratio	Weight (gr)	Weight ratio
D158	220	936	4.3	1738.9	7.9
D173	75	782	10.4	937.7	12.5
D120	390	3392	8.7	7427.1	19
D44	170	802	4.7	3569.0	21
Llama pit	255	2764	10.8	10003.4	39.2
D40	200	201	1	489.2	2.5
D46	340	3886	11.4	14701.3	43.2
D36	270	331	1.2	762.9	2.8
D71	220	2379	10.8	2665.5	12.1
Total MK-D	**2140**	**15473**	**7.2**	**42295**	**19.8**
A10	n/a	374	n/a	1613.4	n/a
A14	190	1016	5.4	3005.0	15.8
A23	140	457	3.3	1996.8	14.3
A123	60	69	1.2	345.6	5.8
A111	350	1107	3.2	2978.4	8.5
Total MK-A*	**740**	**2649**	**3.6**	**8325.8**	**11.3**

** Total without data from A10*

Table 6-6: Ratio of bone specimen counts and bone weight per litre excavated. All events are presented from earliest to latest by excavation areas (Occ. IV: D158, D173, D120; Occ. III: D44, Llama pit, D40, D46; Occ. I/II: D35, D71; Occ. A1: A10; Occ. A2: A14; Occ. A3: A23; Occ. A21: A123, A111).

The pit with the lowest ratio of bone fragments to litres of soil is D40, which presents ratios similar to those of the hearth content (D36). Hearth accumulation is presumably slow, the likely result of fragments falling in during preparation and casual discard. The size of D40 is not insignificant, with a total of 200 litres of soil excavated; in fact, a Spearman Rank Order Correlation test showed that there is no significant correlation between litres of soil and density of artifacts in the garbage pits of Mollo Kontu, regardless of whether weight or count values are used. This means that the size, or the 'mass' of the garbage pits does not predict the density of bone material within at Mollo Kontu. Of course the density of bone specimens per litres of soil is also dependent on the density of other artifacts, notably ceramic sherds. Nonetheless, large garbage pits should not be assumed to equate with consumption events where large amounts of food were produced and discarded (i.e. feasting).

Weathering

To further investigate discard patterns, and in particular the possible link between garbage pits and household-level feasting events, a detailed description of the effects of weathering on bone specimens for each assemblage is presented in this section. The argument for Tiwanaku garbage pits possibly resulting from feasting events requires evidence that the feast remains were accumulated and discarded quickly in a few dumping episodes, rather than representing a slow accumulation of refuse from domestic meals (Janusek 2009). Weathering data could illuminate this by suggesting whether the bone fragments were covered quickly or left in open pits for a very long time. Slow accumulation of refuse would expose bones to the effects of weather until they are covered by more refuse or dirt to cover the pit. In this case, a majority of moderately weathered bones would be expected. Rapid deposition would result in a high number of non-weathered specimens forming the bulk of the deposit and a top layer of weathered specimens in cases where the pits were left open after filling. Furthermore, a slow accumulation of refuse rather than sporadic discard of large quantities of material would reinforce the argument that Mollo Kontu was continuously occupied. Bone specimens can also be weathered before discard into pits, if strewn across a floor or patio for months. These could eventually be swept into a pit and mixed with freshly consumed bones. In this case the assemblage would display a mixing of weathered and well-preserved specimens within the same pit.

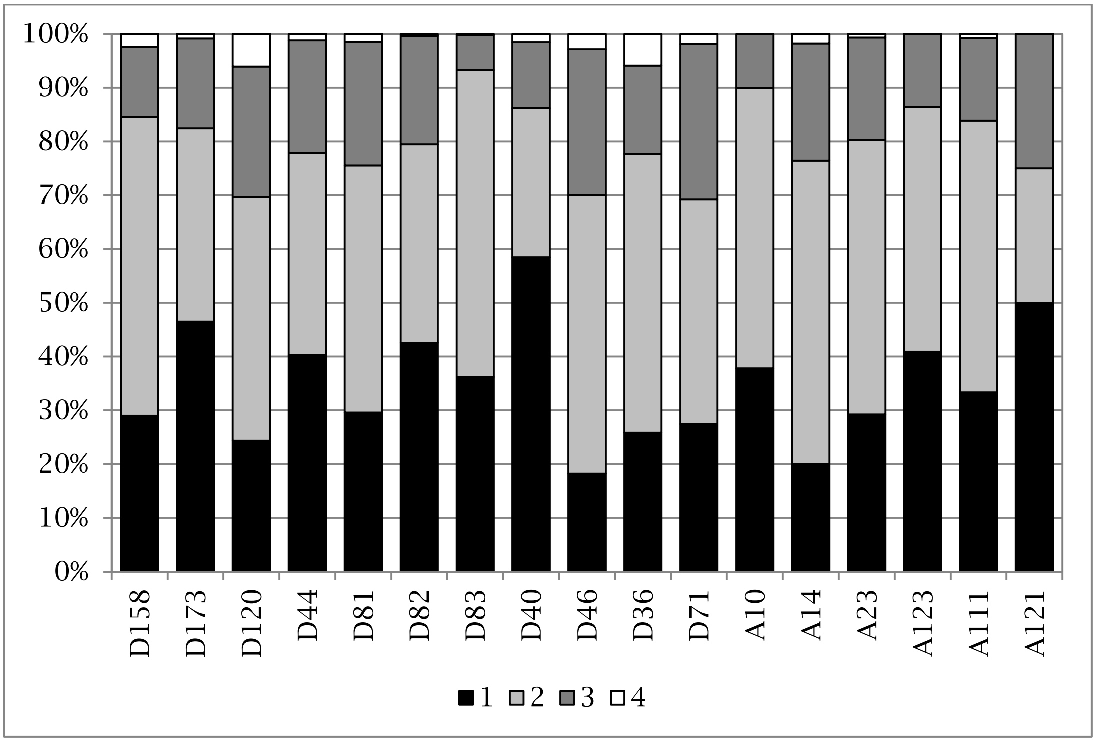

Figure 6-15: Texture distribution (where 1 is excellent and 4 is poor with more than 50% of its surface flaked off) for all events at Mollo Kontu. All events are presented from earliest to latest by excavation areas (Occ. IV: D158, D173, D120; Occ. III: D44, D81, D82, D83, D40, D46; Occ. I/II: D35, D71; Occ. A1: A10; Occ. A2: A14; Occ. A3: A23; Occ. A21: A123, A111, A121).

Experimental studies suggest that the first signs of flaking and cracking on bone surfaces (stage 2) typical of weathering will usually appear after a year of exposure to the elements and only start showing heavier weathering (stages 3 and 4) after over 3 years exposure (Behrensmeyer 1978). Figure 6-15 shows the distribution of specimens for each texture stage from 1 (excellent) to 4 (very poor)[85] for each event analysed. This data suggests that all pits contain specimens that have been exposed to the elements for over a year although the preservation is overall very good. In terms of accumulation pattern, the data

[85] See Chapter 5 for a more detailed discussion of these stages.

suggest a fairly uniform way to discard refuse that leave bone specimens within the pits variably weathered. The fact that all but one pit have less than 50% of their faunal assemblage unaffected by weathering can be interpreted as a slow accumulation of dumping events rather than the rapid deposition of a large quantity of faunal material within the pit. It also suggests that pits were not covered with dirt rapidly after deposition. This is further supported by the common presence of a cement-like mineral crust that coats some of the faunal remains from Mollo Kontu.[86] Moore (pers. comm.) interprets this cement-like mineral crust as possibly the result of water pooling into pits, which may indicate that the pits were left open to the elements. Ultimately, these data would be more informative if the internal pit stratigraphy was recorded. It would be worthwhile to select a few pits in future excavations for a stratified analysis in order to see whether there are changes from top to bottom, and whether there are thin layers of more heavily weathered bones.

Burning Data

As discussed in the previous section on meat preparation at Mollo Kontu, most Andean cooking techniques leave no burning traces on bone material. Therefore, bone must be burnt post-consumption, possibly as part of discard practices, whether by being thrown into a hearth or by periodically setting the garbage pits on fire. Three levels of burning were recorded on the bone material from Mollo Kontu: burnt, charred and calcined. The three were differentiated primarily through color. Burnt bones are a dark brown but not quite black, charred bones are black and calcined bones are grey or white. When specimens exhibited more than one stage of burning, I recorded the more advanced stage,

[86] See chapter 5 for a more detailed discussion of this phenomenon.

but noted that the burning was variable. In this section, I present the data on burning by events, and discuss the possibility of variable discard practices that may occasionally favour setting the pit contents on fire for sanitary purposes and included already burnt material from hearth cleaning.

The importance of burning in the Mollo Kontu assemblages is investigated by converting the NSP for each event into ratios of unburnt, burnt, charred and calcined specimens (see Figure 6-16). These percentages included all unidentified fragments and every species identified. The burning data for the aggregated assemblages for each excavation sector (MK-D and MK-A) shows that the majority of bones are unburnt, and less than 10% were calcined. However, there is a much greater variability in burning patterns when looking at assemblages individually.

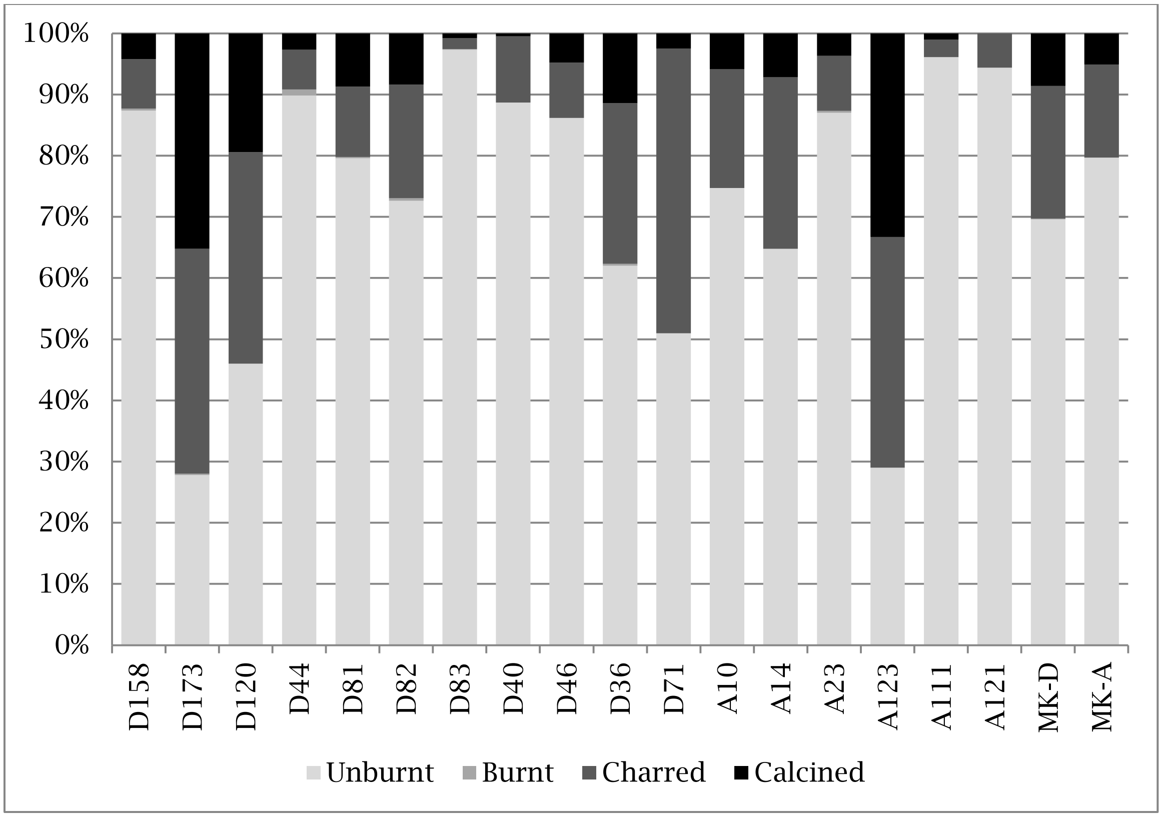

Figure 6-16: Distribution of burning categories within each assemblage (%NSP). Note that the last two are the aggregated results for each Mollo Kontu sectors. All events are presented from earliest to latest by excavation areas (Occ. IV: D158, D173, D120; Occ. III: D44, D81, D82, D83, D40, D46; Occ. I/II: D35, D71; Occ. A1: A10; Occ. A2: A14; Occ. A3: A23; Occ. A21: A123, A111, A121).

Three pits are heavily burnt with less than 50% of their bone content left unburnt (D173, D120, and A123). Pit D71 rounds up the heavily burnt category with 51% of its specimens left unburnt. Excavation notes for the latter pit mention that the pit was capped by a hard layer of soil, suggesting its content may have been burnt *in situ* then covered by soil when hot. These heavily burnt assemblages vary in size, density of bone specimens and time periods. Therefore they do not represent a specific discard practice associated with size and density of deposits, or a change in discard practices through time. For example, while the three assemblages from MK-D are large (NSP=782, 3392, and 2379), the one from MK-A is very small (NSP=69) and not very dense with bone material. The strong presence of calcined and charred bones could be interpreted as accumulations from hearth cleaning. However, the assemblage from the hearth feature (D36) contains more than 60% unburnt bones. This suggests that accumulations from hearths still may not contain such high levels of burnt bones. If garbage pits were periodically set on fire, as is often done in the modern town of Tiwanaku, it is likely that only a portion of the bones would be burnt due to the low burning power of the fuel likely used (i.e. camelid dung). This is further supported by the high presence of unburnt bones in the hearth feature. High frequencies of burnt bones could therefore represent the frequent burning of small amounts of garbage as the pits gradually filled.

Not all assemblages show high evidence of burning; the low levels of burnt bones in all three strata of the llama pit (D81, D82 and D83) do not come close to the percentage levels of burnt specimens recorded in Miller's (1979) ethnoarchaeological work. This could suggest that this pit was not burnt but quickly filled and covered, perhaps to bury the decomposing camelid at the bottom of the pit (D83). As mentioned above, the presence of burnt material could also represent episodes of hearth cleaning. In sum, all pits and the hearth show some evidence of burning to varying degrees but it remains difficult to pinpoint the cause and location of the burning. It appears likely that pits with high levels of burnt faunal material were periodically set ablaze for sanitary purposes. A combination of burnt data from other material from the pit, along with a careful recording of evidence for burnt soil and hardened caps, may provide more information on the likelihood of *in situ* burning.

Worked Bones

Somewhere in the chaine opératoire of food preparation, serving and discard, certain bone elements are selected for use as the raw material for making tools, adornments and musical instruments. Ultimately, they too will be discarded; tool making creates bone waste, and tools break or get worn out. These tools may be related to culinary practices, although admittedly their specific functions often remain unknown. Regardless, the selection of bone elements as raw material delays their introduction into the garbage pit assemblages. A number of the worked bones analysed are likely not the tool *per se*, but rather waste from tool making or expedient tools made of fragments that were likely not curated, suggesting that the tools were made in the residential areas with their own raw material. That is, it seems unlikely that there was a redistributive system for intact bone elements necessary for bone tool manufacture. The presence of tool manufacture debris from a variety of bone elements is another piece of data that suggests that camelid meat did not reach the household through indirect redistribution of meat packets, but rather as complete animals.

Bone tools are not common in the assemblages analysed; a total of 65 worked bones were found, totalling 0.35% of the overall large mammal assemblage. Appendix VIII presents a list and description of all worked bones found in the analysis of the present assemblages.

To test which bones are more likely to be selected for tool manufacture, and therefore to be discarded belatedly, the number of worked bones per element was tallied and compared with the element's NISP (see Table 6-7). The most commonly worked bone is the mandible. This is not surprising as the “mandible tool” (see Figure 6-17) is an emblematic part of the Tiwanaku IV and V toolkit (e.g. Bermann 1994; Goldstein 1989; A. Webster 1993; Webster and Janusek 2003), although the function of this tool remains unknown. Their worked edge and occurrence in domestic contexts, as opposed to agricultural, ritual or specialized areas suggests “they served some scraping, cleaning, or polishing function in everyday Tiwanaku household activity” (Webster and Janusek 2003:357). One specimen from a Tiwanaku colony of the Moquegua valley was found hafted (see Goldstein 1989). Many uses could be extrapolated for these tools. Rivera (2003: 308) suggests they may have been scrapers used for ceramic production at Ch’iji Jawira. In step with the subject of this dissertation, I suggest that these tools may also have been used as kitchen utensils. When hafted, these could be used to stir, scrape and serve out the stews that were likely served as meals.

Element	**MK %**	**MK-D %**	**MK-A %**
mandible	7.69	8.06	5.71
1st phalange	2.26	1.36	6.8
radio-ulna	2.22	0.9	8.16
tibia	2.22	2.76	0
scapula	1.79	1.07	5.56
metatarsal	1.19	0	7.14
humerus	1.17	1.52	0
metacarpal	1.02	1.18	0
metapodial	0.68	0.28	2.44
femur	0.52	0	1.82
rib	0.43	0.26	1.27
pelvis	0.41	0.53	0
canine	0.29	0	3.03
LB	0.27	0.24	0.47
unid	0.03	0.02	0.07

Table 6-7: Percentages of worked bones in each element categories for total Mollo Kontu, MK-D and MK-A.

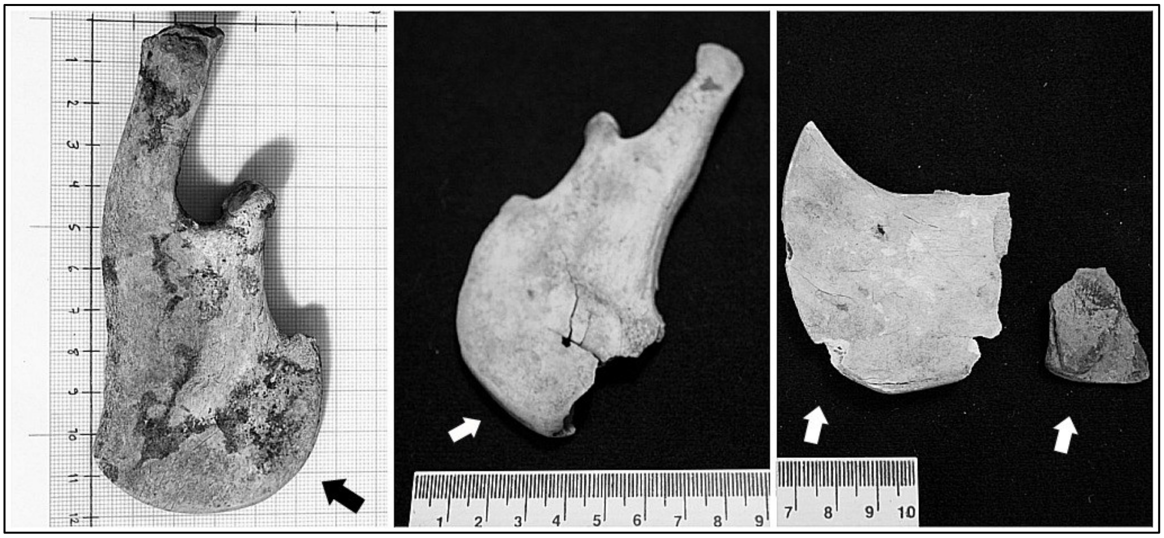

Figure 6-17: Examples of mandible tools found at Mollo Kontu; one complete and three fragments.

First phalanges are the second most often worked bone element at Mollo Kontu. The majority of these were carefully sawed in two or more pieces horizontally (see Figure 6-18 for examples). The proximal ends of 1st phalanges were usually recovered with the distal end sawed off at Mollo Kontu. This contrasts with Webster's (1993: 243) description of 1st phalanges found at Lukurmata. These worked specimens were drilled on the proximal end, and the edges were smoothed out. She suggests that the shaft and distal end became receptacles for carrying pigments or hallucinogenic snuff. It is possible that, though the techniques are different, the intent for the Mollo Kontu worked phalanges was also to create some hollowed receptacle. However, it is worth noting that at least one of the worked phalanges found was a distal end with its shaft sawed off (see third specimen on Figure 6-18), which suggests that either the hollowed receptacle could function proximally or distally, or that the phalanges were worked at both ends to create a tube with the shaft. However, no examples of tubes made with phalanges were found, and worked distal ends were not as common as the proximal ends. Figure 6-19 shows a different type of worked 1st phalanges from the Mollo Kontu assemblages, phalanges which are perforated throughout. Similar bones from European contexts are interpreted as whistles, and a bone whistle was found at AKE1. However, the AKE1 whistle was open ended with only one side perforated (Webster and Janusek 2003: 358). Perforated objects are often assumed to be pendant, but there is nothing to suggest this function or why such pendants would be discarded when seemingly still functional.

Figure 6-18: Examples of worked 1st phalanges with the shaft "sawed off."

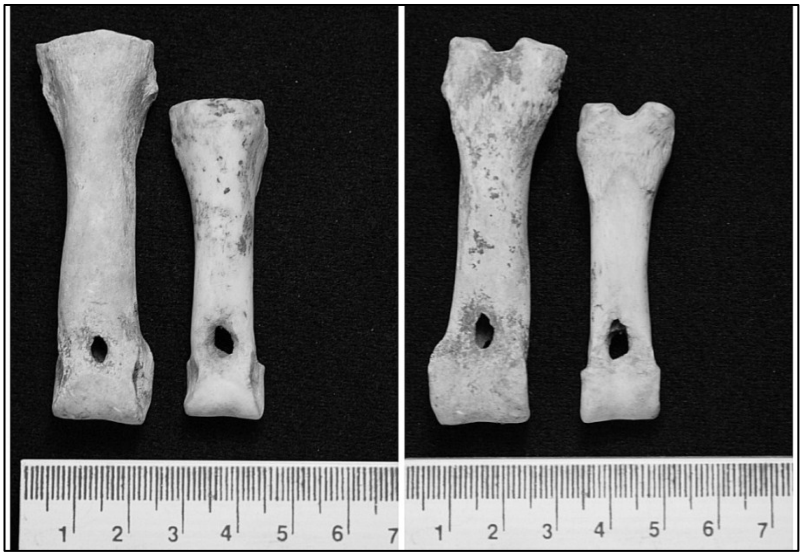

Figure 6-19: Two perforated 1st phalanges, shown from the front and back.

Most worked bones were made out of various long bones. They fall into two categories of modifications: 1) shaft "sawed off", or 2) seemingly expedient tools with a polished edge. Event D46 displays a high frequency of worked tools, particularly "sawed off" tibiae fragments (see Figure 6-20 for examples from this event). Such horizontally cut long bone shafts are made of varied elements and found in a number of pits. For example, Figure 6-21 shows a femur and a metatarsal also bearing modifications quite similar to the ones found on the tibiae and 1st phalanges previously discussed. Interestingly, none of these appear to be finished products. Instead, they look like waste from tool manufacture, with the exception of the specimen on the lower right corner of Figure 6-20.

A possible goal of tool making at Mollo Kontu may have involved creating tubes out of long bone shafts, though no particular element is preferentially selected. Bone tubes excavated at Tiwanaku and local sites were used for hallucinogenic drugs consumption and to produce pan-pipes (Webster and

Janusek 2003:356-359). A bone flute and a whistle were also excavated in AKE 1, both made of hollow long bone tubes. Ultimately, it looks like the selection of bones used as raw material to create bone tubes was ruled by which long bone was available, and did not necessarily focus on one type rather than another. In that sense, the removal of those bones from the discard patterns should be indiscriminate, perhaps based more on which elements held up well during the processing operations.

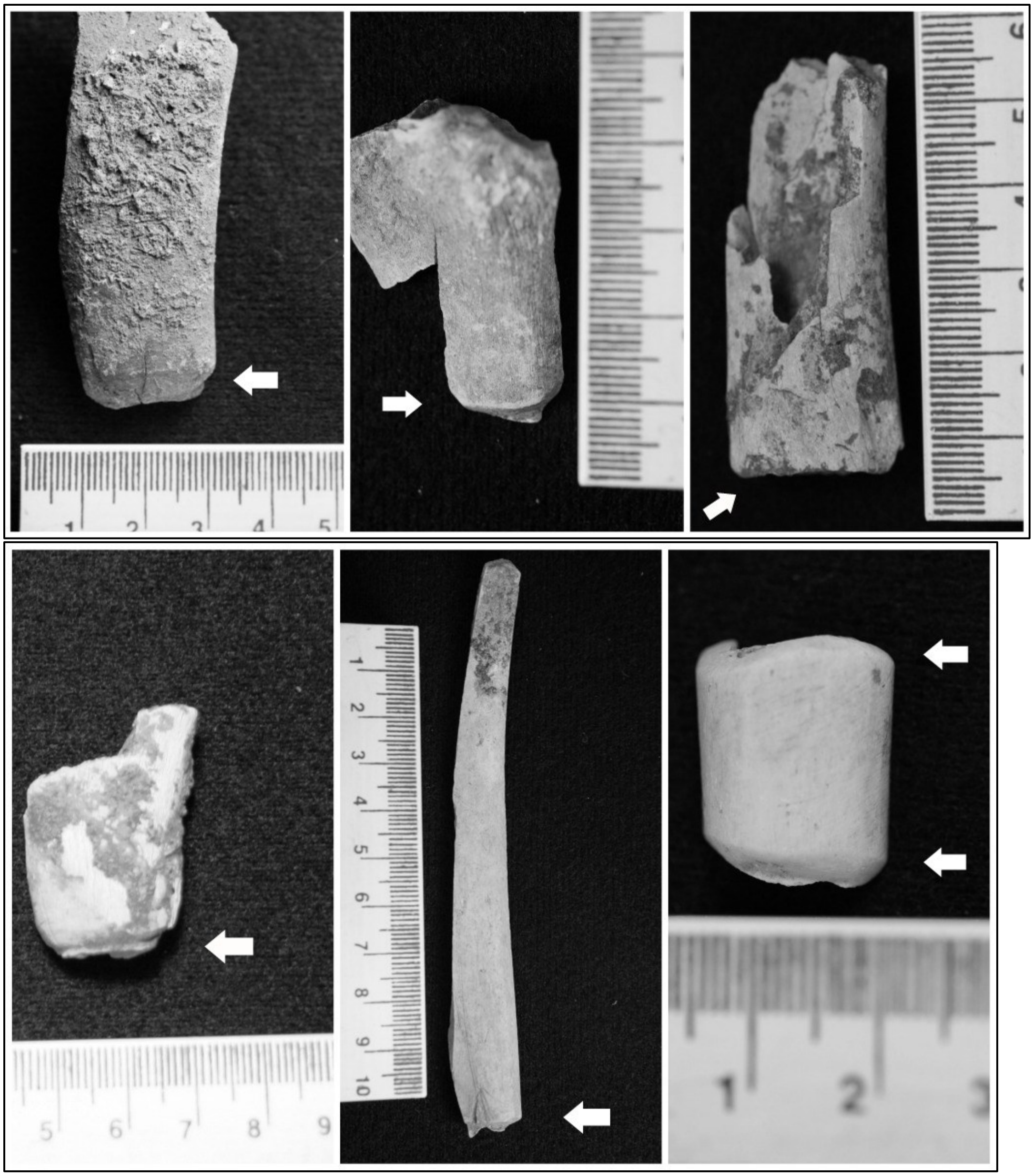

Figure 6-20: Examples of "sawed off" long bones from D46; upper row shows worked tibiae, lower row shows unidentified worked bone specimens.

Figure 6-21: Femur and metatarsal specimens with the shaft "sawed off."

The use of shaft, ribs and mandible body fragments as expedient tools does not cluster toward specific elements either. Their selection is likely random; bone specimens fragmented during food preparation are selected based on their appropriate shape for a job at hand. Some of these polished tools have pointed ends (see the first two examples on Figure 6-22), while others have rounded ends (see the last two examples on Figure 6-22). The Tiwanaku tool kit includes a variety of pointed end tools, notably bone needles, leather perforators and *wichuñas* (a type of weaving implement still in use today). The examples from Mollo Kontu do not correspond to these types of implements, with an exception made perhaps for the humerus and radio-ulna shaft fragments illustrated on Figure 6-22. These could be interpreted as a type of wichuñas, though they are not stylistically similar.

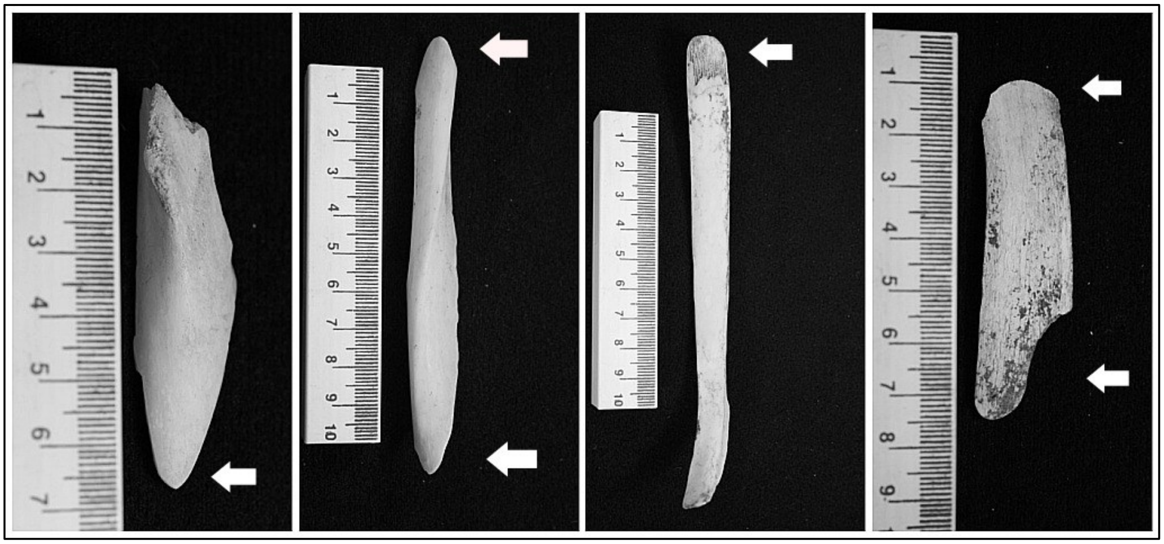

Figure 6-22: Examples of expedient tools; from left to right: humerus shaft fragment, radio-ulna shaft fragment, rib fragment, rib fragment with two worked edges.

Back to Table 6-7, the scapula is the fifth most often-modified bone element in the Mollo Kontu faunal assemblages. The modification of this element is not mentioned by A. Webster (1993) or by Webster and Janusek (2003) in their analysis of bone implements from Tiwanaku, Lukurmata and the Tiwanaku valley. At Mollo Kontu, scapulae tools share a similar shape to that of the mandible tool (see Figure 6-23 for examples). The posterior angle appears to be cut off to form a more rounded edge, and a scraping motion polishes the working edge. The first example to the left in Figure 6-23 is the most complete, while the second one has been shaped but shows no polish on the edge, which suggests this tool was not used. Overall, scapulae were selected as raw material for a specific type of tool, although only 1.79% of the total scapulae analysed showed signs of such modifications.

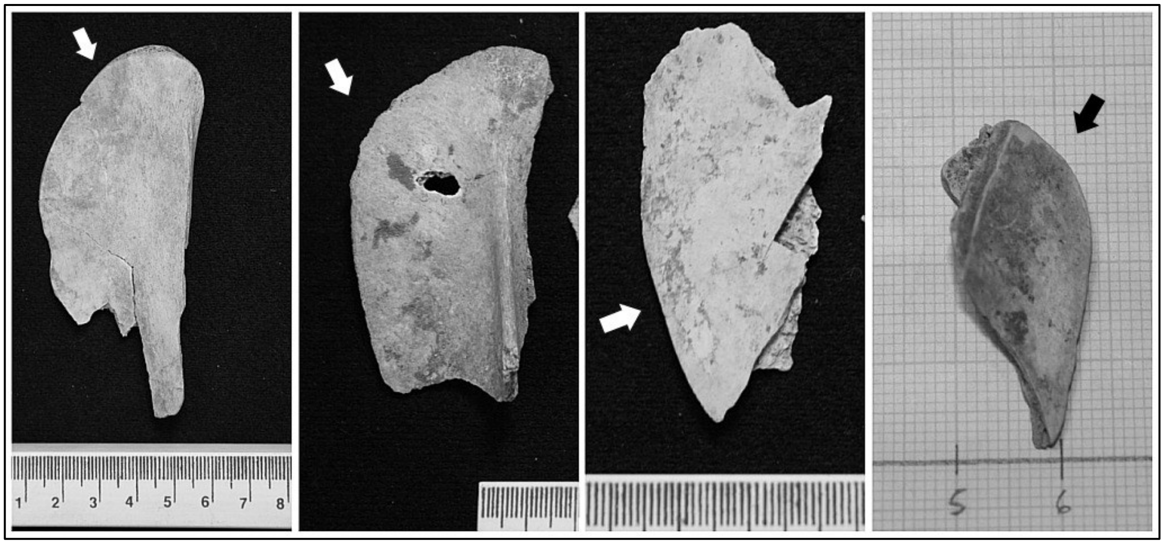

Figure 6-23: Fragments of worked scapulae.

Summary: Becoming Garbage

In this chapter, results from the faunal analysis of garbage pits and one hearth at Mollo Kontu were presented in an order that facilitates discussions of all recoverable aspects of cuisine through zooarchaeological research. The focus on camelid meat is not meant to diminish the importance of other foodstuffs such as fish and plant products. Indeed, research on these aspects at Mollo Kontu is underway, and the preliminary results are discussed in the next chapter. The faunal data presented was divided into three sections that represent distinct steps in cuisine's chaine opératoire: food acquisition, food preparation and food discard.

As established in Chapter 5, the overwhelming majority of species found at Mollo Kontu are camelids, mainly from the domesticated species. Vicuñas are absent, but guanaco specimens are present. The presence of other domesticates (guinea pig and dog) is inferred by the presence of very few bone specimens. Evidence of deer and guanaco specimens suggest that hunted items reached the domestic areas of Mollo Kontu, which in turn suggests that there might not have been sumptuary laws against hunting in Tiwanaku times as there were in Inka times.

Mortality profiles compiled to assess the distribution system for animals and meat show the consumption of both very young and mature animals, a signature close to a natural herd profile, suggesting a producer site. Yet there is also a strong presence of prime-age (in terms of meat yields) animals (i.e. 1 to 3 years old). Such a profile is often associated with a pastoral strategy that emphasizes meat production. The standardization of age-at-death can be interpreted as evidence for an indirect redistribution. Yet the breadth of age-at-death is akin to the variability expected with direct redistribution, either through herd ownership or through direct relations with herding specialists. Pathological bone specimens suggest that the herders tended to their animals when injured or sick. Furthermore, certain pathologies on the back and legs of the animals may indicate their role in hauling long-distance caravans before becoming part of a meal.

The aggregated skeletal part frequencies for MK-D and MK-A are similar whether using %MAU or %weight of elements. Using the %weight data to factor in the influence of heavy fragmentation of elements, it appears that the presence of most elements follows the normal representation in a complete skeleton. This suggests that animals likely arrived complete to the compound, either 'on the hoof' or as complete carcasses. The %weight data shows an over-representation of ribs while %MAU data points to an under-representation. The assemblages' high fragmentation levels, especially for ribs, negatively affects derived counts, therefore the use of %weight for interpretations is likely more accurate. As such, the over-representation of ribs could suggest that the Mollo Kontu residents supplemented their consumption of camelid meat acquired from direct exchange with extra rib meat parcels, perhaps in the form of *ch'arki*. It is not possible to assess whether this other distribution level would be direct or indirect.

Skeletal part frequencies also highlight the near absence of sternebrae and sacrums in the Mollo Kontu assemblages. It is hypothesized that the caudal vertebrae might follow the pelt rather than the rest of the carcass. The absence of the sternum could be linked to its association with entrails. That is, removal of the sternum permits access to the camelid internal organs (e.g. Flannery et al. 1989: 85). The sternum could have been heavily processed beyond recognition, fed to the dogs, or processed in a distinct context from the rest of the elements, which in turn could result in a different discard pattern. That is, the sternebrae might have left the butchering process with the organs and collected blood, and been consumed in a dish with these highly perishable items at the time of butchery. If, as suggested, people met in a household patio or in a more 'public' area to share a meal from the entrails and organs that would quickly decay otherwise, the few pieces of bones encountered in this meal could be spit out on the spot, and would therefore be more likely to be found embedded in house or patio dirt floors rather than in the garbage pits. This is assuming that house floors and patio floors were not cleaned out regularly. The near-absence of sacrum in the assemblage is puzzling, especially since cutmark data on the pelvic areas suggest great care was taken in removing the sacrum.

The correlation between quantification and element utility was tested to see whether the skeletal element frequencies at Mollo Kontu reflected either a specific transport strategy from the production center or an unequal redistribution of resources. The near absence of the axial elements, especially sternum (and the ribs, when using %MAU as a quantification methods) produces a negative correlation, as they are the most *useful* elements in camelids. However, assemblages were not strongly shaped by element utility as shown by the spread of the data points for the medium-utility elements. This was confirmed with Spearman Rho tests for every assemblage. Overall, utility did not significantly shape the presence of elements in the assemblages because every part of the body was exploited, as suggested by skeletal part frequencies. Skeletal element frequencies may have been more influenced by taste, means of acquisition, and methods of preparation and disposal, than by a concern for nutrient maximisation.

Many aspects of food preparation are invisible in the archaeological record. In zooarchaeological studies, two indicators of preparation techniques are cutmarks and breakage patterns. The location and intensity of cutmarks, coupled with fragmentation data per element, can illuminate the way an animal was quartered and how each packet was reduced into manageable portions to be transformed into meals. The ratios of cut to uncut bone specimens per element is strikingly similar between MK-D and MK-A, which can suggest shared butchery practices between the two areas. Cutmarks and breakage patterns suggest that care was taken in recovering the brain and the tongue. The lower phalanges and caudal vertebrae were rarely encountered and rarely processed, which may indicate they were left in the pelts of the animals. The 1st phalanges were often selected as raw material for tool (or container) manufacture. The sacrum was removed with great effort from the pelvic area. The hind limb was disarticulated at the acetabulum and femur head joint without breaking the femoral head. The lower legs were separated from their meatier upper part through the two rows of carpals and tarsals. Comparison with modern analogues (e.g. Flannery et al. 1989; Miller 1979; Moore 1989) suggests that aspects of these butchery and preparation techniques are distinct.

Most of the bone elements were heavily fragmented, except for the lower limbs. The cranium in particular was practically pulverised, which suggests an emphasis on brain extraction. Great care was also taken in removing the mandible and the tongue without breaking the ascending ramus of the mandible, which is an important component of mandible tools. Such care is not recorded in modern butchery accounts. Cutmarks on, and high fragmentation of ribs and vertebrae are hypothesized to result from ch'arki production and preparation. Combined with the age profiles, this could represent an acquisition system where Mollo Kontu residents kept their own herds but had their meat intake supplemented through distribution of rib meat, possibly in the form of ch'arki. These patterns are noteworthy, but perhaps lack contemporary material to flesh out the nuances of food preparation at Mollo Kontu.

Since there is no published detailing of cutmarks and fragmentation patterns from other Tiwanaku sectors and surrounding sites, it is uncertain whether the butchering process described here represents widely shared Tiwanaku butchery and preparation practices, or if this process reflects a specific 'Mollo Kontu way.' Nonetheless, the butchery patterns recorded demonstrate that the path from live animal to meal can be illuminated through a combination of fragmentation data, detailed cutmark analysis and skeletal part frequencies. These patterns are not only dictated by animal physiology and efficiency; they are a combination of history, expertise and innovation.

The analysis of garbage pits suggests a lack of standardization in discard practices within the characteristic Tiwanaku amorphous pits. At Mollo Kontu, there is no correlation between pit size (as calculated through litres of soil excavated) and density of faunal material within. Combined with the weathering data that shows that most pits had more than 50% of their faunal material exposed to the elements for a long time period, these data warns against an interpretation of large pits as evidence for feasting events at Mollo Kontu. All pits show some degree of burning although the ratios are quite variable between pits. Since cooking techniques rarely reach the temperature levels necessary to burn the bones, most burning occurrences likely happened after consumption. Certain pits contain higher ratios of burnt to unburnt bones than those found in the analysed hearth feature. This could suggest that in some instances pit content was periodically set ablaze for sanitary purposes. Some burnt bones found in garbage pits are also likely the result of cleaning hearths. A detailed stratigraphic excavation of pits could help untangle whether pits went through one or multiple episodes of *in situ* burning. This type of excavation could also help better interpret weathering data by suggesting whether pits were left open to the elements for extended periods or were covered rapidly.

In sum, the zooarchaeological data presented in this chapter suggests that the residents of Mollo Kontu acquired complete camelids through direct distribution. The presence of neonatal animals is indicative of a producer site, which therefore suggests that Mollo Kontu residents owned camelid herds. These animals were brought whole to the residential compounds and processed in patterned ways. Bone elements were heavily processed and fragmented, although not necessarily to maximize bone grease consumption as epiphyses are often intact. It is not yet known whether the butchery and preparation pattern recognized here represents a specific Mollo Kontu practice, or whether this was a broadly shared tradition. Detailed investigations of fauna from other urban sectors are required first. Faunal remains were discarded into morphologically varied pits. The burning of pit content is suggested though not demonstrated. Discard patterns are not standardized; it is suggested that certain pits may have been left open to the elements for long periods of time while others showed less signs of weathering. Variations in weathering and the presence of a mineral crust on certain faunal elements may suggest that some pits were indoor pits, protected from the elements. However, poor understanding of spatial relations within the excavated sectors of Mollo Kontu precludes further analysis of this possibility.

The trends discussed in this chapter represent only a section of Mollo Kontu culinary practices. Other correlates of cuisine such as plant, fish and ceramic remains are presented in the following chapter to expand our discussion on culinary practices. Furthermore, comparison of these patterns with data from past research at Tiwanaku and Tiwanaku sites are presented whenever possible to test whether these trends are representative of a Tiwanaku way of life or unique to Mollo Kontu.

CHAPTER 7: ARCHAEOLOGICAL CORRELATES OF *CUISINE* AT MOLLO KONTU

Mollo Kontu cuisine goes beyond the acquisition and consumption of camelid meat. Cuisine also includes the dishes combining varied foodstuff, the cooking and storing of food in appropriate containers, the etiquette of using proper service ware and the context of preparation and consumption. This chapter presents data from Mollo Kontu contexts collected by colleagues and members of the Proyecto Jach'a Marka. Analyses of fish and plant remains detail the foodstuff available to Mollo Kontu residents. Bioarchaeological analyses of skeletons from MK-A, and other parts of the urban center, demonstrate that Mollo Kontu residents emphasized meat consumption and low maize consumption in contrast to other neighbourhoods. This focus on meat may suggest that Mollo Kontu residents were pastoralists. This correlates well with the zooarchaeological data presented in the previous chapter, which suggested that Mollo Kontu residents likely owned camelid herds. Finally, this chapter presents ceramic data for MK-D and MK-A, and contrasts this with the data of other urban sectors. The ceramics reinforces the domestic nature assessed for MK-D and MK-A.

Analysis of Fish Remains

Elizabeth Arratia Velasco is currently undertaking the zooarchaeological analysis of fish remains recovered at Mollo Kontu from the flotation samples. Preliminary results of this analysis explore the economic importance of fish at Mollo Kontu, and by extension at Tiwanaku since no such studies exist for the site thus far (Arratia 2010). All identified fish remains at MK-D and MK-A belong to two genus, *Orestias* (also known as Andean killifish), and *Trichomycterus* (or catfish). Both of these fish genera are native to Lake Titicaca, and no exotic fish remains were found at Mollo Kontu.

Some of the fish bones recovered were burnt, even calcined, which leads Arratia (2010) to suggest that they were burnt post-consumption, either by discarding them in hearths or by periodically burning the content of garbage pits, as I also suggest for the mammal remains. There is no evidence of the preparation methods; modern consumption behaviours by local residents suggest that the smaller killifish would be eaten whole, bones included, which would effectively diminish the evidence of their presence in the archaeological record, let alone the method of preparation.

Killifish are more predominant than catfish in the archaeological assemblages from MK-A and MK-D. This uneven distribution could be intentional, a culinary preference of the residents, though there are other factors that favour the presence of killifish over catfish. For example, catfish bones are weaker and do not preserve as well archaeologically. Furthermore, there is a greater distribution of killifish within the lake population. Finally, catfish and killifish live in different habitats within the lake; killifish thrive in various water depths, while catfish inhabit the lake and rivers' muddy bottoms (Arratia 2010). These differences affect how easy it is to catch them while fishing. Fish size estimates from the recovered material suggest a focus on specimens longer than 10cm. This apparent standardization in fishing techniques is cautiously presented by Arratia (2010) as possible evidence for fishing specialists providing the urban center with fish resources through a yet undetermined pathway (that is, it is possible this was done through direct exchange with farmers and pastoralists, or through a more state-regulated distribution system).

Overall, the preliminary fish data demonstrates that Mollo Kontu residents consumed both catfish and killifish from the neighbouring Lake Titikaka. The strong presence of killifish bones indicates that these may not have been consistently consumed whole as is common today, since this would impede their archaeological recovery. Catfish are less consistently identified in the flotation samples. The differences in frequencies between catfish and killifish could be the result of a culinary preference, an artifact of the fishing methods employed, or a taphonomic issue.

Paleoethnobotany

An essential component of diet at Tiwanaku comes from cultigens and wild plants. The importance of local cultigens is highlighted in part by the extensive raised-field system built in Tiwanaku times in the region.[87] Research conducted under the Proyecto Wila Jawira provided the first paleoethnobotanical results for the Mollo Kontu Mound and Mollo Kontu South (Wright *et al.* 2003). Following paleoethnobotanical analyses done by Mabel Ramos Fernandez and Maria Bruno through the Proyecto Jach'a Marka provides us with a glimpse at plant food access and consumption in the MK-A and MK-D sectors of Mollo Kontu. They attest to the local nature of plant products, while demonstrating that Mollo Kontu residents had access to exotic goods such as maize and molle.

[87] See Chapter 2 for a discussion of raised-fields.

Flotation samples were collected for every locus excavated by the Proyecto Jach'a Marka. A minimum of one 10-litre soil sample per locus was floated and separated into light (e.g. charred seeds,[88] fish bones, wood and charcoal) and heavy (e.g. bone, ceramic and lithic material) fractions. Loci that were smaller than 10 litres were collected and sent in their entirety for flotation. Not all carbonized seeds recovered were for human consumption; in the altiplano context, a high proportion of burnt seeds come from the use of camelid dung for fuel. The cultigen seeds recovered are usually carbonized by accidentally falling into hearths, or through burning of the area where they are kept or discarded. Bruno and Ramos (2009) use a similar methodology to that of Wright *et al.* (2003); therefore, the results of these two studies are comparable. However, because seed species identification has improved since the study done for Proyecto Wila Jawira, the newer samples for Jach'a Marka appear to have greater species diversity. The following discussion of plant remains at Mollo Kontu is based on the unpublished data and interpretations of Mabel Ramos Fernandez and Maria Bruno (2009), unless the work of Wright and colleagues (2003) on samples from the Mollo Kontu Mound and Mollo Kontu South is directly cited. Bruno and Ramos' results are preliminary and do not represent the complete sample to be analysed. As such, the following preliminary results suggest trends, but are in no way the final word on plant use at Mollo Kontu.

Three main expected crops are present within the MK-D and MK-A flotation samples: fragments of parenchyma tissue believed to be tubers (possibly potatoes, oca, and *isañu*), chenopods (e.g. quinoa and possibly *kañawa*), and maize. Of these three crops, maize is the only import; tubers and

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[88] Seeds need to be charred or carbonized to preserve in the archaeological record.

chenopods are local. Tubers and chenopods were found in all samples (100% ubiquity). Maize is also ubiquitous at Mollo Kontu, with a percent ubiquity of 69% for all analysed samples. In terms of density, tubers were the most abundant with 15.7 fragments per litre, followed by chenopods at 4.33 seeds per litre. Maize fragments were found at a density of 1.15 fragments per litre, a relatively high representation compared to data presented by the Proyecto Wila Jawira (Wright *et al.* 2003: 399) for both Mollo Kontu and other Tiwanaku contexts (such as the Putuni, the Akapana pyramid, and the Akapana East sectors). This higher density may be attributed to the emphasis by the Proyecto Jach'a Marka on analysing garbage pits, middens and hearths, where food remains would be denser; the paleoethnobotanical studies undertaken by the Proyecto Wila Jawira focused on a more diverse array of contexts, including interior and exterior floor surfaces, which tend to have lower densities of carbonized plant remains (Bruno and Ramos 2009).

In terms of edible wild plant species, cactus seeds were found in 94% of the samples at Mollo Kontu, with a low density of 1.28 seeds per litre. These seeds come from the fruits of local species of cactus that grow in relatively undisturbed places, such as rock hilltops or rock piles (Bruno 2008: 226). Camelids are known to eat cactus fruits, thus the presence of these seeds in our assemblages could be from burning camelid dung. However, it is likely that Tiwanaku residents would relish snacking on this local fresh fruit, since there are few fruits available on the altiplano. Furthermore, these cactus fruits have been used locally for medicinal purposes, and as dyes for cloth, drinks and foods (Bruno 2008: 226-230; Bruno and Ramos 2009).

Another wild food item recovered through the flotation of soil samples is molle (*Schinus molle*), the fruit of a lowland tree that has been used for producing chicha, though the tree and its fruits can have other uses (e.g. medicine, dyes, and construction material) (Bruno and Ramos 2009). Eight molle seeds were recovered from only one soil sample. It is the first time that the exotic molle is reported at the site (Bruno and Ramos 2009). Its presence in only one Mollo Kontu pit is not strong enough to be considered as part of daily consumption. However, when combined with the common evidence for maize, it suggests that residents of Mollo Kontu had ties to the lowlands.

In terms of intra-site analysis within the Mollo Kontu sector, preliminary results show that the garbage pits, middens and hearths from MK-D and MK-A share similar densities of plant remains per litres (MK-D=234.96 fragments/L; MK-A=266.33 fragments/L), and a similar range of identifiable species (31 taxa in MK-D; 33 taxa in MK-A). Food species also occur in similar ubiquities (Bruno and Ramos 2009) save for the molle specimens found in a garbage pit from MK-A. Overall, Bruno and Ramos' (2009) paleoethnobotanical data suggest that the events found in MK-A and MK-D were the result of domestic activities, including cooking fires fuelled with dung and wood, and the likely burning of the accumulated garbage from daily meals.

The representation of paleoethnobotanical remains related to food consumption at Mollo Kontu is similar to those for the Late Formative site of Kala Uyuni, on the Taraco peninsula, particularly with the presence of tubers, quinoa and cactus.[89] These local foods were also staples in the Middle Formative period (Bruno 2008: 455). Although three maize fragments were found in the

[89] See Bruno 2008, Chapter 10, for detailed data and interpretations.

Late Formative contexts at Kala Uyuni (Bruno 2008: 456-457), these quantities are drastically smaller than that found in the Tiwanaku period at Mollo Kontu, corroborating that sustained maize consumption only dates to the Tiwanaku period in this area of the altiplano (see also Berryman 2010; Wright et al. 2003). Therefore, plant consumption by Mollo Kontu residents follows broadly the local diet of the previous time periods. Molle remains a species unique to the Mollo Kontu contexts for now. Ultimately, the plant food analysis suggests the people of Mollo Kontu kept a long-standing altiplano diet, save for the introduction of maize. However, as the following section shows, the high presence of, and access to, maize does not necessarily correlate with the high *consumption* of maize.

Bioarchaeology

Bioarchaeological analyses can provide direct evidence for food consumption in individuals. Recent research done by Carrie-Anne Berryman (2010) on the Mollo Kontu human remains uses dental health and within-bone isotope ratios to explore individual food consumption and its relation to the broader political economy. Comparing individuals from MK-A to individuals from other sectors of the city, Berryman (2010: 195, 235) argues that the diet of Mollo Kontu residents was distinct from that of other neighbourhoods.

Frequency data from dental wear and pathologies (e.g. caries and abscesses) indirectly suggests whether individuals took part in a pure agriculturalist economy, an agro-pastoral economy, or a pastoral/hunter-gatherer economy. Agriculturalists who feed mostly on plant carbohydrates will have the highest frequencies of dental problems, while those who eat mostly meat will have the least. The caries rate for individuals buried in MK-A were significantly lower than any other group in the city, a rate seen usually in hunter-gatherer groups. This leads Berryman to suggest that the Mollo Kontu inhabitants could have been pastoralists (Berryman 2010: 195). However, individuals from the mound area of Mollo Kontu (MK-M) had dental caries rates in the range for pure agriculturalists, similar to individuals from the Putuni, Akapana East and La Karaña.[90] This suggests significant consumption of plant carbohydrates, which may have included maize.

Calculations of stable carbon and nitrogen isotope ratios found within individual's bones indicate the type of food resources consumed by these individuals. There are recognizable ratios for different food resources known to be consumed on the altiplano: C4 ratios represent maize or fish consumption, while C3 presence indicates tuber, quinoa, and meat consumption. Though these carbon and nitrogen ratios are related to plant photosynthesis, animals that consume those plants, including humans, will also show these ratios in their bones. Certain nitrogen isotope levels indicate how much meat was consumed.[91] The data clusters by sectors, suggesting that individuals within neighbourhoods share a similar broad diet, one that is distinct in some ways from the diets of individuals from neighbouring sectors. This gives weight to the argument that daily cuisine could express distinct neighborhood identities.

Isotopic results for the individuals interred in MK-A suggest elevated meat consumption when compared to individuals from other urban sectors (Berryman 2010: 236); the difference is significant between those of Mollo Kontu

[90] La Karaña is a small excavated sector located in the civic-ceremonial center.
[91] See Berryman (2010: 124-134) for a detailed discussion of stable carbon and nitrogen isotope methodologies.

and the bodies found in the Akapana who display the highest ratio of maize consumption (Berryman 2010: 234). The diet of individuals from MK-M consisted of 56.9 ± 10% C4 enriched resources, with nitrogen data indicating most of these resources were protein deficient (i.e. maize, not fish). This nitrogen data also points to the greater consumption of meat for these individuals when compared to those buried in the Akapana. The data from burials in MK-A, however, shows these individuals' diet was significantly different from the diet of inhabitants of the other sectors, including MK-M. Specifically noteworthy is the low contribution of C4 plants to their diet, at 27.1 ± 10%, the bulk of which was protein depleted (Berryman 2010: 236). Their diet shows a greater dependence on C3 crops and terrestrial herbivores than in other sectors of the site, showing similarities only with the three individuals analysed from Ch'iji Jawira (ibid.).

Combining the dental health data that suggests a pastoralist/hunter-gatherer diet, and the higher consumption levels of terrestrial herbivores, Berryman (2010: 286) argues that the inhabitants of Mollo Kontu were likely pastoralists uninvolved in agriculture. The diet of the MK-A residents was distinct from that of neighbouring sectors of the city, with a strong emphasis on meat consumption, and a low consumption of maize. This is particularly interesting in light of the paleoethnobotanical results that show a strong presence of maize at MK-A and MK-D. Clearly, maize was available, but not consumed.

Ceramics: Serving, Cooking and Storing Food

So far in this dissertation, cuisine has been investigated through the chaine opératoire of meat acquisition, preparation and discard, along with the contribution of fish and plants as evidenced through both their remains and bioarchaeological markers left in human remains. Another side to cuisine is the importance given to the material culture used to prepare, store and serve food. The proper *culinary equipment* (see Bray 2003) is needed for the preparation of desired dishes as well as for the presentation of the meals. Culinary equipment also speaks to manners and etiquette, which are integral to eating as a social activity. At Tiwanaku, these aspects are better studied through the analysis of ceramic assemblages. However, it is probable that part of the material culture of Tiwanaku cuisine was made of wood or basketry, which would not survive in the archaeological record.

Interpretations for the use of certain ceramic forms at Tiwanaku come from ethnohistorical records addressing Inka cuisine, along with ethnographic analogy, and deductions based on form and such correlates as the presence of burning on the exterior or interior of particular ceramic vessels. Ollas, for example, are presented in both Inka and Tiwanaku contexts as cooking pots, and will usually present burn marks on the exterior surface of their base.

The ceramic data from Mollo Kontu was identified, counted and weighed by Nicole Couture, C. Wesley Mattox, and Jonah Augustine. It is presented here to illustrate this discussion on the culinary function of Tiwanaku ceramics and their role in Mollo Kontu and Tiwanaku cuisine. Though the members of the Proyecto Jach'a Marka mentioned above catalogued each type into detailed subcategories of ceramic wares, simplified categories are used for the purposes of the present research. Table 7-1 presents the ceramic data for all occupation levels at MK-A and MK-D in terms of cooking (ollas), storage (tinajas), serving (keros, tazons, escudillas, cuencos, vasijas, and wide-mouthed jars), and ceremonial (sahumadores and incensarios) wares. The latter category is not directly related to culinary practices, although the greater presence of ceremonial ware would be a correlate for food events of a ceremonial nature.

At the time of the Conquest, ollas were round cooking pots used specifically for the preparation of stews, whereas keros, vasijas, and tinajas were associated with chicha production, storage, serving and consumption (Bray 2003: 9). The same function is given to similar types of vessels at Tiwanaku.[92] Ollas, tinajas, and vasijas, for example, could be used for both serving and storage purposes, on top of the cooking purpose of ollas. However, in the present ceramic analysis, the storage category only includes tinajas since storage was their primary function. Vasijas and wide-mouthed jars were serving vessels used for pouring liquids into keros (a drinking goblet), or perhaps into tazons. Tazons are deep, but relatively small bowls with flared rims and a shape similar to that of the keros. They were likely used to contain individual meal portions, although their shape is adequate to hold any liquids. As such, it is possible that this was a multi-purpose vessel for both drinks and food in the context of everyday consumption. Cuencos are another type of bowl that was not used often in Tiwanaku, but that was more popular in the Late Formative period (Janusek 2003a: 66). Escudillas are a type of shallow plate with a wide

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[92] For a detailed description of the ceramic ware found at Tiwanaku, and their function, see Janusek 2003a.

flaring rim, found in large quantities at the Putuni palace, and rare in other areas.

	Occupation I A		Occupation II A		Occupation III A		Occupation IV A	
	N	%	N	%	N	%	N	%
Cooking	57	67.1	176	60.5	69	60.5	57	24.6
Storage	10	11.8	51	24.6	28	17.5	76	32.8
Serving	16	18.8	53	13.2	15	18.2	94	40.5
Ceremonial	2	2.4	11	1.8	2	3.8	5	2.2
Totals	85	100.0	291	100.0	114	100.0	232	100.0

	Occupation I/II D		Occupation III D		Occupation III/IV D		Occupation IV D	
	N	%	N	%	N	%	N	%
Cooking	826	43.6	790	37.2	34	31.8	333	35.1
Storage	538	28.3	652	30.7	35	32.7	294	31.0
Serving	481	25.4	603	28.4	34	31.8	303	31.9
Ceremonial	49	2.6	77	3.6	4	3.7	19	2.0
Totals	1894	100.0	2122	100.0	107	100.0	949	100.0

Table 7-1: Comparison of MK-A and MK-D ceramic assemblages per occupation levels (ceramic identification and counts provided by Nicole Couture, C. Wesley Mattox, and Jonah Augustine).

The following sections present broad interpretations of ceramic data in terms of what information these wares can provide on cooking, serving and eating, and storage of food and drinks at Mollo Kontu. The ceramic data for MK-A is limited to the pits used in my faunal analysis. The data from MK-D is an amalgamation of many contexts, all pits and hearths, including all events used in the faunal analysis. Following the discussion of Mollo Kontu ceramic assemblages as culinary equipment, ceramic data from the various excavations of the Proyecto Wila Jawira are used to evaluate how Mollo Kontu differs from, and is similar to, other areas around the urban center.

Cooking

The percentages presented in Table 7-1 for cooking wares in the different occupation levels of MK-A and MK-D reinforce the argument that MK-A was not a dedicated mortuary area but rather was part of a domestic context; the three latest occupation levels for MK-A, for example, show high concentrations of cooking ware (over 60% of the total ceramic assemblages). These percentages are in fact much higher than those found in MK-D, the residential area. Since we did not delineate much architectural features or spatial patterning at MK-A, it is difficult to posit its function exactly, but it is likely that it was situated close to a kitchen area, even though the density of bone fragments in MK-A is lower than MK-D. The ratios of cooking ware to other types of vessels at MK-D are very similar from one occupation level to another. In fact, the total ceramic type ratios for MK-D are practically equivalent, suggesting that these pits represent a stable domestic refuse accumulation. Households using MK-D for refuse disposal partook in cooking, storage and consumption, without emphasizing one activity over another.

Although they vary in shape, and in the presence or absence of handles, ollas from the Tiwanaku period consistently have rim diameters between 10 and 20 cm (Janusek 2003a: 57-58). This suggests that if meat was cooked with the bone still in it, a likely scenario as bone grease and marrow add flavour to broths, bone elements would have to be broken up into smaller pieces for easy removal from these rather constricted olla mouths. This, of course, assumes that most meals at Mollo Kontu took the form of stews or soups. Since the olla is the only "cooking implement" found at Mollo Kontu, and in most of

Tiwanaku's ceramic assemblages,[93] this assumption seems likely. Its deep shape and constricted mouth makes it a good candidate for stew and soup preparations, rather than roasting or frying. The high fragmentation levels of faunal material at Mollo Kontu further suggest that bone and grease extraction, as well as small portions of meat, were required for the standard Tiwanaku meal.

Serving and Eating

An analysis of serving vessels can further our understanding of food preparation, food and drink consumption and serving etiquette. For example, bone fragment size is not only constrained by the restricted mouths of the cooking pots; the bowls (tazons) used for eating individual meal portions are also fairly small, albeit deep, which precludes the consumption of large slabs of meat. The data for serving vessels can be further subdivided into broad categories (see Table 7-2) to allow for more in-depth analysis of an important component of cuisine, eating etiquette. This aspect of cuisine cannot be easily gleaned through an analysis of the food items *per se* (i.e. through zooarchaeology, paleoethnobotany or bioarchaeological analyses) but rather through a study of ceramics as culinary equipment.

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[93] Note that rare large roasting or frying platters have been found in Akapana East (Janusek 2003a: 58).

	Occupation I A		Occupation II A		Occupation III A		Occupation IV A	
	N	%	N	%	N	%	N	%
Keros	1	6.3	8	15.1	5	33.3	46	48.9
kero/tazon	0	0.0	11	20.8	0	0.0	17	18.1
Tazon	0	0.0	21	39.6	3	20.0	26	27.7
Escudilla	0	0.0	4	7.5	0	0.0	0	0.0
Cuenco	0	0.0	2	3.8	0	0.0	2	2.1
Vasija	15	93.8	7	13.2	3	20.0	3	3.2
Wide-mouthed jar	0	0.0	0	0.0	4	26.7	0	0.0
Totals	16	100.0	53	100.0	15	100.0	94	100.0

	Occupation I/II D		Occupation III D		Occupation III/IV D		Occupation IV D	
	N	%	N	%	N	%	N	%
Keros	98	20.4	99	16.6	3	8.8	45	14.9
kero/tazon	125	26.0	101	16.9	20	58.8	103	34.1
Tazon	134	27.9	274	45.9	6	17.6	69	22.8
Escudilla	7	1.5	14	2.3	0	0.0	5	1.7
Cuenco	16	3.3	17	2.8	0	0.0	5	1.7
Vasija	78	16.2	89	14.9	5	14.7	69	22.8
Wide-mouthed jar	23	4.8	3	0.5	0	0.0	6	2.0
Totals	481	100.0	597	100.0	34	100.0	302	100.0

Table 7-2: Comparison of MK-A and MK-D serving ware assemblages per occupation levels (ceramic identification and counts provided by Nicole Couture, C. Wesley Mattox, and Jonah Augustine).

In his ethnoarchaeological work, Miller (1979: 70) notes that most meals he observed consisted of boiled meat and potatoes in a thin broth drunk directly from the bowl (though sometimes using spoons). The meat and potatoes were eaten using fingers. The tazon is perfectly suited to this type of meal, as opposed to eating large slabs of roasted meat for example. The bowl shape and small rim diameter of the tazon, between 12 and 18 cm (Janusek 2003a: 63), suggest portions of soups and stews. If the stews and soups included small cuts of meat with bones still attached, it is possible that the meat was chewed off the bone and the bone fragment was then tossed aside, perhaps in a nearby hearth, garbage pit, or on the floors. No floor surfaces were identified at Mollo Kontu, only fill episodes, thus it is not possible to know whether floors were relatively clean or pockmarked with bone fragments. It should be remembered, however, that certain meals may have required deboned meat, thus larger fragments identified in archaeological assemblages could be have been discarded during meal preparation. A large defleshed bone could also have been added to the pot to flavour the broth.

The wares used to consume individual servings of a meal or drink, that is, keros and tazons, make up approximately 80% of the serving ware at Mollo Kontu, except in the case of Occupation I and Occupation III for MK-A, where jars are predominant. It is difficult to compare the relative importance of keros and tazons as these vessels, once fragmented, share a similar form and paste, and thus can be indistinguishable from one another (see the kero/tazon category). Many questions also remain with respect to the use of these vessels; that is, are keros used only for drinking chicha, and if so, does chicha accompany every meal as part of the Tiwanaku daily experience? Are tazons used in the context of daily consumption as both drinking glass and plate for the meal? An equal or higher representation of keros over tazons could suggest the importance of a particular drinking etiquette. That is, it could suggest that drinking chicha (perhaps made of a local cultigen) was a necessary part of a typical meal. On the other hand, high presence of keros in domestic contexts can suggest that Tiwanaku drinking etiquette required the use of this particular equipment rather than the use of any other utilitarian ware available such as a tazon.

Escudillas are rare at Mollo Kontu; this is unsurprising as they are a type most frequently associated with the elites of the Putuni palace (see Table 7-1). Couture (2004: 135) argues that the broad flaring rims of escudillas signal the need for a certain degree of finesse in order to eat elegantly out of them. This signals the user's higher status through the demonstration of his or her mastery of proper eating etiquette. Though they are mainly associated with elites, escudillas are present in low numbers in three out of four occupation levels at MK-D, as well as in one occupation level at MK-A. This could suggest a certain degree of elite emulation, or that certain individuals or households were privy to the special etiquette knowledge required to use these vessels properly.

In terms of serving jars, that is, both vasijas and wide-mouthed jars, their representation is low within the serving categories. It seems likely that for daily consumption, cups or bowls would have been filled by pouring, or cupping, liquid straight from tinajas. Yet the presence of vasijas within the domestic range of ceramic serving ware indicates that in certain instances, emphasis was put on a more manageable or even delicate way of pouring drinks than the often large, and presumably unwieldy, tinajas. It is also possible that low representation is the result of being less easily identifiable to the vessel when fragmented, which would make them appear less important than they actually were. In either case, the use of vasijas and wide-mouthed jars suggests an extra step, in certain or all instances, when pouring liquid from the storage jars to the drinking ware.

Storage

Tinajas were not only used to store liquids such as chicha and water; they also potentially stored chuño and grains, and were further used in the chicha fermentation process. It is also likely that ollas served a storage function as well. The percentages of storage vessels for the four occupation levels in MK-D are very similar, at around 30% of the total ceramic assemblages. The results for MK-A are more variable, but within the 20% range ± 10%. Until we have more information on what these tinajas contained, whether they more commonly held liquids or grains for example, interpretations of their presence remain very tentative. However, the presence of tinajas reveals that the residents of Mollo Kontu kept stores of foodstuff within their households. That is, they were not living on a day-to-day subsistence level. To date, no large storage areas have been found at Tiwanaku that could suggest state stockpiling for redistribution. The foodstuffs consumed and stored by Mollo Kontu residents could be acquired through some degree of state redistribution, but the storage data coupled with the results of the zooarchaeological analysis presented in Chapter 6 suggest that households, or supra-households, could sustain themselves and create surplus through independent means, either through ownership or direct exchange with producers.

Ceremonial Wares

There is no indication of whether ceremonial wares were part of rituals involving food and/or drink consumption at Mollo Kontu. However, the presence of some ceremonial ware fragments within garbage pits suggests two broad trends in garbage disposal at Mollo Kontu. First, their presence in most garbage pits, commingled with refuse from domestic practices such as cooking and bone tool manufacture, suggests that the content of these pits do not represent a single event, but are more likely representative of the slow accumulation of refuse from a variety of daily activities. These daily activities may have included intimate household rituals. The presence of ceremonial ceramics may also indicate that within the daily trash were mixed in remains of more formal rituals. The presence of ceremonial ceramic vessels within the refuse of daily activities also demonstrates that these ceremonial objects did not require a special disposal, distinct from the discard of common household goods. That is, there is no evidence for 'ceremonial trash' (see Walker 1995) at Mollo Kontu. These objects were perhaps set apart during their use life, but became common trash once unusable.

Comparison with Other Tiwanaku Areas

In order to assess patterns that are broadly shared within Tiwanaku, and those that may point to neighbourhood-specific practices, the aggregated ceramic assemblages from both MK-D and MK-A are compared to the ceramic assemblages from other areas of the urban center, for both Tiwanaku IV and Tiwanaku V periods (see Table 7-3). Overall, the representation of different vessels by assumed function within the Mollo Kontu (MK) assemblage is similar to most other areas. However, two areas show unusual trends; the Putuni has a higher representation of ceremonial vessels, and Ch'iji Jawira (CJ) has a very high percentage of storage vessels compared to cooking ware. Cooking vessels represent between 30 to 50% of all ceramic fragments identified in most areas of the site, save for Akapana East 2, which has a slightly higher representation and Ch'iji Jawira, which has a very low ratio of cooking vessels compared to serving and storage ones. Interpretations for these deviations from the norm at

Tiwanaku are beyond the scope of this dissertation. However, it should be noted that Mollo Kontu ceramic assemblages correspond very well to a general view of Tiwanaku ceramic assemblages per residential areas. Cooking, serving and storing foods and drinks were an integral part of daily life at Mollo Kontu, just as these processes were at the elite area Putuni. Although this is hardly surprising for residential areas, it bears reminding that food at Tiwanaku was not only related to feasting events; a study of foodways also informs us on the minutia of daily life.

The percentage count of serving vessel types throughout Tiwanaku (see Table 7-4) demonstrates disparities in the ware used between neighbourhoods. In particular, Putuni residents' serving paraphernalia was more varied than that of residents of lower status areas, such as Mollo Kontu. Specifically, the distribution of escudillas, found overwhelmingly in the Putuni area, suggests that elites differentiated themselves from lower status groups through the use of this vessel type (Couture 2002, 2004; Couture and Sampeck 2003). The use of escudillas requires knowledge of proper etiquette (Couture 2004), but it is not yet known whether escudillas required a different type of meal preparation and presentation. Isotopic data by Berryman (2010) suggest that individuals buried in Putuni ate the same ingredients as other Tiwanaku residents; they simply ate more maize and meat than most residents of other areas.

In areas where the serving vessels were not as diverse, vessels such as tazons may have been used in a more multi-purpose way, holding a variety of dishes, and possibly drink. The ratio of keros within the serving ware category at Mollo Kontu is somewhat lower than those of other areas of the site, though it should be noted that the kero/tazon category is much larger at Mollo Kontu.

Whether this is a reflection of the analysts' prudence when identifying fragments of these similarly shaped vessels with identical pastes, or whether this is a reflection of greater fragmentation levels of ceramics at Mollo Kontu, effectively erasing diagnostic features of both types, it is likely that the pre-deposition presence of both keros and tazons was greater than suggested by Table 7-4. Overall, 80% of the serving ware was composed of plates, bowls and goblets for individual diners. At least 20% of these serving wares were keros, a ratio similar to those of other sectors. If people of Mollo Kontu used and broke keros at the same relative magnitude as residents of other areas, yet consumed significantly less maize than them,[94] it appears that this disparity might represent the consumption of a different type of drink, perhaps ch'ua (a quinoa chicha) or another beer made of local staples.

	MK		Putuni		MK-S		AKE 1M		AKE 2		CJ*	
	N	%	N	%	N	%	N	%	N	%	N	%
cooking	2342	40.4	8964	32.0	1220	47.4	3312	46.0	10409	57.5	1992	9.9
storage	1684	29.1	9021	32.2	724	28.1	2306	32.0	4473	24.7	13094	65.2
serving	1599	27.6	6090	21.7	419	16.3	1302	18.1	2864	15.8	4962	24.7
ceremonial	169	2.9	3945	14.1	210	8.2	277	3.8	351	1.9	23	0.1
Totals	5794	100.0	28020	100.0	2573	100.0	7197	100.0	18097	100.0	20071	100.0

** Counts for Chiji Jawira are only for Tiw IV*

Table 7-3: Comparison of Mollo Kontu ceramic assemblages with other areas of Tiwanaku (data for Putuni, Mollo Kontu South, Akapana East 1 Mount, Akapana East 2 and Ch'iji Jawira from Couture 2002: Tables 5.7 and 6.5).

[94] As discussed previously in the bioarchaeology section through the work of Berryman (2010).

	MK		Putuni		MK-S		AKE 1M		AKE 2		CJ*	
	N	%	N	%	N	%	N	%	N	%	N	%
Keros	305	19.6	1523	25.9	160	35.8	281	17.4	856	30.4	1628	33.6
kero/tazon**	377	24.2	89	1.5	17	3.8						
Tazon	533	34.3	1279	21.7	82	18.3	832	51.4	1166	41.4	2505	51.7
Escudilla	30	1.9	1660	28.2	19	4.3	172	10.6	194	6.9	0	0.0
Cuenco	42	2.7	424	7.2	14	3.1	37	2.3	104	3.7	148	3.1
Vasija	269	17.3	910	15.5	155	34.7	296	18.3	494	17.6	566	11.7
Totals	1556	100.0	5885	100.0	447	100.0	1618	100.0	2814	100.0	4847	100.0

** Counts for Chij'i Jawira are only for Tiw IV*
*** Counts for kero/tazon were only provided for Tiw IV assemblages*

Table 7-4: Comparison of Mollo Kontu serving ware assemblages with other areas of Tiwanaku (data for Putuni, Mollo Kontu South, Akapana East 1 Mount, Akapana East 2 and Ch'iji Jawira from Couture 2002: Tables 5.8 and 6.6).

Cuisine at Mollo Kontu

Results from the analysis of food correlates at Mollo Kontu reinforce the importance of the ingestion of local staples, emphasize the domestic nature of garbage pit contents, and suggest that the drink consumed likely included non-maize chicha. Fish consumption is limited to the two most common species from the area. The presence of charred fish bones suggests post-consumption burning, possibly as part of the discard practices. Plant remains also emphasize local foodstuff, with the caveat of a strong presence of maize throughout all assemblages. Local plants consumed include chenopods and tubers, but also local cacti. Finally, a connection with the lowland suggested by the ubiquity of maize is reinforced by the presence of molle in one garbage pit. Exotic foodstuff may have been present within the paleoethnobotanical remains, but isotopic analysis of skeletons from MK-A reveal that Mollo Kontu residents ate very little maize compared to other urban residents. That is, though they had access to maize, they did not consume it regularly.

Bioarchaeological analyses of diet markers on skeletons from throughout the urban center demonstrate that diets of residents were similar within neighbourhood, but distinct in certain ways from one area to another. The diet of Mollo Kontu residents emphasized meat consumption over the high consumption of agricultural staples. In fact, dental health data and isotopic results suggest Mollo Kontu residents may have been pastoralists, uninvolved in intensive agricultural pursuits. Finally, the ceramic data from Mollo Kontu reinforces the domestic affiliation of both MK-D and MK-A. In fact, MK-A presents a high proportion of cooking ware versus serving ware. As such, MK-A may have been an outdoor area close to a kitchen. The ceramic data also shows a significant presence of keros within the Mollo Kontu assemblages. Keros are ubiquitous in Tiwanaku contexts as part of the Tiwanaku chicha complex. That is, they are commonly associated with the consumption of maize chicha. However, the low maize consumption indicated by bioarchaeological markers suggests that the presence of keros in an archaeological context may not necessarily equate maize chicha consumption.

CHAPTER 8: DISCUSSIONS AND CONCLUSIONS: EATING TIWANAKU

This final chapter brings together the archaeological data presented in this dissertation and in previous research on Tiwanaku foodstuff and culinary practices, to form a vision of the choices and preferences expressed in daily life at Tiwanaku through the lens of cuisine. This discussion presents three interlinking sets of arguments that build upon each other to disentangle the role of maize, camelid, feasting and daily consumption in identity formation and maintenance at Tiwanaku. First, data from previous faunal analysis using a greater temporal and geographic focus are compared to the faunal analysis in this dissertation in order to test whether the patterns identified in the Mollo Kontu assemblages are unique to the area, or shared more broadly. Furthermore, the zooarchaeological data are combined with bioarchaeological data for the Titicaca Basin area, and it is suggested that the increase in camelid pastoralism in certain Late Formative period sites is linked to an increase in monumental construction, as well as to the introduction of maize into the diet. Following this, an argument for the social value of camelids is presented, which links the consumption of socially valued camelids to a sense of local belonging for the cook and consumer. Finally, Mollo Kontu culinary practices as gleaned from the results of varied archaeological data are discussed within the context of the negotiation of a broad Tiwanaku identity and a more privately expressed local identity. That is, it is suggested that Mollo Kontu residents used camelid ownership and a manipulation of Tiwanaku hospitality etiquette to manifest a certain distinction from the cosmopolitan nature of Tiwanaku.

Camelids in a Temporal and Regional Perspective

The data from Mollo Kontu demonstrates that its residents consumed nearly exclusively camelid meat. Though a certain degree of specialization in camelid herding is suggested by the preponderance of juvenile animals consumed (from 1.5 to 3 years of age), there is evidence for variable pastoral strategies within the Mollo Kontu faunal record. Certain animals were much older than the standard and could have been used as pack animals. This is further suggested by the tally of pathologies found on camelid bones. In addition, the strong presence of young animals less than a year old suggests the possibility that residents were themselves pastoralists who may have exploited the by-products of very young animals that did not survive their first year, or at least discarded their remains within the residential compound trash pits. In particular, the presence of a fully articulated 5 month old camelid deposited at the base of a common trash pit without consumption or evidence for ritual interment suggests that Mollo Kontu residents had access to, and disposed of weak and possibly diseased crias.

To test whether some of these trends are unique to Mollo Kontu, or whether they represent broader geographical and temporal Tiwanaku production and consumption patterns, the Mollo Kontu data is compared with data from two previous zooarchaeological studies performed on faunal remains from Tiwanaku sites: Webster's analysis of fauna from the urban center of Tiwanaku and surrounding sites (A. Webster 1993; A. Webster and Janusek 2003), and Park's zooarchaeological analysis at Iwawi (Park 2001). The broad contours of these arguments as they relate to Tiwanaku's political economy have been presented in the second chapter. The present section focuses instead on an assessment and reinterpretation of the zooarchaeological data, whenever comparable.

The data presented by both of these researchers presents a greater time-depth than that found at Mollo Kontu, which allows for the discussion of longer-term trends. Among these trends is the steady increase by altiplano residents in reliance on domesticated camelids as meat sources. It should be first noted, however, that comparisons between the data from these multiple analysts are complicated by the use of different quantification methods and by an analytical focus on varied contexts. For example, the data presented by Webster for the Tiwanaku periods is only available in derived measurements (MNI) and integrates faunal remains from three sectors of the urban center of Tiwanaku (Putuni, AKE1 and AKE2). The exact contexts of these assemblages are unknown (that is, whether the faunal remains analysed were from garbage pits, floors, offerings, or fills). Furthermore, the excavated and analysed sectors from the Tiwanaku urban center straddle the division between the civic-ceremonial core and its surrounding, broadly residential sector.[95] Therefore the data collected by Webster from Tiwanaku *per se* cannot be used to assess intra-site differences between neighbourhoods. As for Park (2001), she uses NISP as a quantification method, and focuses on excavated material from numerous occupation levels on a natural mound devoid of much architectural remains, and representing roughly 1000 years of domestic occupation.

The abundance of camelid remains in the faunal assemblages of Mollo Kontu over other species is echoed in the species distribution presented in

[95] See Chapter 3. AKE1 and Putuni are situated within the civic-ceremonial core of the center, while AKE2 is situated a little outside of this area.

Webster's study of Tiwanaku and its surroundings, and in Park's (2001) research at the site of Iwawi. However, the ratios of species are not as pronounced. Webster notes that species diversity decreased from the Formative Period to Tiwanaku times, although camelids were always present in good quantities, even during the Formative Period (A. Webster 1993; Webster and Janusek 2003). In Early and Middle Formative contexts, small mammals such as viscachas and guinea pigs were present in greater proportions than camelids (Webster and Janusek 2003: 344-345). Starting in the Late Formative Period, camelids became the dominant species, while small mammals decreased in representation but remained more important than cervids. The dominance of camelids continued into the Tiwanaku period.

In the case of Iwawi, the species breadth increased during the Tiwanaku Period, though this is also linked to an increased reliance on camelids compared to previous periods (Park 2001). Comparison of species representation needs to be done carefully in this case, since Park's ratios for species representation include fish remains, unlike the species representation data presented in this dissertation as well as Webster's zooarchaeological analyses. Fish and camelids are invariably the two most dominant species through time at Iwawi, with mammals such as deer and dogs, amphibians, rodents and birds rounding up the species list (Park 2001: 52). Camelids were consistently part of the altiplano diet in the Formative and Tiwanaku Periods at Iwawi, as is also suggested by Webster's data. In terms of camelid species, the majority of all camelid remains analysed by Park (2001), Webster (1993; Webster and Janusek 2003b) and those presented here, belong to Kent's (1982) 'Large Camelid' category. That is, they conform to the modern llama size range. Incisor morphology from both of the previous studies suggests the presence of vicuñas, unlike what is found in the Mollo Kontu assemblages. In sum, the diacritical trends in species representation for both Park's and Webster's studies suggest an increase in the reliance on camelids from the Formative Period into the Tiwanaku Period, in both the urban center and the surrounding region. Nonetheless, in both cases the species breadth suggests a wider exploitation of the varied animal sources of the altiplano than what is seen in the Mollo Kontu data.

The identification of camelid acquisition method for Mollo Kontu relies greatly on mortality profiles. The data suggest an emphasis on the consumption of juvenile animals of 3 years old or less. This emphasis could be interpreted as the result of specialization in herding strategies, and an indirect redistribution through a state apparatus. However, variability in age profiles, especially in the presence of animals less than a year old and over 7 years old, suggest a more direct type of distribution from the producer to the consumer, and the possibility that Mollo Kontu was a producer site (i.e. that its residents cared for their own camelid herds). Data from Webster and Park suggest that the variability in age representation may have been a common pattern through time and space. However, their aging methods differ from one another, and from the method used at Mollo Kontu. Webster uses crown height to determine age, while Park uses tooth eruption and wear data to create mortality patterns. Fusion times of skeletal elements, for example, were not used to explore age-at-death in these studies.

The age profile data for Iwawi, like that of Mollo Kontu, emphasizes young animals. However, the Iwawi fauna has more neonatal individuals. In fact, 67% of the mandibles used to create the age-at-death profiles came from animals 9 months or younger (Park 2001: 92). Note that the use of mandible for the creation of mortality profiles could lead to the under-representation of juveniles and adults, since their mandibles are usually favoured for the manufacture of mandible tools. In fact, 19.5% of all mandibles recovered at Iwawi were worked (Park 2001: 116). It seems likely that the mandibles of juvenile and adult animals would have been curated for making these tools, thus effectively removing a strong sample of this age group from the Iwawi mortality profiles.

Webster (1993: 218) presents the age data for Tiwanaku, Lukurmata, and its hinterland in percentages of life span. The most often represented age group at Tiwanaku and hinterland sites is the 10% life span (i.e. 0 to 1.5 year old), followed by the 20% life span (i.e. 1.5 to 3 years old). All other life span categories have low representation, with the oldest specimens belonging to the 70% life span category (i.e. 9.5 to 11 years old). The Tiwanaku age data aggregates the fauna from Putuni, AKE, and AKE2 in such a way that intra-site comparison in age group distribution is not possible. Webster uses the representation of animals in the 20% category as an indicator of standardization in camelid herding, and thus of specialization and centralized distribution. The strong representation of juvenile animals is similar to the patterns found at Mollo Kontu, yet at Mollo Kontu the presence of crias and mature animals was interpreted as the result of direct distribution, likely through direct herd ownership. The data presented by Webster is not easily comparable to see similar patterns in age profile, as the life span categorization does not allow for a detailed look at the presence of very young animals that may indicate access to a producer site. However, these data do demonstrate that sectors of

Tiwanaku other than Mollo Kontu consumed animals that were kept alive longer to provide their by-products. In sum, based on the presence of very young animals, it is likely that Iwawi was a camelid producer site. That is, the residents of Iwawi, like those of Mollo Kontu, likely herded camelids. However, the low representation of juveniles and adults at Iwawi leaves doubts as to whether these producers participated in direct or indirect exchange of animals, or whether the herding strategy was to cull animals before they reached the end of their first year. Data from Tiwanaku and its hinterland suggest a greater consumption of animals between the ages of 1.5 to 3 years old, a pattern similar to that of Mollo Kontu.

In all three analyses, mature animals were also recovered. These animals would have likely been kept alive longer for reproductive purposes, but it is also possible that they would have been involved in caravan trade. Pathologies recognized on the Mollo Kontu fauna raises the possibility of use as pack animals, with these pathologies located on the lower legs and the vertebral column and rib heads. Though the tally of pathological specimens found at Mollo Kontu (n=24 out of 18 500 specimens, or 0.1% of the total assemblage) is low, it is quite similar to those recorded by Webster (n=26 out of 12 000 specimens,[96] or 0.2% of the total assemblage) (1993: 248-258). Webster's faunal specimens display higher incidences of pathologies on joints, including exostoses on the articular surfaces of first phalanges, a pathology not seen in Mollo Kontu. Furthermore, there are no signs of infections, while two were

[96] The estimate of roughly 12 000 bone specimens analysed by Webster comes from Webster and Janusek (2003: 344). Since this more recent publication is based on Webster's (1993) doctoral work, it is assumed to relate to the same dataset. A total n or NISP tally is not published in Webster (1993) as her dissertation work uses MNI counts.

recorded in our assemblages. Osteoarthritis cases are more pronounced and the ribs in Webster's sample are marred with pathologies, though in fewer incidences than those found at Mollo Kontu. The small number of pathological specimens precluded strong temporal and geographical distinctions (Webster 1993: 249).

The analysis of pathological specimens from Iwawi is not drastically different from either Webster's (1993), or the present pathological analysis. Though Park analysed a greater sample of pathological specimens at Iwawi (n=70), the percentage of pathological specimens within the total assemblage is situated somewhere between the two other studies at less than 0.2% of the total assemblage (2001: 102). The high presence of 'stress related' pathologies, including exostoses and porosity on limb elements, rib heads and vertebrae leads Park (2001) to conclude that the animals consumed were used as pack animals. The same suggestion has been made in this dissertation as well as in Webster's analyses. Although the aetiology for these pathologies remains uncertain, and the use of camelids as pack animals cannot be confirmed, the presence of pathologies in similar ratios relative to total assemblage counts in all three zooarchaeological studies suggests at least that camelids were cared for and kept alive once hurt, instead of being culled before they lost too much weight and became less attractive for consumption.

The skeletal part frequencies from Mollo Kontu were used in this dissertation to argue that animals arrived complete, and likely alive, within the residential compounds of Mollo Kontu. Comparisons with Park and Webster's data are done cautiously as these studies use different quantification methods. Webster (1993: 138) argues that in Tiwanaku IV and V, the residents of these

Tiwanaku sites were being provisioned in whole limb meat packets, based on the low representation of axial elements, mainly mandibles, scapulae and innominate. The Formative Period skeletal element representation is similar, but with a lower frequency of fore leg elements. Ultimately, most elements are present within Formative and Tiwanaku Period sites, both within the hinterland and the urban center.

Using NISP as a quantification method, Park (2001: 83) argues that the high representation of lower limb elements at the site indicates that animals arrived there 'on the hoof.' Park uses this evidence, reinforced by other indicators of on-site butchery, to posit that a local autonomous political economy best fits the distribution of camelids at Iwawi. That is, that the Iwawi residents had their own herds, independent from the Tiwanaku state. Park associates the presence of lower limbs to a distribution of camelids 'on the hoof,' while Webster sees their presence as evidence for distribution of whole leg meat packets.

All sites recorded high degrees of fragmentation, which likely influenced the NISP and MNI of these assemblages. To counter the effects of fragmentation on the quantification of elements, I have used %weight and compared them to the ratios for complete skeletons.[97] The %weight data shows a more balanced representation of all elements compared to MAU data for Mollo Kontu. This suggests that disparities in element frequencies using NISP or derived measurements may relate more to high fragmentation rather than the presence or absence of elements within faunal assemblages. Ultimately, comparisons

[97] See Chapter 6 for an explanation of the use of %weight to quantify skeletal part frequencies.

between these assemblages are complex due to quantification issues. It appears that all elements are represented in some proportions for all time periods, both within the urban center and throughout the Tiwanaku hinterland.

Coupled with the age data, the skeletal part frequencies suggest that at least certain areas within, or close to, the civic-ceremonial center of Tiwanaku managed camelid herds, and consumed both prime-age animals and older animals used first for secondary product exploitation. In fact, based on the presence of animals less than a year old, pathological individuals that show signs of having worked in llama caravans, and the mortality profiles of older animals, it could be argued that certain households throughout the Tiwanaku hinterland were engaged in direct distribution of animals. Indeed, households in Mollo Kontu, Iwawi, certain central Tiwanaku neighbourhoods and sites within the Tiwanaku Valley could have acquired their camelids either through exchange with pastoralists or through herd ownership. Furthermore, the meat-producing pastoral management strategies of the Tiwanaku hinterland residents appear unseen in modern Andean ethnographic examples, nor explained in Inka chronicles. It is also possible that more than one system of distribution has created these age and skeletal element profiles; as Zeder demonstrates with her Mesopotamian case study, “in any given urban system, many levels of specialization and control may be operating at once, even within single economic spheres” (2003: 177). That is, in our case, carnivorous pastoralism, herding of camelids for wool and use as cargo animals, and herd ownership at the household levels, do not have to be explained by one system of economic (or political) control, but might instead demonstrate the remarkable plasticity of the Tiwanaku organization.

Broad regional and temporal trends for diet, and particularly meat consumption, are not only accessible through zooarchaeological research. Berryman's (2010) bioarchaeological analyses tested individuals from the Formative and Tiwanaku Periods, throughout the Southern Titicaca Basin. As discussed in Chapter 6, this data suggests that Mollo Kontu had access to meat in much greater quantity than most groups at Tiwanaku and in the hinterland valleys, and had frequencies of dental caries similar to those typically found in hunter-gatherer groups. Berryman suggests that Mollo Kontu residents were uniquely pastoralist in the agro-pastoral and agricultural landscape of the Titicaca Basin. Her diachronic regional comparisons suggest a trend toward increased meat consumption during periods of heightened monumental building construction, both during the Formative Period (as exemplified at Khonkho Wankane) and during the Tiwanaku Period (at Tiwanaku and Lukurmata) (Berryman 2010: 264). That is, meat consumption increased at sites with growing ceremonial centers, suggesting an increased investment in camelid pastoralism (Berryman 2010: 295). Meat consumption decreased at Khonkho Wankane once monumental construction at the site stopped. Of course, isotopic analysis of human remains can only point to meat consumption, and not what type of meat was consumed. Yet these data correlate well with the increased reliance on domesticated camelids seen in the zooarchaeological record of the region (Park 2001; Webster 1993). These lines of inquiry suggest that the rise of monumentalism at the transition from the Formative to the Tiwanaku Periods – an aspect that comes to define Tiwanaku's identity as a capital and pilgrimage center – was not only accompanied by an increase in feasting and the introduction of maize beer within commensal politics, but also by an intensification of pastoralism (see also Janusek 2008: 193-199). Janusek argues that this intensification was a means of coping with the increased demands for food sparked by intensified feasting. I propose that the choice of camelids to respond to growing needs for food in commensal politics emphasized the importance and value of camelids for altiplano inhabitants, and reaffirmed their local food preferences, perhaps to balance out the burgeoning acceptance and desire for non-local maize. Indeed, Berryman's (2010) isotopic results provide evidence for a significant consumption of maize in the Late Formative Period at sites emphasizing monumental construction, such as Khonkho Wankane and Tiwanaku.

Berryman suggests a possible link between pastoralism and increased site status in the altiplano, yet concludes that involvement in pastoralism does not necessarily correspond to a rise in social status for the consumers. Indeed, the groups that show the greatest amount of meat consumption in Tiwanaku times are residents of Mollo Kontu, followed by those of Ch'iji Jawira and Putuni. Inter-neighbourhood status distinctions based on architectural material, cleanliness, and location in relation to the civic-ceremonial center (as discussed in Chapter 3), place Putuni residents as high elites, while residents of Ch'iji Jawira are of low social status; residents of Mollo Kontu are somewhere between the two. As such, meat consumption does not appear to follow status lines at Tiwanaku. This contrasts with the Inka case, where ethnohistorical sources say that meat was a rarely consumed luxury food for commoners (Hastorf 2003; Murra 1956), and therefore a marker of social status.

The rise in camelid representation within Formative Period assemblages, the considerable focus on camelid consumption within Tiwanaku Period sites, and the disparity in meat consumption between different sectors of the Tiwanaku urban center and hinterland, could altogether be interpreted in terms of an intensification of 'traditional' ways of life for certain sectors of Tiwanaku society, rather than in terms of a discussion of status. That is, this intensification could express an altiplano preference in an increasingly cosmopolitan urban environment marked by the introduction of exotic maize, and referencing a time of local regional identity building. This could explain the similar meat consumption ratios between the individuals interred in the Putuni palace and those found in the lower status areas of Mollo Kontu and Ch'iji Jawira.

The Social Value of Camelids

Camelids were not only consumed in domestic settings and commensal politics; camelids and their secondary products were integrated into a wide range of social contexts, including Tiwanaku's ritual life. As such, consuming camelids, even in a domestic setting, need not have been a mundane practice. That is, their value was not tied only to their caloric yield and economic roles; their daily consumption as socially valued animals was meaningful. Such a human-animal relationship interpretive stance was applied to one of the earliest social zooarchaeological analyses, which focused on Polish Neolithic cattle remains. In that case, zooarchaeological material suggested that cattle started out as ideologically important, and then gradually became economically important in feasting settings. The cattle were therefore integrated into the social fabric of these Neolithic groups and provided "metaphors for the creation of the group and its identity" (Marciniak 2005: 203). Similarly, I argue here that camelids were integrated into the social fabric of Tiwanaku life, making their use and consumption meaningful in more than an economic and dietary sense.

The social value of camelids is suggested by their sustained consumption from the Formative Period onward, along with the use of camelid by-products, and their role in Tiwanaku ritual life. Meat consumption was variable between neighbourhoods and unrelated to the residents' social status. The Putuni elites consumed a great amount of meat, as well as the residents from lower status areas such as Mollo Kontu and Ch'iji Jawira. Therefore, camelid meat was a significant part of elite meals, though not an exotic or luxury item. Indeed, meat consumption levels were not dictated by status, but demonstrated distinct tastes and culinary practices. Camelids were also ingrained in other aspects of Tiwanaku life. They provided wool and transportation for goods (including maize); they also provided fuel and fertilizer, raw material for tool making, and leather. Camelids were also integral to Tiwanaku's ritual life, a ritual life that attracted pilgrims and residents from afar. To demonstrate a link between the symbolic importance of camelids and their daily ingestion, their role as important agents in the ritual life of Tiwanaku is first established.

Camelid dedicatory offerings are found within public, ritual, and residential contexts. Furthermore, evidence of commingled camelid remains and broken ceramics used for beer and food consumption within the civic-ceremonial core suggest possible feasting events. One of the most salient examples of camelid dedicatory offerings was the remains of 14 animals found semi-articulated and mixed up with other types of offerings including human remains in a room on top of the Akapana pyramid (Manzanilla 1992). These animals were at the cusp of the juvenile and adult age categories (Manzanilla

1992:59; Webster and Janusek 2003: 360-361), reflecting the age-at-death signature prevalent at Mollo Kontu and in Webster's Tiwanaku assemblages. However, semi-articulation suggests that these camelids were likely not consumed, or if they were, that the carcasses were not exploited to the full extent usually seen in domestic contexts. The camelids offered but not consumed in ritual were 'expensive' dedicatory offerings; an example of conspicuous consumption signalling that these juvenile animals were worthy offerings.

Recent excavations in an open area northeast of the Akapana pyramid revealed another example of a dedicatory offering. In this case, the fully articulated remains of a 3 year old female topped with the disarticulated remains of a 1.5 year old possibly male animal were uncovered (Gardella 2008). The latter disarticulated animal is interpreted as possibly representing the remains of a feasting event discarded in the pit before closing it. Importantly, the remains of both the reproductively viable female camelid sacrifice and the younger disarticulated animal were found comingled with human sacrifices (Verano *et al*. 2006). Other examples of dedicatory offerings of semi-articulated camelids and humans are also found in front of and on the many terraces of the Akapana (Janusek 2008: 118; Manzanilla and Woodard 1990).

Dedicatory offerings of camelids are not only found in public and ritual settings such as the Akapana pyramid and adjacent open spaces; they are also encountered in residential settings. Internments of llama foetuses under house floors were uncovered in the Palace of the Multicolored Rooms in the Putuni complex (Couture 2002: 271) and in AKE1 (Janusek 2008: 195). While the first recorded instance of this practice in the archaeological record dates to the Late

Formative (Janusek 2008: 196), it is still alive in modern-day Bolivia. The importance of camelids as offerings rather than foodstuff in both private and public rituals reinforces the argument that camelids were socially valued animals beyond their economic contributions. Consumption in non-ritual mundane settings does not rob foodstuff of its symbolic importance (e.g. Smith 2006). At Tiwanaku, the meat selected for sacrifices and household consumption is from the same animal, making camelids a good case for interpretations using the daily ingestion of identity through food preferences. The ubiquity of camelid secondary products in daily life, their role in ritual life, and the abundance of camelid bones in household contexts suggest that they were part of Tiwanaku just as much as its residents.

As camelids take a more active role in the ritual and social life of Tiwanaku residents from Formative times, perhaps through a combination of the rise of pastoralism with the intensification of monumental construction at certain sites, camelids come to be associated with the flourishing socio-political and ritual life of the area. Therefore, their increased consumption leads to the ingestion and internalization of a developing regional identity. That is, the intensified reliance on camelids for meat consumption may not correlate uniquely with fulfilling the needs of increased political manipulations through feasting events. It may also indicate a select emphasis on a ‘traditional’ local way of life within the fluid socio-political environment of the southern Titicaca Basin, starting in the Late Formative in an effort to balance out the introduction of the foreign and desired maize. A feast of maize beer, camelid meat, and potentially local staples (such as tubers and quinoa) thus presents the best of both worlds; the exotic libations lubricate the political proceedings and come to be associated with a newly rising regional socio-political organization, while the food fed to the participants anchors them in local tradition with a quintessentially 'altiplano' valued foodstuff. In less public arenas, such as the household and residential compounds, the intensity of consumption of these symbols of socio-political and regional affiliations is negotiated between the tastes and attitudes of its members. That is, much like the Ecuadorian peasant women that favoured locally grown barley in their meals to express through cuisine their difficult relationship with modernity as embodied in white rice (Weismantel 1988), camelids may have come to represent a local way of life that contrasted with the Tiwanaku polity's use of exotic maize in political and ritual life. The degree of consumption of these staples within the domestic setting may indicate the inhabitants' rapport with both local traditions and a broader, newer Tiwanaku identity.

Here, I turn upside down the underlying assumption in Tiwanaku research that camelids are valued because they are an important economic resource. I argue the contrary: they are economically important *because* they are socially valued. Camelid meat consumption may seem mundane because it is consumed daily, yet it is because it is consumed daily that it is not trivial. Camelids were valued at Tiwanaku. The integral role of camelids in all aspects of Tiwanaku life, from domestic and public consumption, to rituals, to the vital role of dung, fat, bones, and transport, make these animals a vital part of living in Tiwanaku. As such, camelid consumption in Tiwanaku times may represent a link to a 'traditional' altiplano way of life, a tradition perhaps sparked and emphasized by certain local groups in reaction to the 'chicha complex' (e.g. Goldstein 2003) and the cosmopolitanism sweeping the altiplano. I believe that the ingestion of local staples such as domesticated camelids represents an ingrained attachment to the socio-political, ritual, and physical landscape out of which Tiwanaku flourished. Camelid meat came to be valued for its origins in a sensibility evoking the notion of "*terroir*" in French cuisine. That is, it is a glorification of the local origin of foodstuff, and in this case, an ingestion of the roots of Tiwanaku, reinforced by the consumption of other local staples such as potatoes, quinoa, and fishes from Lake Titicaca.

Cuisine at Mollo Kontu: A Taste of Tiwanaku

Both access to, and consumption of maize and meat increase concurrently in the period leading to Tiwanaku's urbanization (Berryman 2010; Park 2001; Webster 1993; Wright *et al*. 2003). Maize presence and consumption is often the focus of archaeological analyses and interpretations as it is a non-local foodstuff that requires exchange with groups from warmer ecological zones, while camelid remains are seen as more mundane as they are abundant and local. However, I have argued that camelids were socially valued animals whose consumption reinforced a sense of tradition and a glorification of the local. The contribution of maize and meat to the diet of Tiwanaku residents varies from one neighbourhood to the next in significant ways (Berryman 2010). In particular, the residents of Mollo Kontu consumed the highest levels of meat but the lowest amount of maize. Given the social importance of both maize and camelids, these discrepancies need not be explained only in economic terms. For example, paleoethnobotanical analyses of Mollo Kontu assemblages demonstrate that Mollo Kontu residents had access to significant quantities of maize (Bruno and Ramos 2009); in spite of this, consumption remains low.

Consequently, the contribution of maize and meat to the diet of Tiwanaku residents may be better explained through a discussion of culinary preferences, rather than in terms of unequal access to valued products based on social status. In fact, I argue that two broad levels of identity were manifested through culinary practices at Tiwanaku. On the one hand, the consumption of chicha, with its hospitality etiquette, specific drinking paraphernalia and role in feasting events, effectively homogenized participants into a Tiwanaku 'state' identity. On the other hand, the daily consumption of camelid meat, in both feasting and household settings reflected a 'local' altiplano identity.

As argued in Chapter 2, the "mania for maize beer" (Goldstein 2003: 144) that seems to characterize the adoption of a Tiwanaku identity across widespread regions may in fact be more variable than previously thought, in light of maize consumption data (Berryman 2010) and the adoption of drinking practices in lowland areas (Anderson 2009). Maize is quickly established as an important staple in Tiwanaku period assemblages (Wright *et al.* 2003) at the same time as colonists are sent to maize growing areas to provide the highlands with this valuable product (Goldstein 2000, 2003), and keros and tinajas are introduced in the Tiwanaku ceramic assemblage (Janusek 2003: 56). Maize, keros, and tinajas are associated together through Inka analogy. In the Inka period, chicha was consumed in keros, lending credence to the assumption that the ceramic paraphernalia that appeared at Tiwanaku were likely adopted for the production and consumption of maize beer. The importance of beer consumption is demonstrated not only through the ubiquity of keros throughout the site, but through their placement in the hands of the elite personages carved onto the many Tiwanaku monoliths. These steles suggest that beer drinking lubricated Tiwanaku's ritual and political life within feasting contexts (see Couture 2007). The consumption of beer in commensal politics also took place in more intimate settings such as residential compounds. For example, Goldstein (2003: 162-163) argues that chicha consumption in the Moquegua Tiwanaku colonies was performed at the household and 'corporate' (or ayllu) level. Furthermore, Janusek (2008: 151-152) argues that the south compound of AKE1 was used to prepare food and drinks for feasting events held in the north compound of AKE1. That is, though characteristic of a Tiwanaku identity, chicha consumption was not solely orchestrated by elites, but took place at all levels of Tiwanaku society. However, although the drinking practices and etiquette exemplified by the chicha ceramic paraphernalia appear uniformly adopted throughout all excavated Tiwanaku neighbourhoods (see Table 15 in Chapter 6), the maize consumption levels are not evenly distributed between residents. Therefore, it may be that the drinking practices and customs, rather than maize consumption *per se* marked Tiwanaku identity within the urban context, as is also argued for the Cochabamba feasting contexts (see Anderson 2009; and Chapter 2 of this dissertation). In more private contexts, such as households and compounds, the host may have chosen the type of beer and food served to the guests according to the preferences of themselves or their guests. Beer need not have been made of maize, but could have been made with local foodstuff as well, such as locally produced quinoa.

Residents of Mollo Kontu were quintessentially local, both in cuisine and in material culture (Couture *et al.* 2010). Though paleoethnobotanical results from MK-D and MK-A show that maize was common (Bruno and Ramos 2009), bioarchaeological data demonstrate that its residents consumed very little of it

(Berryman 2010), less even than the residents of the lower status area of Ch'iji Jawira, and in spite of having access to maize. They may not have consumed much maize in comparison to the rest of the Tiwanaku population, but they did eat a great amount of camelids. Not only were these valued animals a great part of the Mollo Kontu cuisine, the zooarchaeological data presented in this dissertation suggests that the majority of the camelid meat consumed came from the residents' own herds. The fact that the camelids consumed came from Mollo Kontu's own herds is important in many ways. It demonstrates a disassociation of Mollo Kontu from a broader state political economy by suggesting a type of urban self-sufficient pastoralism unseen in ethnographic and ethnohistorical records. It further suggests a possible rejection of more centralized efforts for meat redistribution through self-reliance. Indeed, Zeder argues that "the extent to which households remain involved in food production for their own consumption might also be taken as a measure of independence from, or perhaps even resistance to, incorporation into the larger urban economy" (2003: 157-158). That is, through maintaining their own camelid herds for self-sufficiency, just like through the choice of which beer to serve within the context of household hospitality, the Mollo Kontu people expressed a certain independence, or distinction from the Tiwanaku state. By ingesting what amounts to the 'fruit of their labor', the residents of Mollo Kontu reinforced their own local identity outside of the reach of the Tiwanaku cosmopolitan center and polity.

The fact that Mollo Kontu residents kept their own camelid herds not only furthers our understanding of Tiwanaku's urban economy; it has implications for Mollo Kontu cuisine. Indeed, that the bulk of the meat consumed by Mollo Kontu residents did not come from a higher authority may have had an emotional resonance too; the animals that residents selected, killed, carefully butchered and prepared within their patios, following steps passed down from one individual to the next, belonged to them. That is, they were known, chosen and raised. Their selection and consumption was not trivial, and in fact served to connect these urban herders with traditions born out of the Titicaca Basin landscape.

The emphasis on locality is not only demonstrated through camelid consumption. Paleoethnobotanical, fish and bioarchaeological data suggest a near-absolute reliance on local foods for the residents of Mollo Kontu, save for the low levels of maize consumption.[98] The meals were prepared and served in typical Tiwanaku ceramics, with no evidence of non-local ceramics. The daily meals included a variety of local fish, chenopods, tubers, and local cactus fruits, along with the ubiquitous stewed camelid meat pieces. Yet rarely did these occasions warrant the consumption of maize or maize beer. The ubiquity of maize in Mollo Kontu's paleoethnobotanical samples may in fact suggest the necessity of providing maize beer to certain guests who might expect or prefer chicha to beer made of locally grown staples.

Local agricultural products were not important uniquely to the residents of Mollo Kontu; their importance for Tiwanaku residents at large is emphatically demonstrated by the extensive raised field agricultural systems that actively transformed part of the Katari valley into agricultural estates by the Tiwanaku V Period (Janusek and Kolata 2004). Raised fields are usually discussed in terms of

[98] See Chapter 6 for a detailed discussion of the fish, paleoethnobotanical, bioarchaeological, and ceramic remains analysed from Mollo Kontu assemblages.

economic importance, socio-political organization, ecology, social landscape, labour investment, and technology (e.g. Erickson 1988, 2003; Janusek and Kolata 2004; Kolata 1986). Yet this process may exemplify how local food crops were significant in more than economic terms to the altiplano residents. As in the case of rice in Southeast Asia presented by Smith (2006), monumental agriculture, even when managed by a centralized entity, still necessitates and often exemplifies a form of local acquiescence. That is, the construction and maintenance of these fields is not necessarily imposed on non-elite populations, but rather presented as such that everyone will be provided with more of an already preferred staple. In that way, the consumption of potatoes and/or quinoa in everyday familiar settings could reinforce a sense of belonging to the altiplano landscape. The energy invested in the growth of these crops through monumental agriculture certainly suggests that local crops in Tiwanaku times were valued.

Tiwanaku's pull for pilgrims and many residents is linked to chicha consumption and festivals associated with the state and its capital's attractive aura. But to *live* in Tiwanaku, for its urban residents, was perhaps a different experience. Mollo Kontu's identity is anchored in the daily ingestion of preferred altiplano staples, primarily acquired independently from the state. These daily meals and small-scale hospitality events were punctuated by festivals where Tiwanaku's greater shared identity was integrated through maize beer consumption. Their local identity, distinct from the broadly shared Tiwanaku state identity, may have been emphasized through production and consumption of quinoa beer at the household level, and through camelid herding for self-provisioning. While the daily consumption practices of Mollo Kontu residents are firmly rooted in a local altiplano identity, quite literally fed by the local landscape, Tiwanaku elites reinforced their link to the altiplano traditions through the continued valuation of camelids in ceremonial and commensal contexts. In addition, the importance of the terroir could be seen as well in the transformation of the neighbouring Katari valley into agricultural estates devoted to the growth of valued local staples, while simultaneously reinforcing their privileged position through the acquisition and sharing of maize beer.

The meat intensive pastoral regime suggested by both my research and the results from previous zooarchaeological work, coupled with the known extent of the agricultural system in Tiwanaku times, not only suggest that daily staples were likely a strong locus of identity; they also paint the Tiwanaku valley as a vibrant landscape. Visitors' first taste of Tiwanaku likely included a mosaic of large herds, qochas, hillslope terraces and fields, and monumental raised fields with the distant but imposing figures of Tiwanaku's monuments. Tiwanaku's pull remains the chicha and hallucinogenic complexes associated with the state and its capital's attractive aura, although the Tiwanaku hinterland's visual imagery and part of the city's identity was also one of abundant agricultural and pastoral yields. Therefore, to *be* Tiwanaku, for Mollo Kontu residents, was to be anchored in the daily ingestion of local staples such as potatoes, quinoa, and camelid meat. In reaction to Tiwanaku's increasing cosmopolitanism, as exemplified in the influx of non-local goods and residents, Mollo Kontu residents rejected the ingestion of non-local maize at the household level, while keeping the hospitality etiquette necessary to be Tiwanaku in their daily culinary practices.

Concluding Remarks

Tiwanaku represents more than a widely accepted ideology rooted in ritual and commensal politics. It was a vibrant urban center, a cosmopolitan capital, and a place of congregation that attracted disparate groups of people joined together in this pluri-identity setting by a broadly shared Tiwanaku identity. Food consumption within Tiwanaku contexts is often discussed with a focus on commensal politics rooted in the ingestion of maize beer. This dissertation used an investigation of culinary practices at the residential level to illuminate the multi-facetted aspect of Tiwanaku food consumption, and how it played out in the daily lives of its residents. That is, I use an approach focused on the choices of foodstuff consumed, their origin, preparation, the way they are served, and ultimately discarded to disentangle the way residents negotiated their identity as both Tiwanaku residents defined by a hospitality etiquette and participation in commensal politics and as distinct groups from their neighbours.

To explore daily culinary practices at the residential level, I have analysed the faunal remains from 14 garbage pits and one hearth from the non-elite residential neighbourhood of Mollo Kontu. This data is presented following the order of the chaîne opératoire of cuisine, within the confines of what can be recovered archaeologically through faunal remains. The mortality profiles, skeletal part representation, pathologies, and contextual evidence suggest that Mollo Kontu residents had their own camelid herds. Camelids were brought alive into the residential patios and butchered there. The butchery practices noted are different from modern descriptions of butchery, but until a similar study is performed on faunal remains from other Tiwanaku neighbourhoods, it cannot be stated that these patterns were widely shared throughout the urban center, or whether this is another way that Mollo Kontu residents were distinct from other groups.

The fish and plant remains analysed at Mollo Kontu, along with the ceramic vessels uncovered, are also quintessentially local except for the sustained presence of maize revealed by paleoethnobotanical remains. However this maize was not consumed in great quantity by the residents. Indeed, bioarchaeological analyses show that the diet of Mollo Kontu residents was significantly different from the diets of other contemporaneous neighborhoods and rural sites, with a much lower consumption of maize, and a higher consumption of meat fed on locally grown plants. Furthermore, dental carries of these skeletons is usually correlated to hunter-gatherer groups rather than agro-pastoral or agricultural groups. The presence of keros and tinajas found at Mollo Kontu is in line with the ratios found within the different sectors of the site. This suggests that household hospitality may have used the chicha complex ceramic assemblage, but that there was leeway for the host to choose what to serve in it. That is, the presence of chicha paraphernalia does not necessarily correlate with the consumption of maize beer; it could have been used for beer made of locally grown plants.

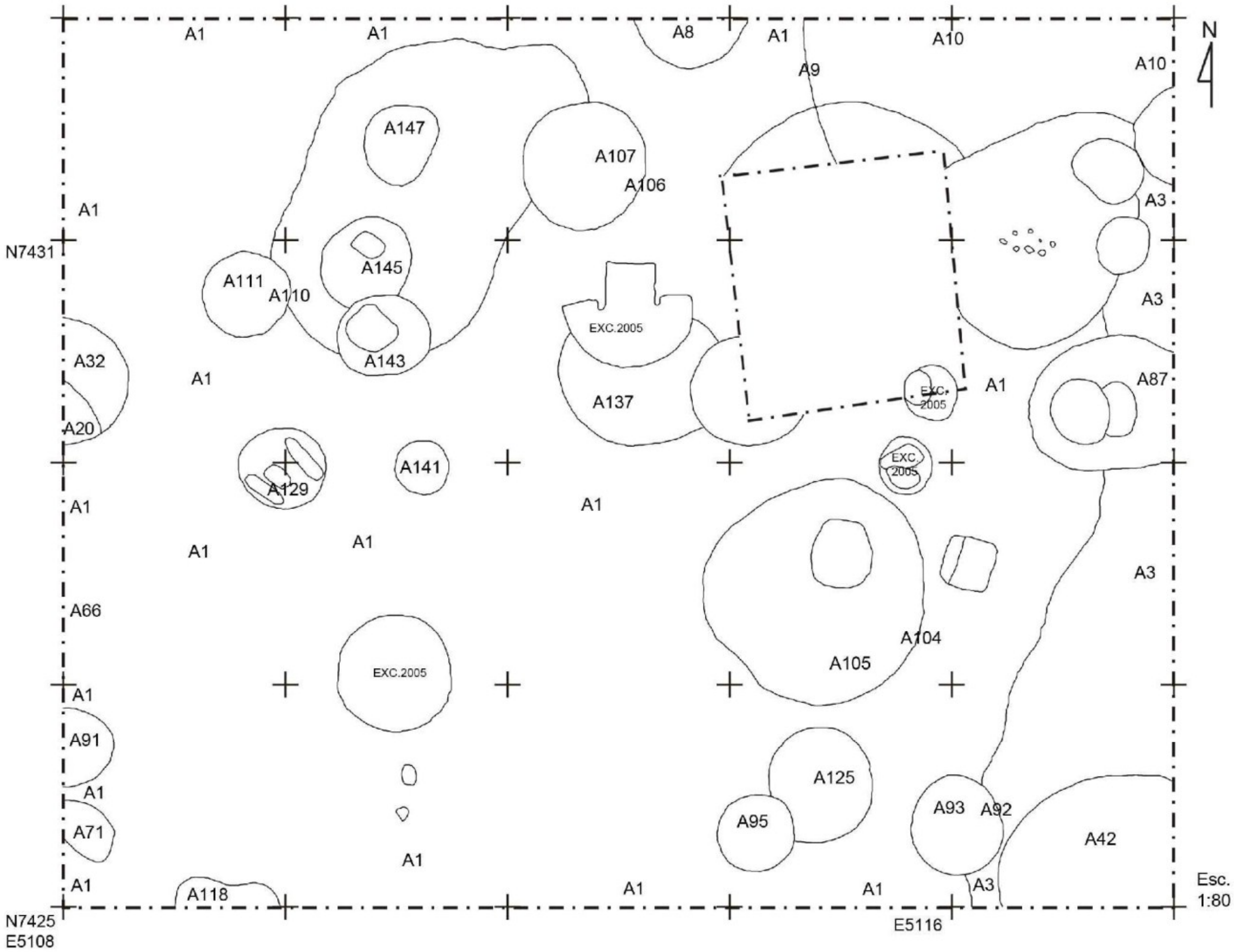
The increased reliance on these domesticates dates to the Late Formative Period, and seems to indicate a shift in pastoral and culinary practices. These changes could be motivated by more than just economic reasons. I suggest that these animals were associated with the recent socio-political and ritual life of the altiplano, with an altiplano 'tradition' of sorts, and perhaps with the reaction to the adoption and intensity of reliance on new and foreign maize beer by emerging elites, pilgrims, and certain local residents. The symbolic importance of camelids is supported by their inclusion in public and private dedicatory offerings. The changes in agricultural practices, especially the instauration of monumental raised fields and the transformation of part of the Katari valley into agricultural estates, suggest the possibility of a similar symbolic association of the local agricultural products to the ingestion of an altiplano identity.

Therefore, there were at least two levels of identity negotiated at Tiwanaku through food consumption. One is a broad Tiwanaku homogeneous identity, linked to Tiwanaku's formal architectural style, compound orientation to the cardinal directions, and to its ritual life, which was accepted, ingested, and shared through maize beer consumption and etiquette as displayed in both large-scale feasting events and smaller-scale corporate hospitality. There was room for the manipulation of these Tiwanaku symbols within the more private sphere of household hospitality. Chicha ceramic paraphernalia could be used to serve different types of beers more suited to the preferences of the hosts and guests.

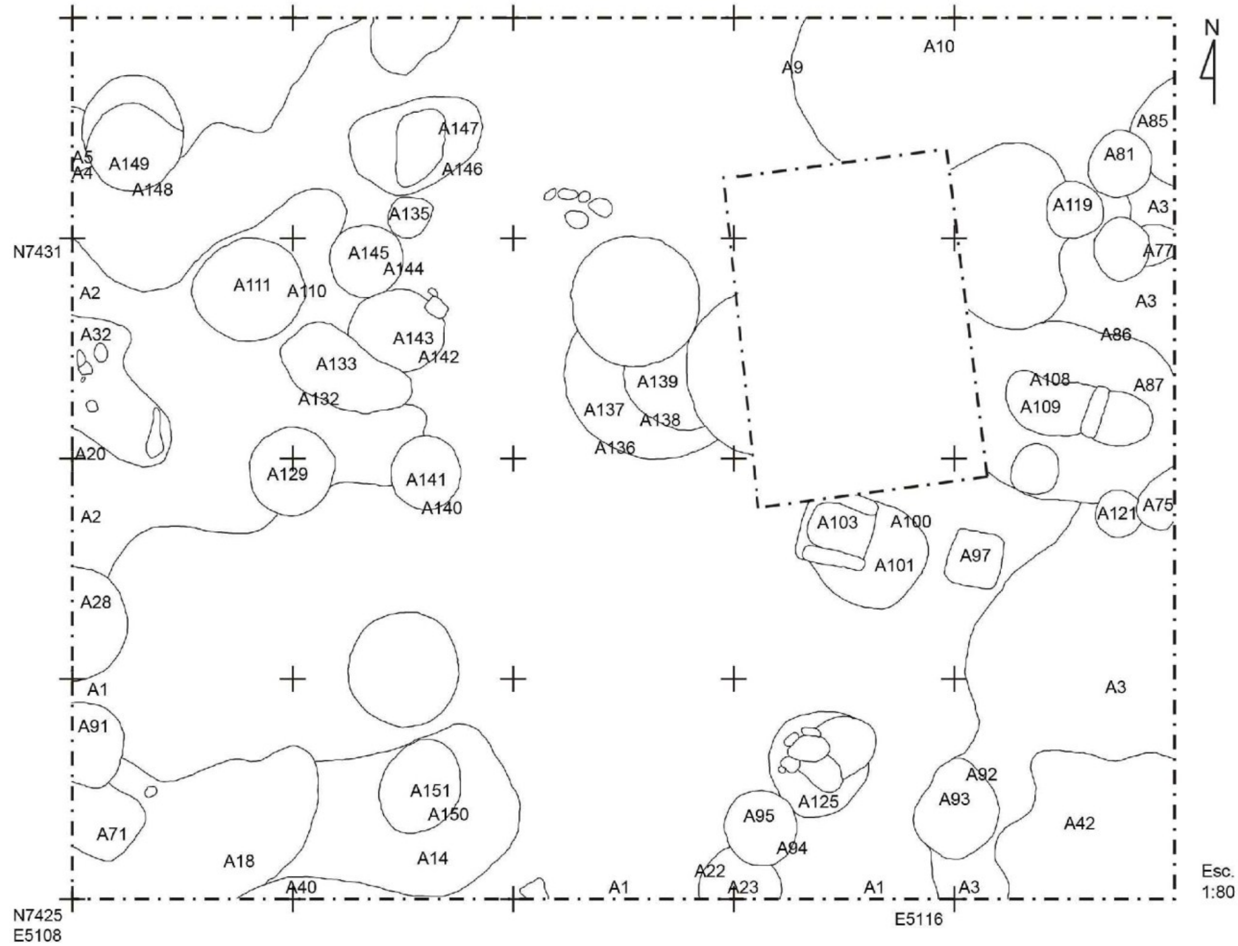
The other level of identity negotiated through culinary practices relates to the daily and ritual consumption of camelid meat, and other local agricultural products. These were valued in part because of their local origins; they were of the altiplano and they represented a link to a more traditional form of food preferences rooted in the landscape from which Tiwanaku, and its predecessors such as Khonkho Wankane and Chiripa, took form. The daily ingestion of these preferred foods would have reinforced the individuals' roots in their local origins. Daily life at Tiwanaku involved the literal embodiment of the altiplano.

APPENDICES

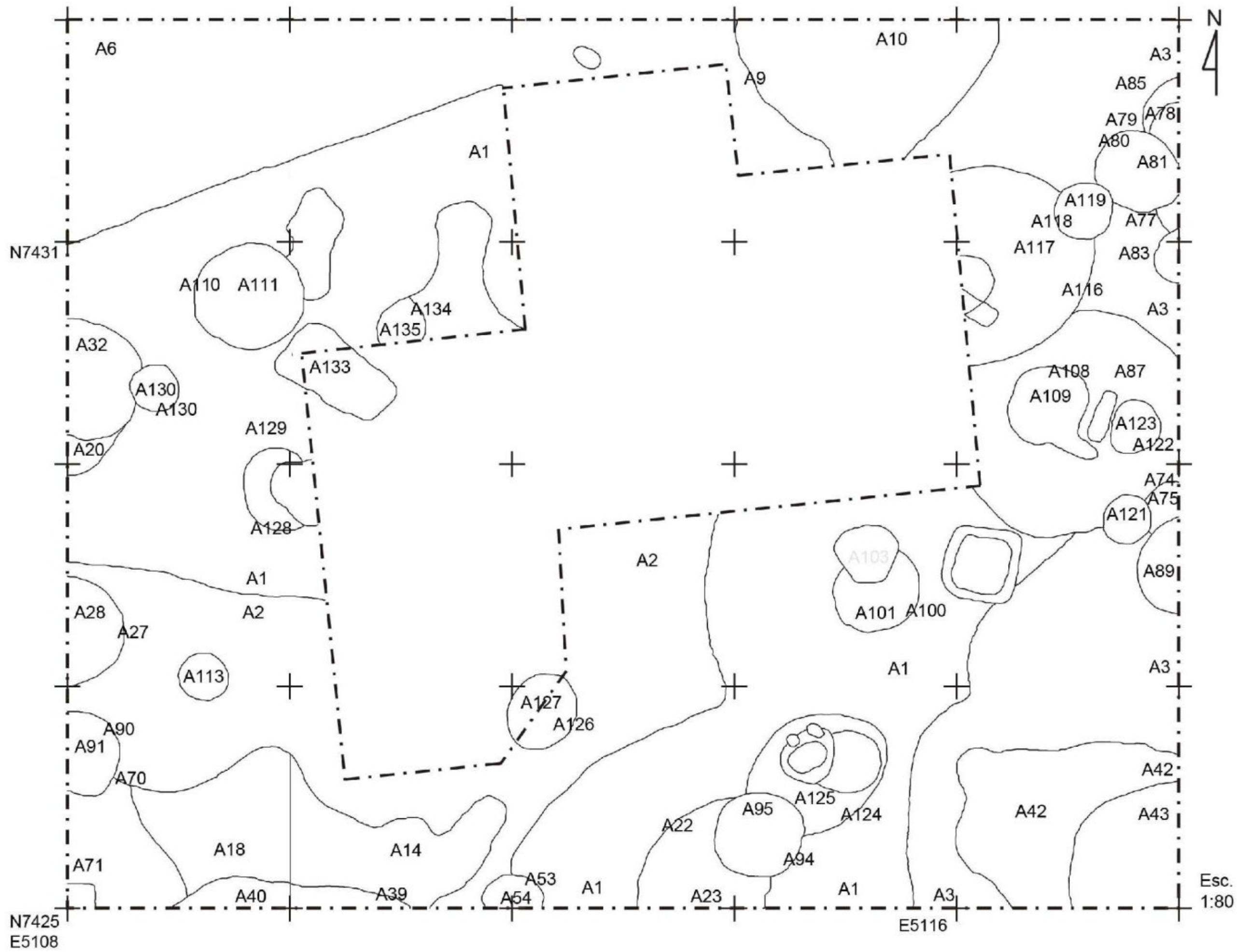
I. Floor Plans for MK-A in Arbitrary 10cm Levels



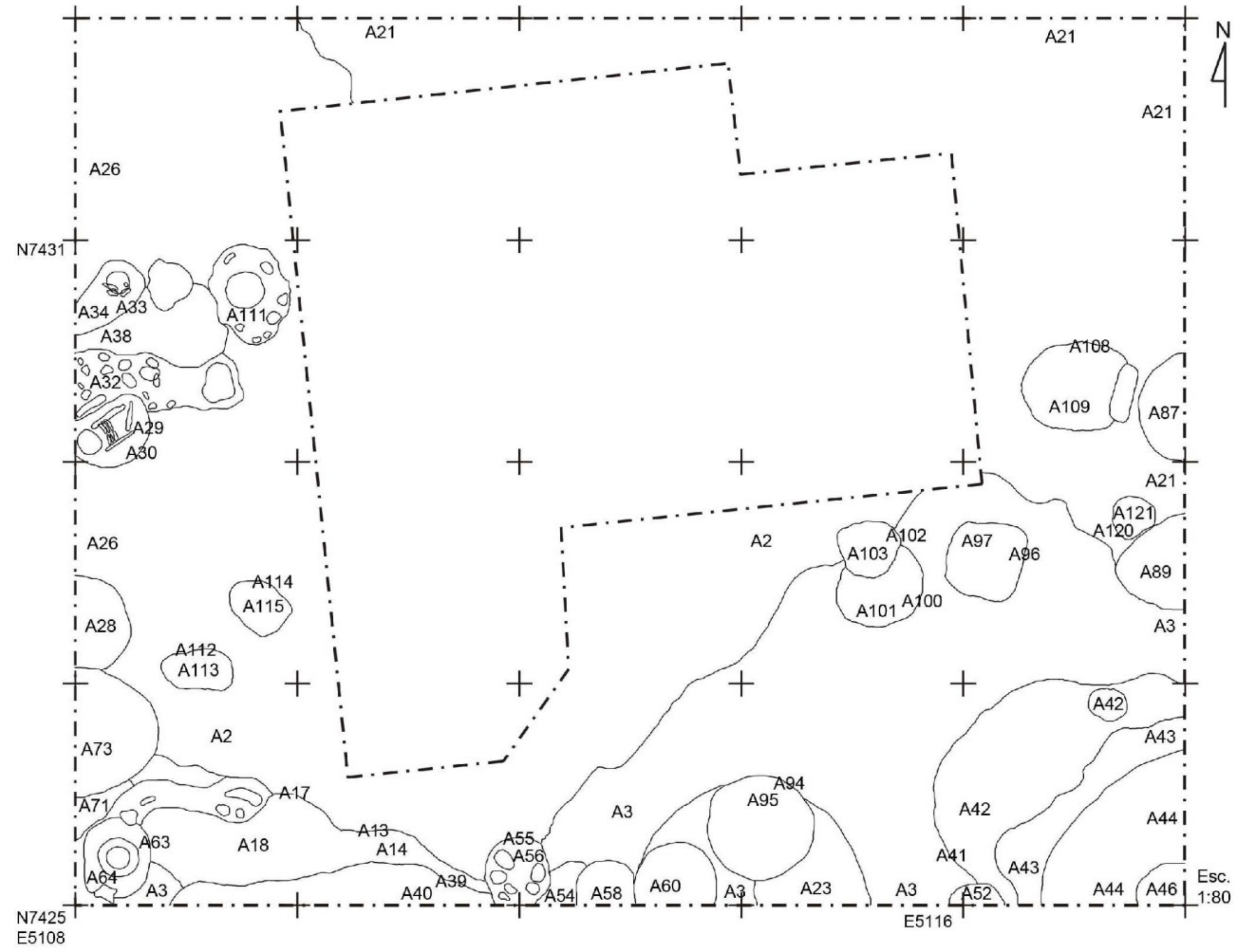
Floor plan of MK-A at 110 cm below datum



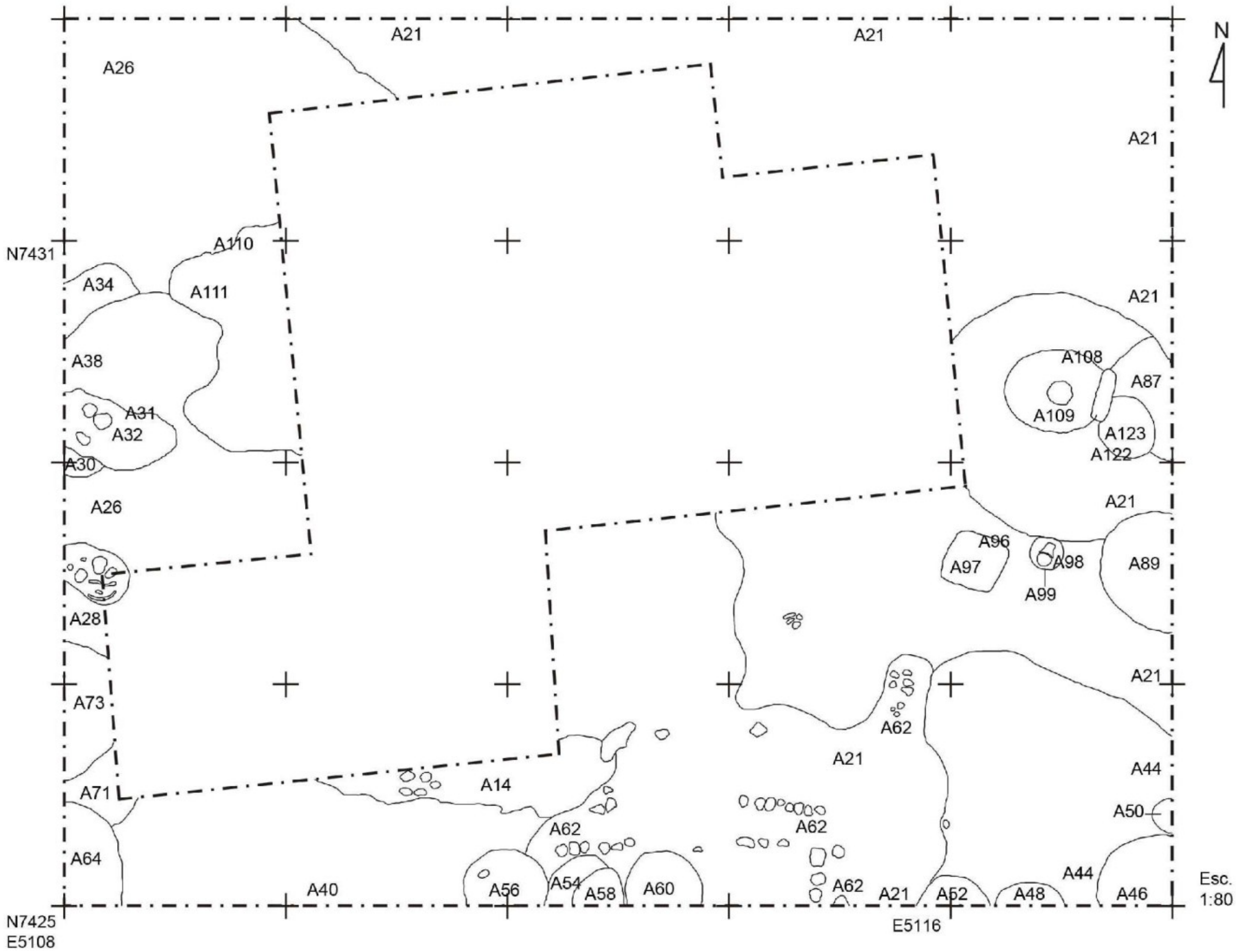
Floor plan of MK-A at 100 cm below datum



Floor plan of MK-A at 90 cm below datum



Floor plan of MK-A at 80 cm below datum



Floor plan of MK-A at ca.70 cm below datum (end of plow zone)

II. Data Recording Form

Area	Locus #	Bag #	Exc. Yr	North	East	Event	Page #

Species	Element	Zone	DZI	Teeth					Count
Side	Prox/Dist	(un)fused	Age	Age justif				HTMwD %	Modif.
Texture	Weath.	Preserv.	Weight gr			Complete	Color	Burning	Butchery
Butchloc	Photos			Notes:					
Extra measurements:									

Though it was usually written in the zone description, whether the specimen was a proximal (p) or distal (d) end was recorded again, with both recorded if complete (p/d), and left empty if only a shaft fragment. When relevant, the fusion state of the specimen was recorded as fused (fd), unfused (unf), fusing (fg), or variable (v). Since most elements have more than one epiphysis and these fuse at different time periods, sometimes specimens show different states of fusion. In those cases, the fusion state was recorded as variable (v) and the different fusion states were explained in the "notes" section. Comparing the fusion states of the specimen to a list of fusion ages compiled from different sources (Wheeler and Mujíca 1981, Kent 1982)[99], the possible age range for the specimen was recorded in an "age justification" box, and the specimen was assigned an age category[100] based on the greater than (>) or lesser than (<) age determined by the fusion state.

[99] When presented with different fusion age by the different authors, I chose the oldest fusion age to be conservative and not inflate the number of young animals.
[100] Following the work of Lairama (2008), the categories were neonatal (neo), neonatal/juvenile (neo/juv), juvenile (juv), sub-adult (s-ad), juvenile/adult (juv/ad), and

adult (ad). I used 16 months old as the cut off age between neonatal and juveniles, and 3 years old as the cut off age between juvenile and adult. These age categories are similar to the age categories given to llamas by the Ayacucho herders studied by Flannery *et al.* (1989: 99-100) and seem to reflect important osteological fusion periods. Furthermore, Flannery *et al.* (1989) mention that "three years was a crucial age for both males and females" as it is at that point that males were castrated and females were likely to be fertile. Thus it appears that 3 years old is a justified transition period into adulthood for llamas.

III. NISP and Weight Data for All Assemblages

		Event D120		Event D158		Event D173		Event D36		Event D40	
Species	**Elements**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**
Cam	Cranium	115	364.00	31	44.34	19	33.72	10	27.42	1	0.53
Cam	mandible	24	183.28	8	54.49	0	0	2	18.19	4	12.05
Cam	isotooth	49	68.19	19	20.25	10	9.93	7	11.37	5	12.45
Cam	Atlas	5	42.07	1	2.74	1	3.4	0	0	0	0
Cam	Axis	7	59.31	2	10.86	2	6.89	0	0	1	1.64
Cam	cerv	69	288.45	12	47.52	6	36.62	9	31.6	4	10.9
Cam	hyoid	3	0.73	4	1.93	0	0	0	0	0	0
Cam	thor	35	154.59	7	11.94	4	18.69	3	35.95	4	11.25
Cam	lumb	38	121.27	15	27.69	6	10.53	1	0.88	8	16.31
Cam	rib	285	681.50	106	308	33	46.45	15	28.77	9	37.31
Cam	cart rib	1	0.99	2	3.06	0	0	4	3.94	0	0
Cam	sternum	2	10.44	0	0	0	0	0	0	0	0
Cam	sacrum	6	23.37	0	0	0	0	1	2.88	2	7.04
Cam	Caudal	1	0.18	0	0	0	0	0	0	0	0
Cam	scapula	17	115.17	32	98.63	5	21.79	3	48.45	0	0
Cam	hum	17	188.21	8	74.52	9	57.3	4	33.06	4	11.25
Cam	radul	35	298.85	10	82.69	9	41.44	7	43.26	4	23.75
Cam	Carpals	19	73.81	3	5.81	2	4.68	3	11.25	1	4.12
Cam	MTC	12	187.06	3	28.8	0	0	2	28.02	0	0
Cam	MTP	54	259.50	32	100.97	5	21.34	6	38.57	7	43.49
Cam	1st Ph	48	264.67	7	24.29	5	31.13	2	3.54	1	9.05
Cam	2nd Ph	22	51.04	5	5.99	0	0	2	4.31	0	0
Cam	3rd Ph	4	5.57	4	4.75	0	0	1	1.13	1	1.28
Cam	pelvis	30	349.63	15	94.53	15	68.84	2	11.93	3	4.12
Cam	femur	15	163.15	7	63.48	2	34.82	2	14	6	56.64
Cam	patella	7	72.60	0	0	0	0	0	0	0	0
Cam	tibia	29	296.26	10	65.09	5	28.35	3	36.09	3	17.28
Cam	tarsals	23	143.39	2	12.19	0	0	1	4.36	1	4.19
Cam	MTT	13	103.89	1	9.69	0	0	2	21.62	1	26.62
Cam	Sesamoid	4	2.34	0	0	0	0	0	0	1	1.24
	subtotals:	*989*	*4573.51*	*346*	*1204.25*	*138*	*475.92*	*92*	*460.59*	*71*	*312.51*
LM	long bone fr	464	1286.59	235	385.64	153	226.55	62	78.67	47	108.77
LM	unidentified	853	609.53	100	38.69	87	97.3	111	184.12	81	67.63
unid	unidentified	1080	954.70	2	1.38	349	97.57	35	16.71	2	0.31
LM	rib/vert pr	0	0.00	120	39.01	38	21.5	21	8.99	0	0
LM	vert	6	2.79	0	0	3	3.64	1	2.42	0	0
LM	irregular	0	0.00	0	0	9	12.52	0	0	0	0
LM	flat bone	0	0.00	112	43.88	5	2.73	9	11.43	0	0
LM	epi	0	0.00	21	26.07	0	0	0	0	0	0
	subtotals:	*2403*	*2853.61*	*590*	*534.67*	*644*	*461.81*	*239*	*302.34*	*130*	*176.71*
	Totals:	3392	7427.12	936	1738.92	782	937.73	331	762.93	201	489.22

		Event D44		Event D46		Event D71		Event D81		Event D82	
Species	**Elements**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**
Cam	Cranium	72	242.53	280	1132.87	15	20.59	28	54.68	56	60
Cam	mandible	12	124.74	94	664.22	18	111.79	4	3.86	11	36.88
Cam	isotooth	16	30.09	90	239.71	38	39.28	23	19.7	41	56.25
Cam	Atlas	2	11.83	8	34.73	1	1.67	1	3.41	2	3.77
Cam	Axis	0	0	10	40.11	4	11.7	1	18.3	2	3.74
Cam	cerv	16	73.77	143	539.95	27	65.02	13	39.75	4	23.73
Cam	hyoid	1	0.4	8	3.08	5	0.93	4	2.3	2	1.51
Cam	thor	5	17.88	91	306.16	8	28.37	9	16.83	14	47
Cam	lumb	28	115.84	108	397.61	17	48.31	21	55.61	8	36.58
Cam	rib	61	279.85	368	1318.27	52	108.16	40	85.79	55	186.82
Cam	cart rib	1	0.24	6	8.06	1	0.99	2	3.3	15	16.28
Cam	sternum	0	0	5	24.87	0	0	0	0	1	5.39
Cam	sacrum	5	33.39	4	11.29	1	0.38	4	13.77	1	0.99
Cam	Caudal	0	0	2	2.06	0	0	2	2.36	2	1.5
Cam	scapula	10	91.57	45	549.04	6	28.48	8	34.99	1	0.86
Cam	hum	16	215.56	44	501.56	4	37.06	5	31.39	3	54.05
Cam	radul	20	299.59	83	1044.2	8	27.95	9	46.7	12	236.9
Cam	Carpals	5	11.13	17	55.29	2	5.39	2	6.62	18	62.57
Cam	MTC	15	200.18	33	306.29	1	1.7	2	34.91	1	81.54
Cam	MTP	33	170.35	147	675.93	36	158.89	12	45.56	10	38.03
Cam	1st Ph	23	105.2	90	532.00	13	30.59	5	10.78	11	73.1
Cam	2nd Ph	11	25.41	34	93.73	3	4.11	4	5.12	12	33.98
Cam	3rd Ph	2	3.77	2	1.97	1	0.61	1	1.68	9	12
Cam	pelvis	7	78.91	59	595.61	16	67.57	8	48.32	5	29.41
Cam	femur	11	245.94	51	648.12	9	52.46	7	62.25	5	35.28
Cam	patella	2	24.64	6	58.83	0	0	1	1.79	0	0
Cam	tibia	16	289.56	71	872.5	8	69.05	5	66.8	5	42.34
Cam	tarsals	18	124.7	57	423.9	8	16.85	4	32.41	6	12.26
Cam	MTT	12	95.54	30	329.16	3	18.81	0	0	3	60.95
Cam	Sesamoid	1	0.88	3	2.28	0	0	3	1.31	3	1.54
	subtotals:	*421*	*2913.49*	*1989*	*11413.40*	*305*	*956.71*	*228*	*750.29*	*318*	*1255.25*
LM	long bone fr	230	494.83	701	2285.33	587	931.08	198	264.66	127	175.95
LM	unidentified	60	90.47	0	0	0	0	132	34.94	116	23.67
unid	unidentified	3	4.61	1196	1002.57	1485	776.43	154	202.46	147	69.16
LM	rib/vert pr	34	20.45	0	0	0	0	1	1.46	34	14.48
LM	vert	4	5.94	0	0	2	1.23	1	0.29	0	0
LM	irregular	50	39.26	0	0	0	0	0	0	38	31.94
LM	flat bone	0	0	0	0	0	0	49	26.79	15	4.73
LM	epi	0	0	0	0	0	0	0	0	0	0
	subtotals:	*381*	*655.56*	*1897*	*3287.90*	*2074*	*1708.74*	*535*	*530.60*	*477*	*319.93*
	Totals:	802	3569.05	3886	14701.30	2379	2665.45	763	1280.89	795	1575.18

		Event D83		Event A111		Event A123		Event A14		Event A23	
Species	**Elements**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**
Cam	Cranium	71	151.25	34	72.46	2	2.32	36	143.36	28	94.69
Cam	mandible	9	130.07	11	45.72	1	7.9	12	143.14	4	23.67
Cam	isotooth	12	17.09	12	37.91	0	0	15	22.48	3	9.18
Cam	Atlas	1	9.58	4	18.1	0	0	1	8.29	4	33.31
Cam	Axis	4	40.22	2	12.76	0	0	5	18.4	0	0
Cam	cerv	30	528.71	31	94.71	2	15.82	20	66.07	19	233.36
Cam	hyoid	0	0	3	1.32	0	0	1	0.43	0	0
Cam	thor	38	289.78	33	100.88	0	0	27	98.75	18	199.3
Cam	lumb	19	153.69	30	103.36	1	1.43	25	200.14	11	48.84
Cam	rib	135	683.44	48	118.55	13	57.84	103	382.28	42	162.91
Cam	cart rib	9	9.77	4	3.91	0	0	0	0	1	1.13
Cam	sternum	9	52.92	1	4.52	0	0	0	0	0	0
Cam	sacrum	9	20.46	3	26.44	0	0	3	9.58	0	0
Cam	Caudal	1	3.07	1	0.87	0	0	0	0	1	2.6
Cam	scapula	60	383.5	6	26.67	0	0	17	95.07	8	42.78
Cam	hum	18	755.48	10	115.3	0	0	11	142.31	9	140.82
Cam	radul	24	787.86	18	275.86	1	8.88	15	191.83	7	79.51
Cam	Carpals	39	94.14	10	42.87	2	9.69	4	9.89	2	8.82
Cam	MTC	16	436.07	6	35.66	0	0	3	25.69	2	20.8
Cam	MTP	14	105.2	18	117.9	3	27.17	32	121.16	13	45.45
Cam	1st Ph	16	83.74	6	15.13	2	5.23	22	90.57	6	29.72
Cam	2nd Ph	14	18.6	8	15.08	0	0	12	35.6	3	7.29
Cam	3rd Ph	7	4.85	2	3.3	1	1.47	0	0	1	1.39
Cam	pelvis	30	490.65	27	208.37	1	16.36	8	39.4	10	240.06
Cam	femur	22	745.44	23	228.86	2	39.13	15	153.92	7	53.31
Cam	patella	2	27.63	1	10.06	0	0	1	6.49	0	0
Cam	tibia	26	627.05	21	332.72	1	2.31	10	101.73	8	88.9
Cam	tarsals	19	124.06	16	100.49	1	3.15	6	48.15	10	85.21
Cam	MTT	5	44.49	6	64.83	2	16.27	4	24.43	2	20.97
Cam	Sesamoid	2	0.94	0	0	0	0	0	0	0	0
	subtotals:	*661*	*6819.75*	*395*	*2234.61*	*35*	*214.97*	*408*	*2179.16*	*219*	*1674.02*
LM	long bone fr	144	238.05	134	408.15	16	70.32	150	485.94	64	211.77
LM	unidentified	222	34.6	0	0	0	0	0	0	0	0
unid	unidentified	2	0.6	578	335.65	18	60.26	458	339.91	174	111
LM	rib/vert pr	41	14.68	0	0	0	0	0	0	0	0
LM	vert	0	0	0	0	0	0	0	0	0	0
LM	irregular	0	0	0	0	0	0	0	0	0	0
LM	flat bone	128	28.71	0	0	0	0	0	0	0	0
LM	epi	8	10.88	0	0	0	0	0	0	0	0
	subtotals:	*545*	*327.52*	*712*	*743.80*	*34*	*130.58*	*608*	*825.85*	*238*	*322.77*
	Totals:	1206	7147.27	1107	2978.41	69	345.55	1016	3005.01	457	1996.79

		Event A10		Event A121		Total MK-D		Total MK-A	
Species	**Elements**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**	**NISP**	**Weight in gr**
Cam	Cranium	23	163.44	0	0	698	2131.93	123	476.27
Cam	mandible	6	55.37	1	3.72	186	1339.57	35	279.52
Cam	isotooth	1	1.31	2	0.63	310	524.31	33	71.51
Cam	Atlas	1	8.09	0	0	22	113.2	10	67.79
Cam	Axis	2	7.63	0	0	33	192.77	9	38.79
Cam	cerv	30	120.04	0	0	334	1688.5	102	530.00
Cam	hyoid	0	0	0	0	27	10.88	4	1.75
Cam	thor	15	46.64	0	0	218	938.44	93	445.57
Cam	lumb	13	81.34	1	0.92	269	984.32	81	436.03
Cam	rib	29	135.29	2	3.4	1159	3764.36	237	860.27
Cam	cart rib	2	4.17	0	0	41	46.63	7	9.21
Cam	sternum	1	3.73	0	0	17	93.62	2	8.25
Cam	sacrum	0	0	0	0	33	113.57	6	36.02
Cam	Caudal	0	0	0	0	8	9.17	2	3.47
Cam	scapula	5	69.08	0	0	187	1372.48	36	233.6
Cam	hum	9	128.33	0	0	132	1959.44	39	526.76
Cam	radul	8	79.53	0	0	221	2933.19	49	635.61
Cam	Carpals	1	2.15	0	0	111	334.81	19	73.42
Cam	MTC	2	21.72	0	0	85	1304.57	13	103.87
Cam	MTP	16	89.3	0	0	356	1657.83	82	400.98
Cam	1st Ph	8	27.09	0	0	221	1168.09	44	167.74
Cam	2nd Ph	0	0	0	0	107	242.29	23	57.97
Cam	3rd Ph	0	0	0	0	32	37.61	4	6.16
Cam	pelvis	6	46.46	0	0	190	1839.52	52	550.65
Cam	femur	8	99.94	0	0	137	2121.58	55	575.16
Cam	patella	0	0	0	0	18	185.49	2	16.55
Cam	tibia	4	27.16	0	0	181	2410.37	44	552.82
Cam	tarsals	4	30.73	0	0	139	898.31	37	267.73
Cam	MTT	0	0	0	0	70	710.77	14	126.5
Cam	Sesamoid	0	0	0	0	17	10.53	0	0
	subtotals:	*194*	*1248.54*	*6*	*8.67*	*5559*	*31138.15*	*1257*	*7559.97*
LM	long bone fr	55	229.13	4	2.32	2948	6476.12	423	1407.63
LM	unidentified	0	0	0	0	1762	1180.95	0	0
unid	unidentified	125	135.73	6	12.61	4455	3126.5	1359	995.47
LM	rib/vert pr	0	0	0	0	289	120.57	0	0
LM	vert	0	0	0	0	17	16.31	0	0
LM	irregular	0	0	0	0	97	83.72	0	0
LM	flat bone	0	0	0	0	318	118.27	0	0
LM	epi	0	0	0	0	29	36.95	0	0
	subtotals:	*180*	*364.86*	*10*	*14.93*	*9915*	*11159.39*	*1782*	*2403.10*
	Totals:	374	1613.40	16	23.60	15474	42297.54	3039	9963.07

IV. MNE and MAU Values for All Assemblages

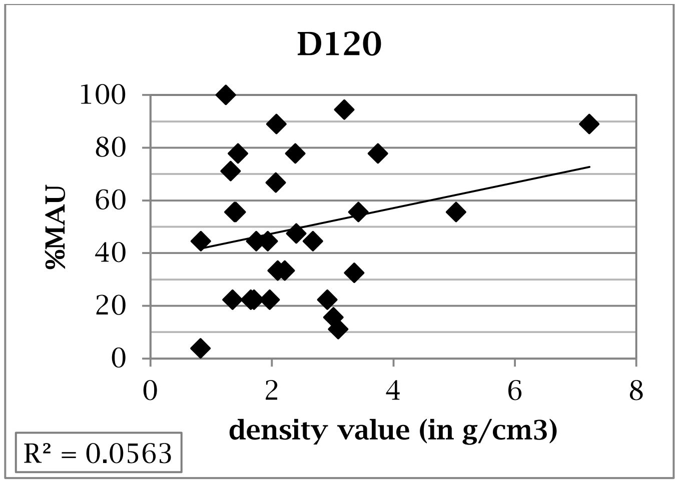
		Event D120		Event D158		Event D173		Event D36		Event D40	
Species	Elements	MNE	MAU	MNE	MAU	MNE	MAU	MNE	MAU	MNE	MAU
Cam	Crania	3	3	1	1	1	1	2	2	1	1
Cam	Mandible	8	4	2	2	0	0	2	1	1	0.5
Cam	Atlas	2	2	1	1	1	1	0	0	0	0
Cam	Axis	1	1	1	1	1	1	0	0	1	1
Cam	Cerv	16	3.2	3	0.6	2	0.4	3	0.6	1	0.2
Cam	Thor	12	1	2	0.17	1	0.08	1	0.08	1	0.08
Cam	Lumb	5	0.7	2	0.3	1	0.14	1	0.14	1	0.14
Cam	Rib	35	1.46	12	0.5	4	0.17	5	0.21	2	0.08
Cam	Sternum	1	0.17	0	0	0	0	0	0	0	0
Cam	Sacrum	1	1	0	0	0	0	1	1	1	1
Cam	Caudal	1	0.17	0	0	0	0	0	0	0	0
Cam	Scapula	3	1.5	1	0.5	1	0.5	2	1	0	0
Cam	Prx hum	4	2	2	1	2	1	2	1	1	0.5
Cam	dst hum	5	2.5	1	0.5	2	1	1	0.5	1	0.5
Cam	Prx radul	3	1.5	1	0.5	3	1.5	2	1	0	0
Cam	Dst radul	4	2	1	0.5	1	0.5	1	0.5	1	0.5
Cam	Carpals	4	2	1	1	1	1	1	1	1	1
Cam	Prx MTC	7	3.5	2	1	0	0	0	0	0	0
Cam	Dst MTC	5	2.5	1	0.5	0	0	2	1	0	0
Cam	1st Phal	34	4.25	5	0.63	4	0.5	2	0.25	1	0.125
Cam	2nd Phal	17	2.13	3	0.38	0	0	2	0.25	0	0
Cam	3rd Phal	4	0.5	4	0.5	0	0	1	0.125	1	0.125
Cam	Pelvis	5	2.5	3	1.5	1	0.5	1	0.5	1	0.5
Cam	Prx femur	5	2.5	2	1	1	0.5	1	0.5	0	0
Cam	Dst femur	2	1	1	0.5	0	0	1	0.5	3	1.5
Cam	Patella	7	3.5	0	0	0	0	0	0	0	0
Cam	Prx tibia	9	4.5	2	1	2	1	2	1	1	0.5
Cam	Dst tibia	6	3	0	0	0	0	0	0	0	0
Cam	Tarsals	7	3.5	2	1	0	0	1	0.5	1	1
Cam	Prx MTT	8	4	1	0.5	0	0	2	1	1	0.5
Cam	Dst MTT	2	1	0	0	0	0	0	0	0	0

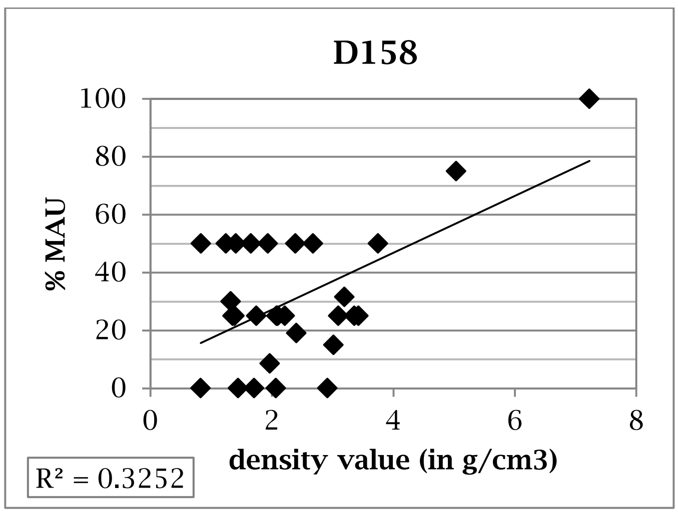
		Event D44		Event D46		Event D71		Event D81		Event D82	
Species	**Elements**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**
Cam	Crania	4	2	7	7	1	1	1	1	2	2
Cam	Mandible	3	1.5	21	10.5	7	3.5	2	1	2	1
Cam	Atlas	1	1	2	2	1	1	1	1	1	1
Cam	Axis	0	0	4	4	3	3	1	1	1	1
Cam	Cerv	3	0.6	29	5.8	6	1.2	3	0.6	1	0.2
Cam	Thor	4	0.33	11	0.92	1	0.08	3	0.25	4	0.33
Cam	Lumb	8	1.14	21	3	5	0.7	3	0.43	3	0.43
Cam	Rib	21	0.875	144	6	9	0.375	9	0.375	14	0.58
Cam	Sternum	0	0	4	0.67	0		0	0	1	0.17
Cam	Sacrum	2	2	1	1	1	1	1	1	1	1
Cam	Caudal	0	0	2	0.33	0		2	0.33	2	0.33
Cam	Scapula	2	1	11	5.5	3	1.5	1	0.5	1	0.5
Cam	Prx hum	4	2	15	7.5	1	0.5	1	0.5	2	1
Cam	dst hum	2	1	8	4	2	1	1	0.5	1	0.5
Cam	Prx radul	7	3.5	13	6.5	0	0	2	1	2	1
Cam	Dst radul	2	1	13	6.5	4	2	1	0.5	3	1.5
Cam	Carpals	1	1	6	3	1	1	1	0.5	3	1.5
Cam	Prx MTC	4	2	16	8	1	0.5	2	1	1	0.5
Cam	Dst MTC	7	3.5	9	4.5	0	0	0	0	1	0.5
Cam	1st Phal	15	1.875	70	8.75	8	1	5	0.625	9	1.125
Cam	2nd Phal	10	1.25	32	4	2	0.25	4	0.5	11	1.375
Cam	3rd Phal	2	0.25	2	0.25	1	0.125	1	0.125	9	1.125
Cam	Pelvis	2	1	10	5	4	2	2	1	2	1
Cam	Prx femur	2	1	10	5	0	0	1	0.5	1	0.5
Cam	Dst femur	3	1.5	6	3	3	1.5	2	1	1	0.5
Cam	Patella	2	1	6	3	0		1	0.5	0	0
Cam	Prx tibia	5	2.5	8	4	1	0.5	1	0.5	1	0.5
Cam	Dst tibia	3	1.5	12	6	1	0.5	2	1	1	0.5
Cam	Tarsals	5	2.5	14	7	2	1	2	1	2	1
Cam	Prx MTT	5	2.5	22	11	3	1.5	0	0	2	1
Cam	Dst MTT	5	2.5	6	3	0	0	0	0	1	0.5

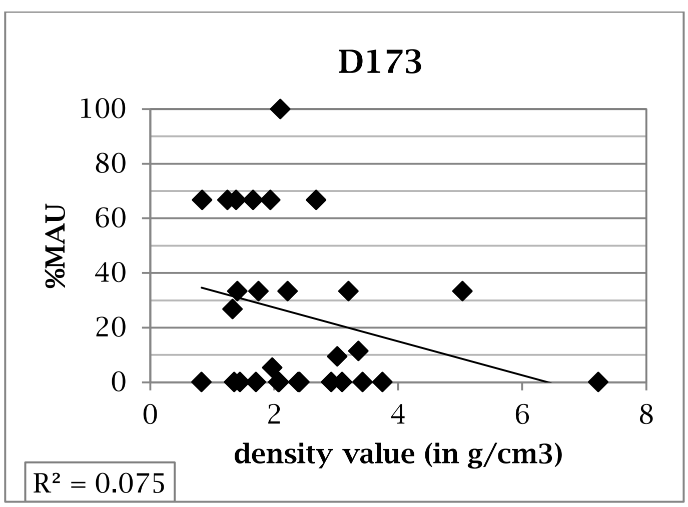
		Event D83		Event A111		Event A123		Event A14		Event A23	
Species	**Elements**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**
Cam	Crania	3	3	2	2	1	0.5	4	2	1	1
Cam	Mandible	3	1.5	3	1.5	1	0.5	4	2	1	0.5
Cam	Atlas	1	1	2	2	0	0	1	1	2	2
Cam	Axis	4	4	1	1	0	0	4	4	0	0
Cam	Cerv	16	3.2	4	0.8	1	0.2	5	1	6	1.2
Cam	Thor	27	2.25	8	0.67	0	0	12	1	8	0.67
Cam	Lumb	11	1.57	10	1.43	1	0.08	6	0.86	2	0.29
Cam	Rib	52	2.17	14	0.52	3	0.125	24	1	13	0.54
Cam	Sternum	9	1.5	1	0.16	0	0	0	0	0	0
Cam	Sacrum	1	1	1	1	0	0	1	1	0	0
Cam	Caudal	1	0.17	1	0.167	0	0	0	0	1	1.17
Cam	Scapula	8	4	3	1.5	0	0	1	0.5	1	0.5
Cam	Prx hum	7	3.5	4	2	0	0	3	1.5	2	1
Cam	dst hum	8	4	4	2	0	0	2	1	2	1
Cam	Prx radul	8	4	5	2.5	1	0.5	3	1.5	1	0.5
Cam	Dst radul	9	4.5	4	2	0		2	1	1	0.5
Cam	Carpals	9	4.5	4	2	1	0.5	2	1	1	1
Cam	Prx MTC	12	6	3	1.5	0	0	1	0.5	1	0.5
Cam	Dst MTC	7	3.5	2	1	0	0	1	0.5	1	0.5
Cam	1st Phal	15	1.875	4	0.5	2	0.25	10	1.25	5	0.625
Cam	2nd Phal	12	1.5	5	0.625	0	0	11	1.375	3	0.375
Cam	3rd Phal	7	0.875	2	0.25	1	0.25	0	0	1	0.125
Cam	Pelvis	7	3.5	5	2.5	1	0.5	2	1	3	1.5
Cam	Prx femur	7	3.5	2	1	0	0	0	0	1	0.5
Cam	Dst femur	6	3	3	1.5	2	1	7	3.5	2	1
Cam	Patella	2	1	1	0.5	0	0	1	0.5	0	0
Cam	Prx tibia	7	3.5	6	3	0	0	5	2.5	1	0.5
Cam	Dst tibia	6	3	7	3.5	1	0.5	3	1.5	4	2
Cam	Tarsals	4	2	5	2.5	1	0.5	3	1.5	3	1.5
Cam	Prx MTT	3	1.5	3	1.5	1	0.5	3	1.5	2	1
Cam	Dst MTT	1	0.5	3	1.5	1	0.5	1	0.5	0	0

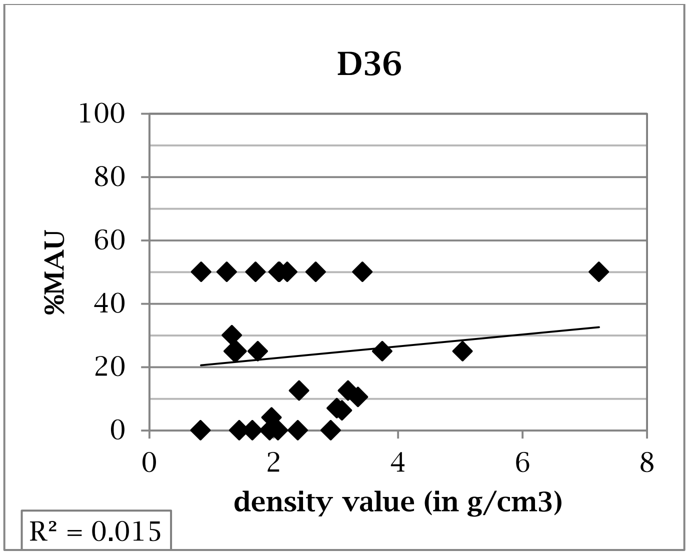
		Event A10		Event A121		Total MK-D		Total MK-A	
Species	**Elements**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**	**MNE**	**MAU**
Cam	Crania	2	2	0	0	9	9	3	3
Cam	Mandible	3	1.5	1	1	39	19.5	7	3.5
Cam	Atlas	1	1	0	0	7	7	4	4
Cam	Axis	1	1	0	0	12	12	6	6
Cam	Cerv	9	1.5	0	0	71	14.2	24	4.8
Cam	Thor	13	1.08	0	0	54	4.5	15	1.25
Cam	Lumb	4	0.57	1	0.14	38	5.43	14	2
Cam	Rib	14	0.58	2	0.08	198	8.25	55	2.3
Cam	Sternum	1	0.17	0	0	13	2.17	2	0.33
Cam	Sacrum	0	0	0	0	4	4	1	1
Cam	Caudal	0	0	0	0	8	1.33	2	0.33
Cam	Scapula	1	0.5	0	0	27	13.5	4	2
Cam	Prx hum	1	0.5	0	0	43	21.5	11	5.5
Cam	dst hum	4	2	0	0	29	14.5	6	3
Cam	Prx radul	2	1	0	0	33	16.5	10	5
Cam	Dst radul	1	0.5	0	0	24	12	5	2.5
Cam	Carpals	1	0.5	0	0	22	11	5	2.5
Cam	Prx MTC	2	1	0	0	41	20.5	7	3.5
Cam	Dst MTC	0	0	0	0	57	14.25	6	1.5
Cam	1st Phal	6	0.75	0	0	155	19.38	25	3.125
Cam	2nd Phal	0	0	0	0	83	10.38	21	2.625
Cam	3rd Phal	0	0	0	0	29	3.625	4	0.5
Cam	Pelvis	1	0.5	0	0	31	15.5	9	4.5
Cam	Prx femur	3	1.5	0	0	28	14	5	2.5
Cam	Dst femur	1	0.5	0	0	15	7.5	6	3
Cam	Patella	0	0	0	0	18	9	2	1
Cam	Prx tibia	1	0.5	0	0	20	10	5	2.5
Cam	Dst tibia	1	0.5	0	0	27	13.5	14	7
Cam	Tarsals	1	0.5	0	0	34	17	10	5
Cam	Prx MTT	0	0	0	0	41	20.5	9	4.5
Cam	Dst MTT	0	0	0	0	30	7.5	7	1.75

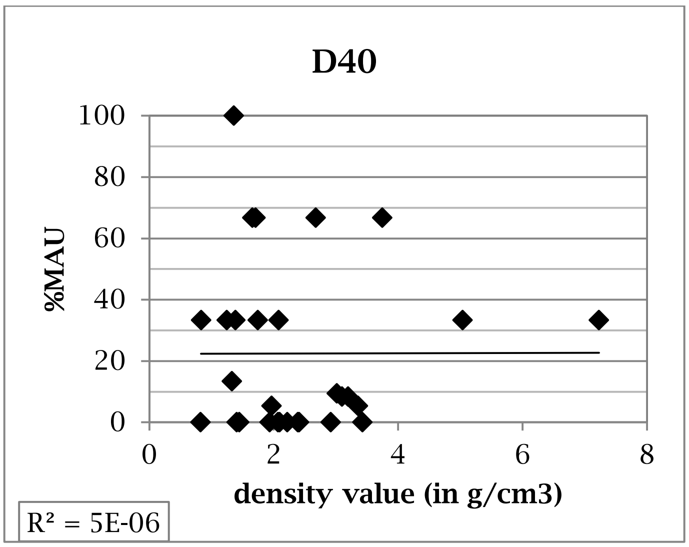
V. Bone Density Graphs for All Assemblages








D36
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.015


D40
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40
20
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%MAU
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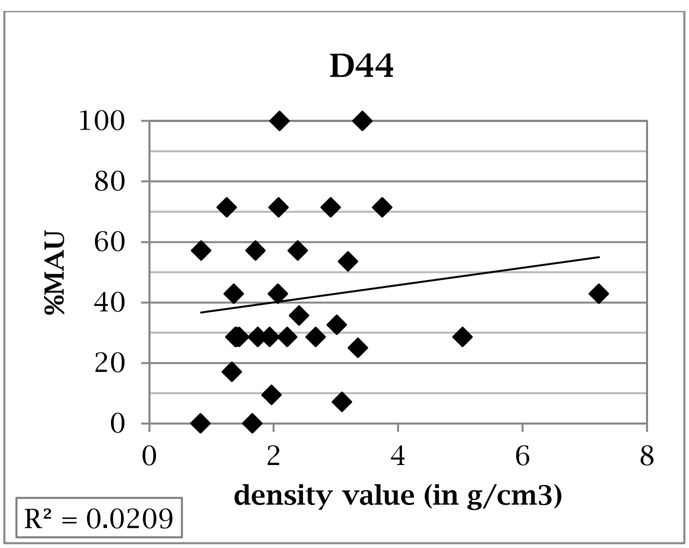
2
4
6
8
density value (in g/cm3)
R² = 5E-06


D44
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20
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%MAU
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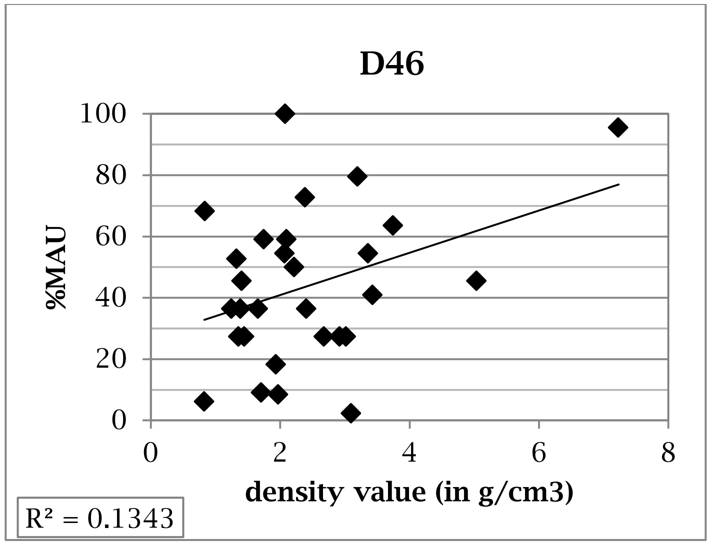
2
4
6
8
density value (in g/cm3)
R² = 0.0209


D46
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60
40
20
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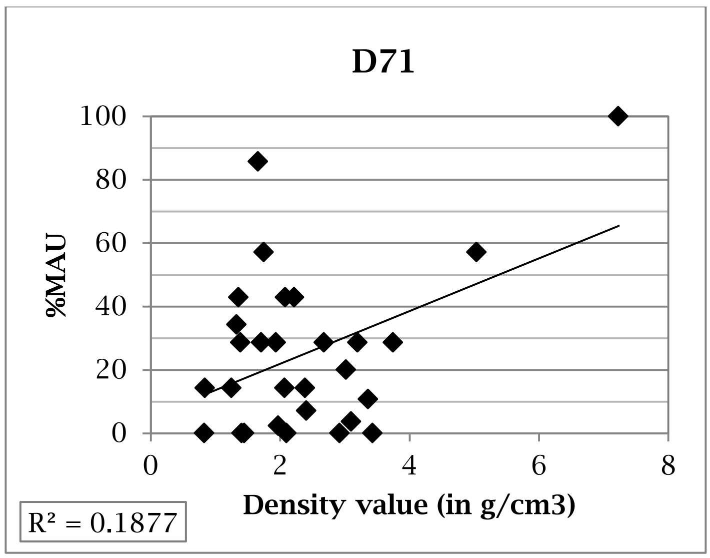
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.1343


D71
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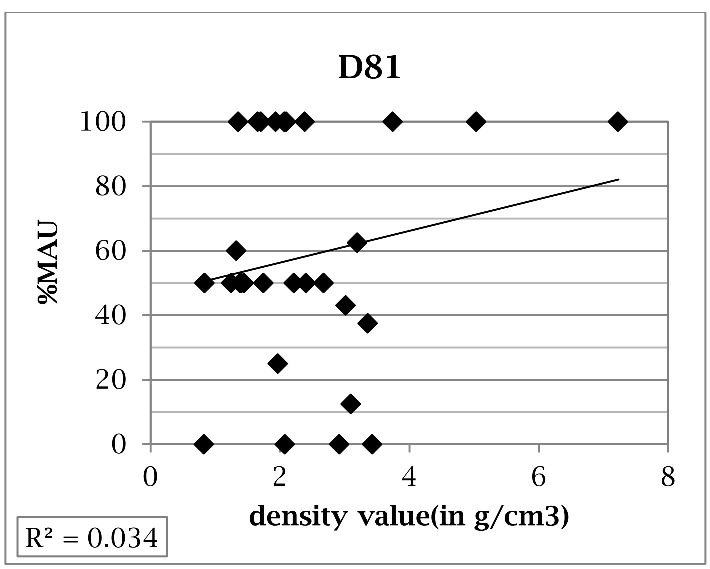
80
60
40
20
0
%MAU
0
2
4
6
8
Density value (in g/cm3)
R² = 0.1877


D81
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60
40
20
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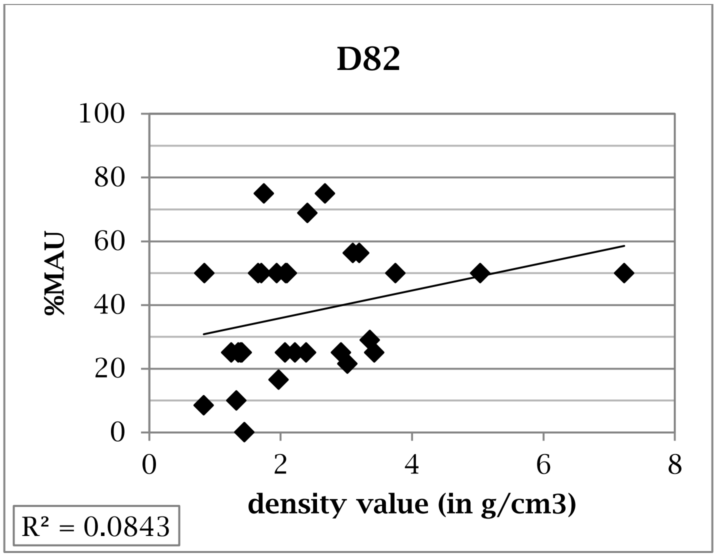
%MAU
0
2
4
6
8
density value(in g/cm3)
R² = 0.034


D82
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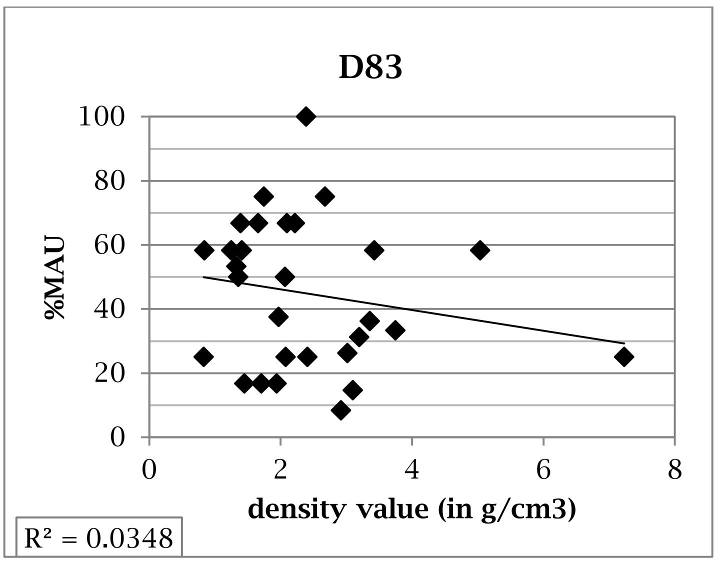
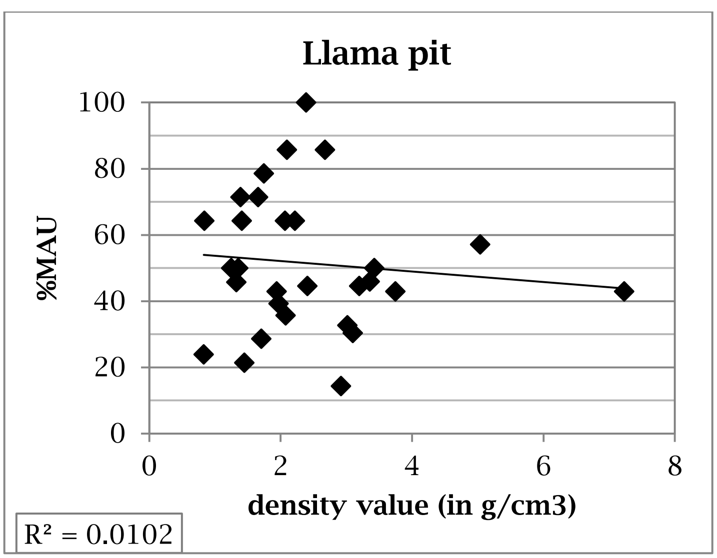
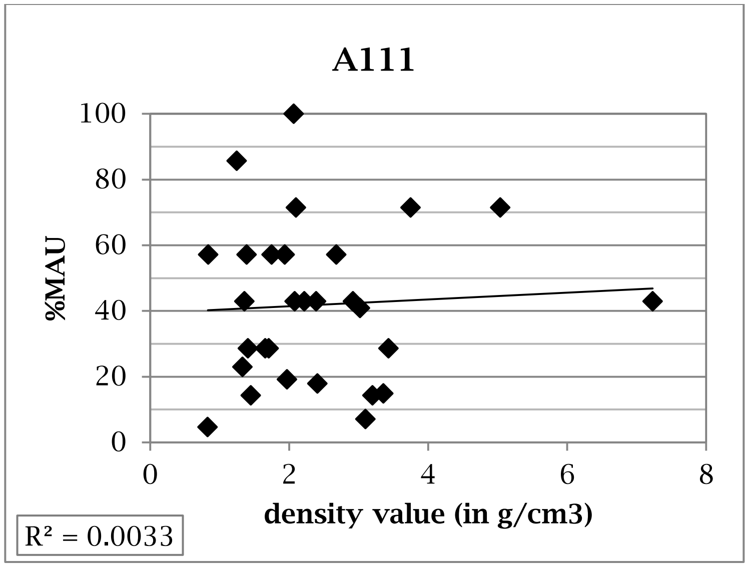
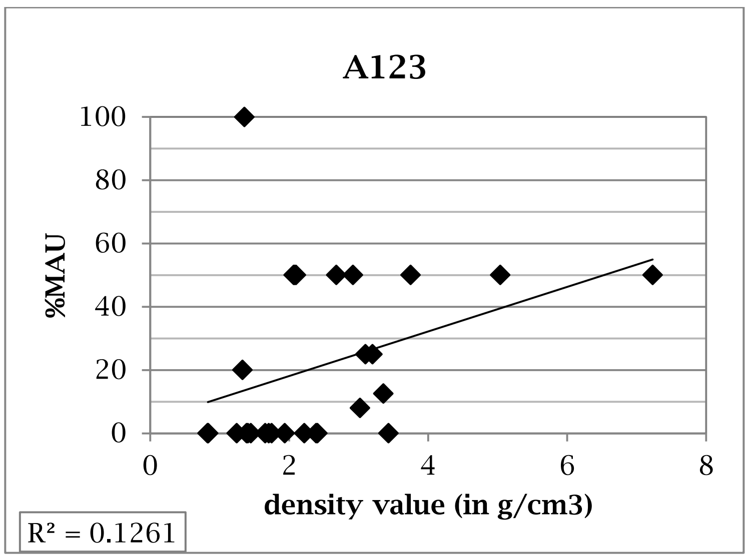
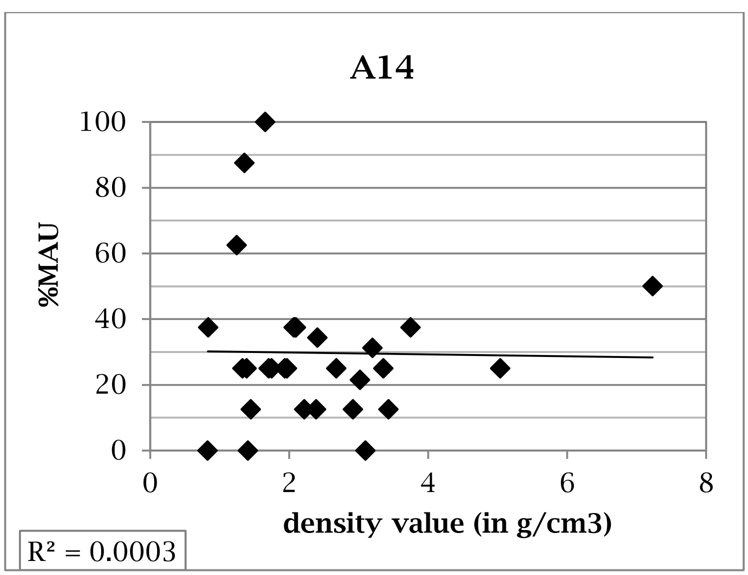
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.0843

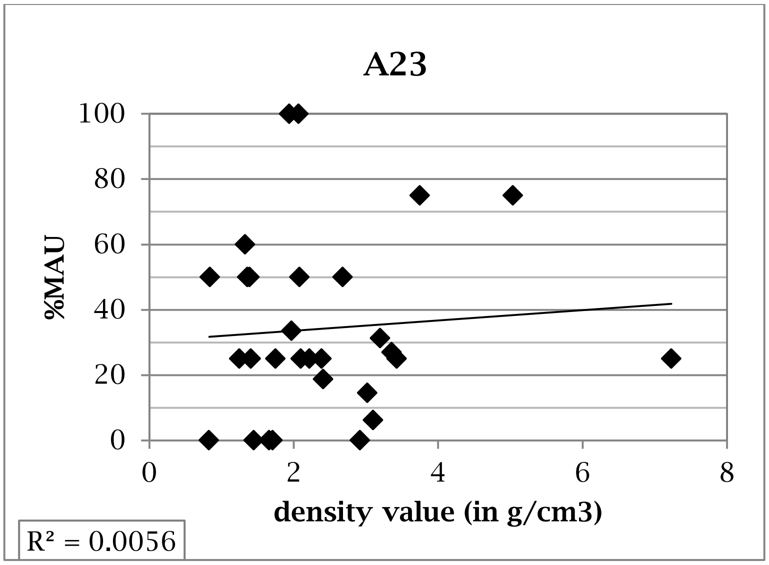

D83
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.0348

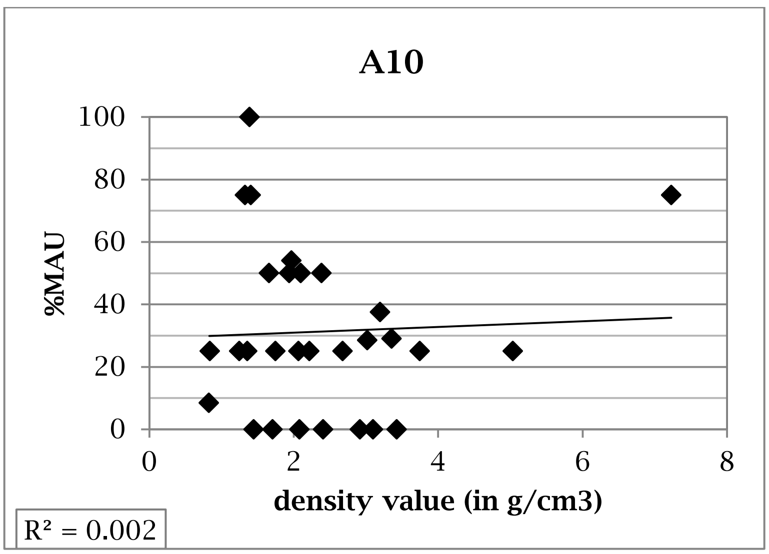

Llama pit
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.0102

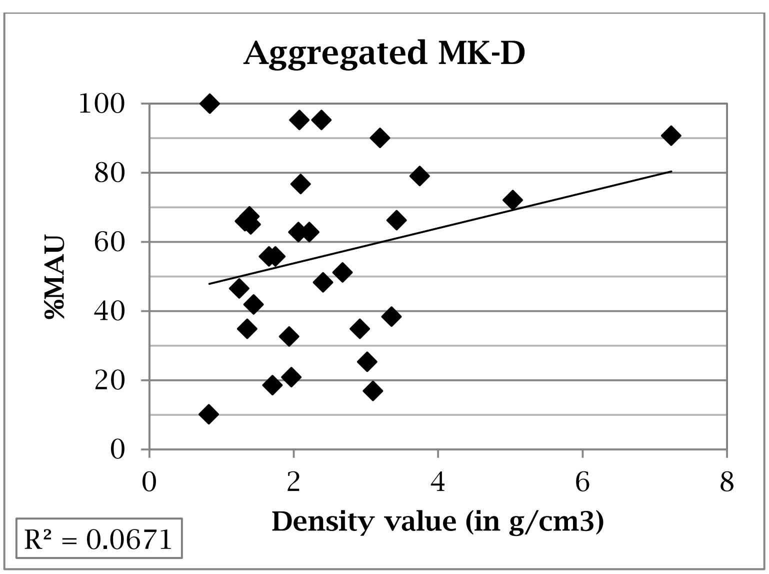

A111
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.0033

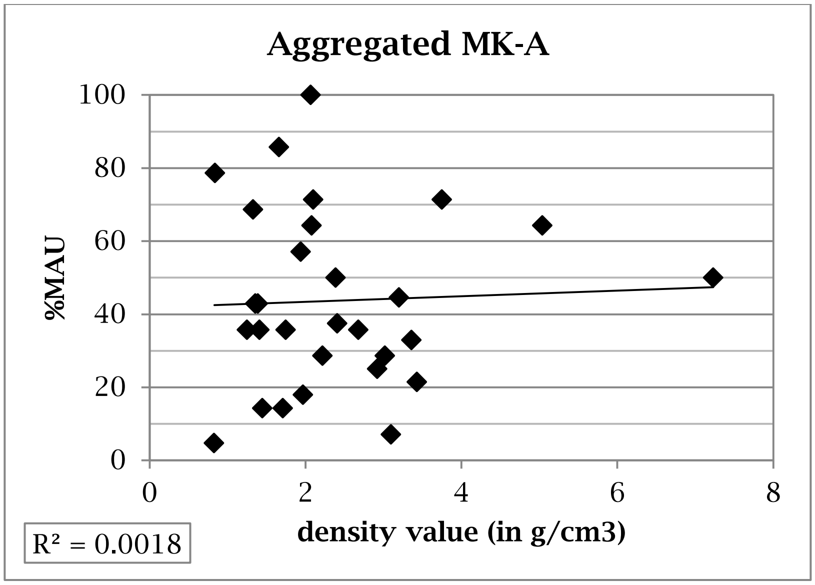

A123
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.1261


A14
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
R² = 0.0003


A23
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
$R^2 = 0.0056$

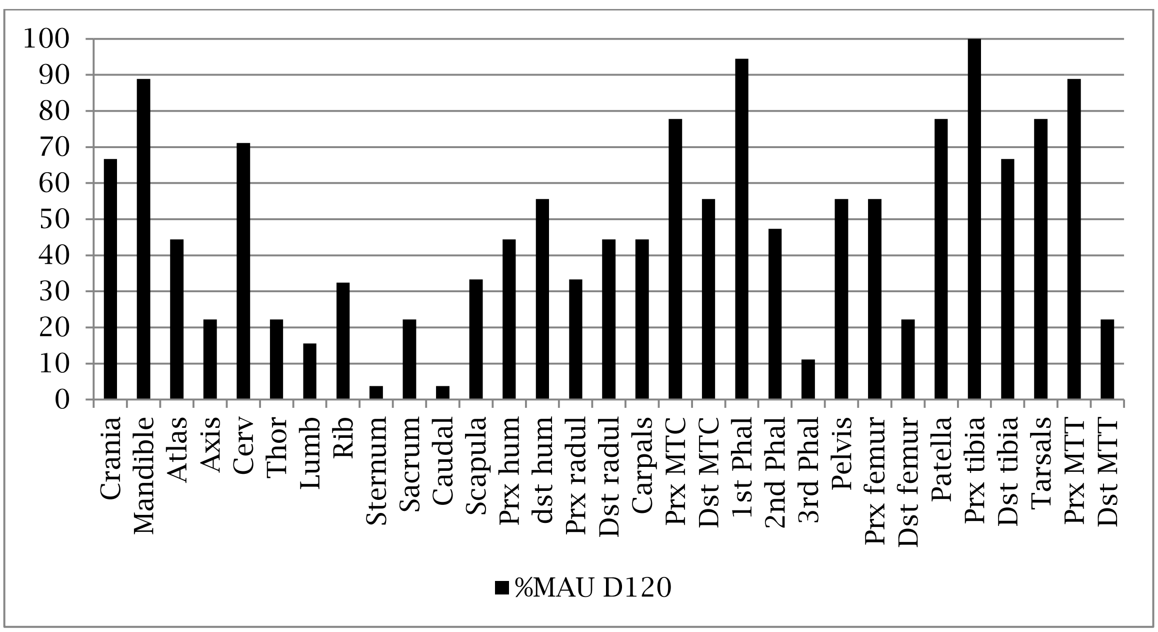

A10
100
80
60
40
20
0
%MAU
0
2
4
6
8
density value (in g/cm3)
$R^2 = 0.002$

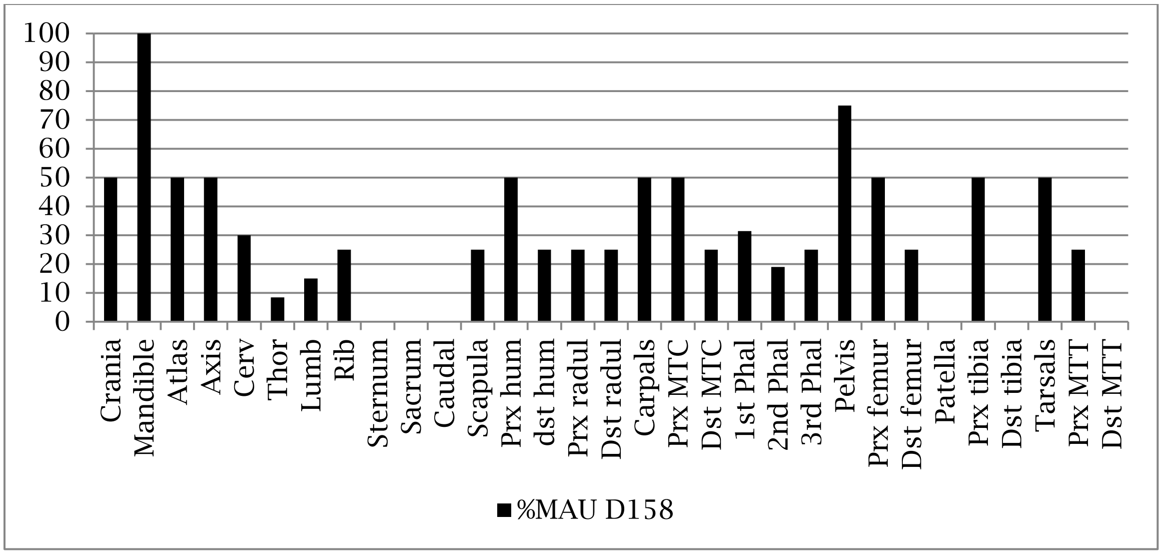

Aggregated MK-D
100
80
60
40
20
0
%MAU
0
2
4
6
8
Density value (in g/cm3)
$R^2 = 0.0671$

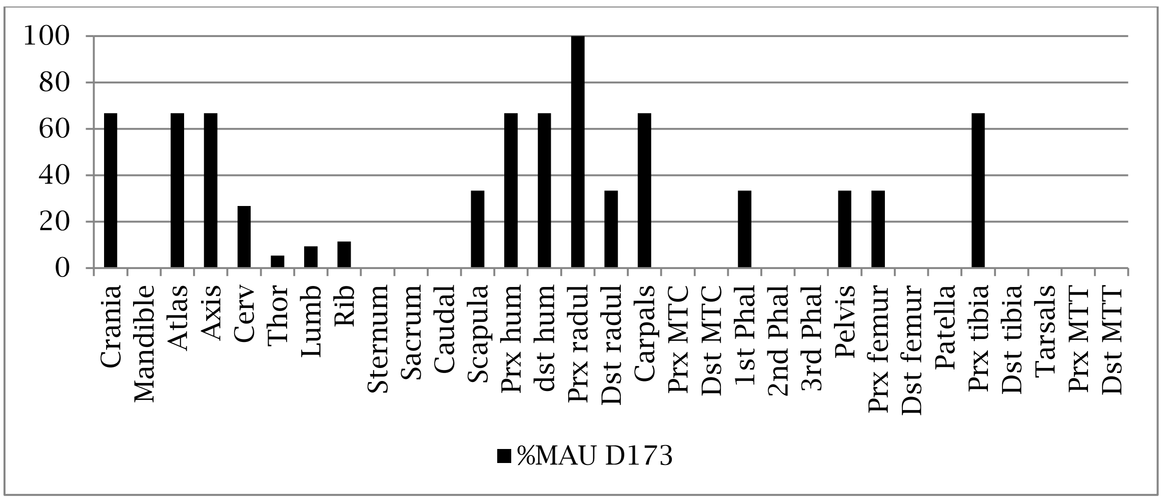


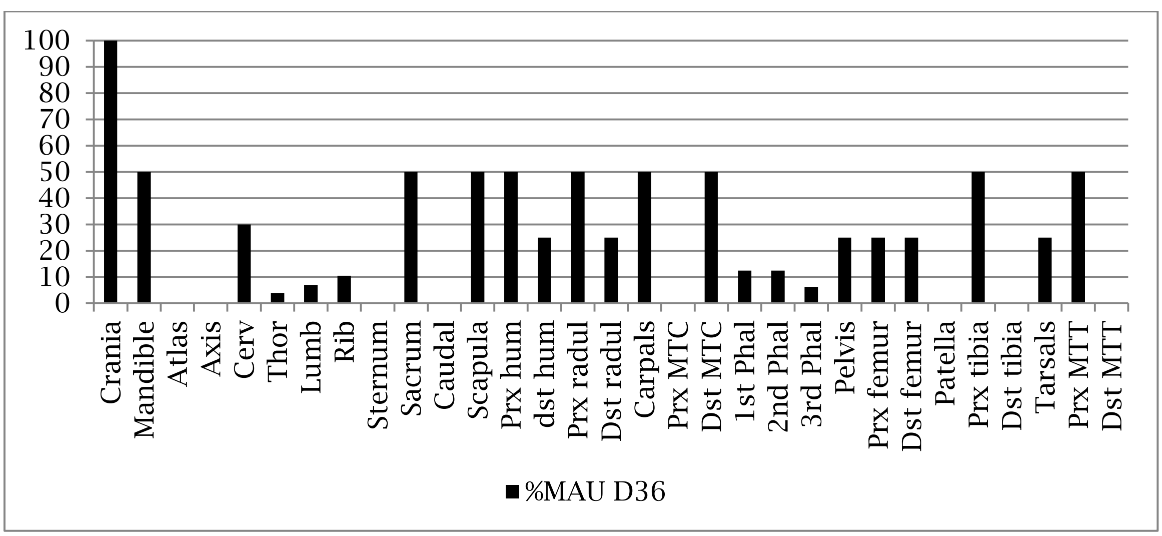
VI. Skeletal Element Frequencies Data

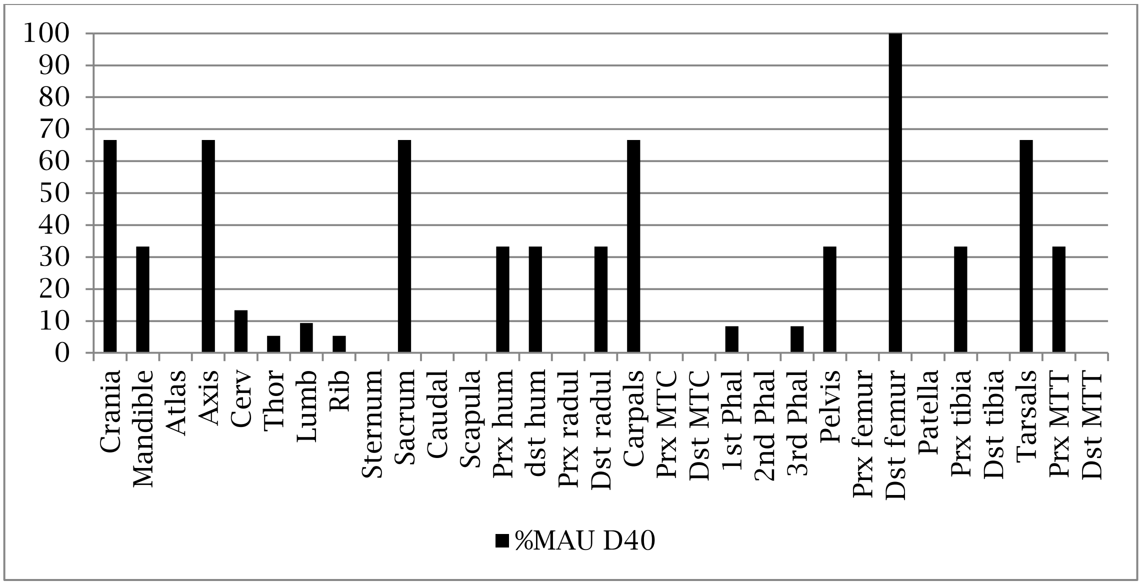
Skeletal Part Frequencies Using %MAU for all Assemblages

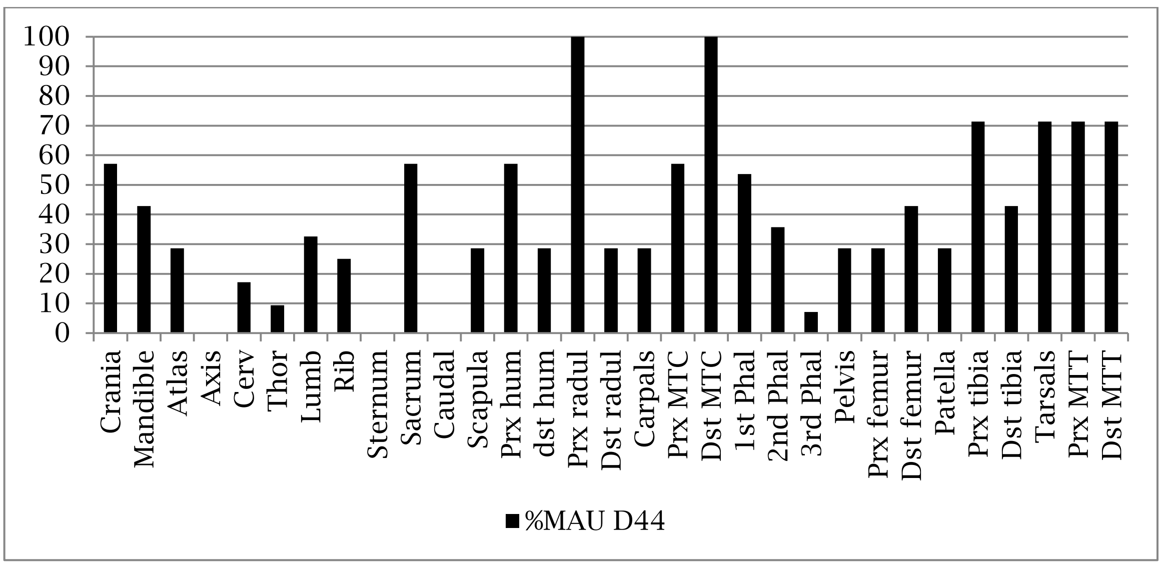


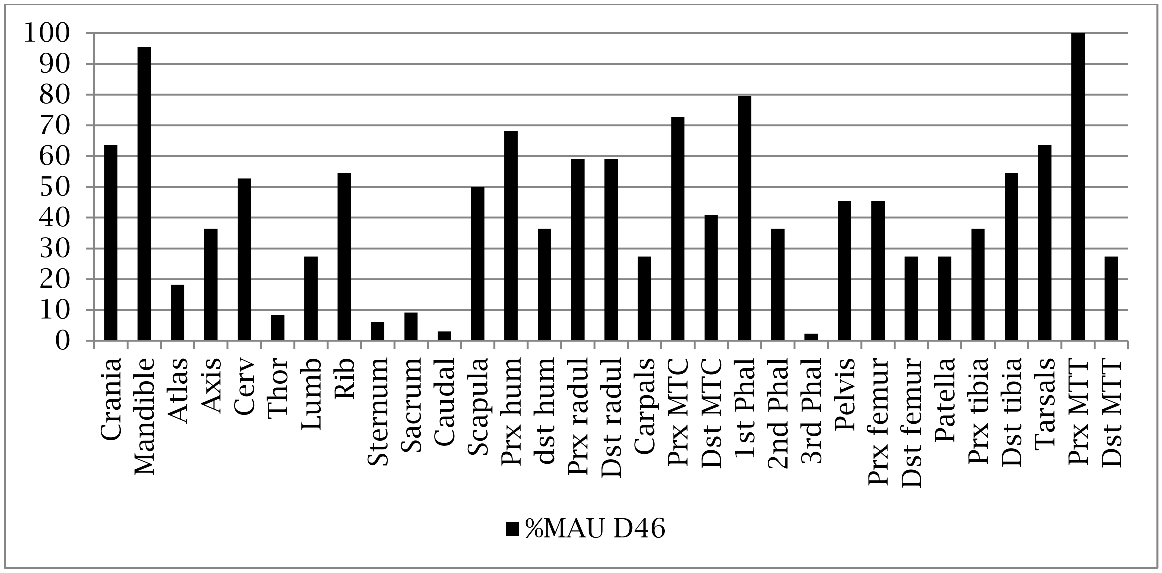

100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D158


100
80
60
40
20
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D173


100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D36


100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D40


100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D44


100
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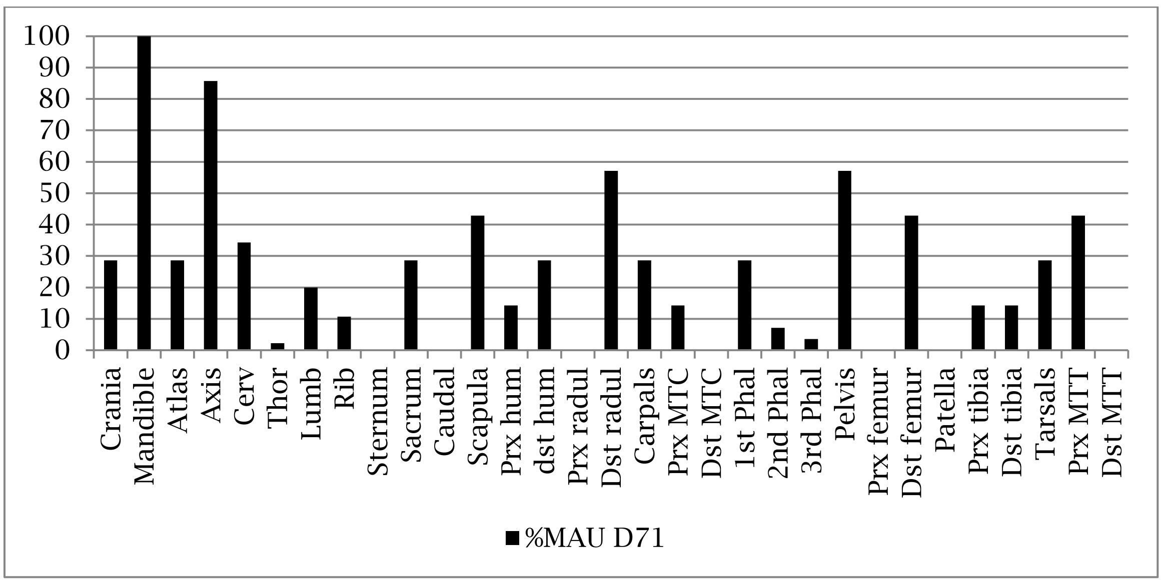
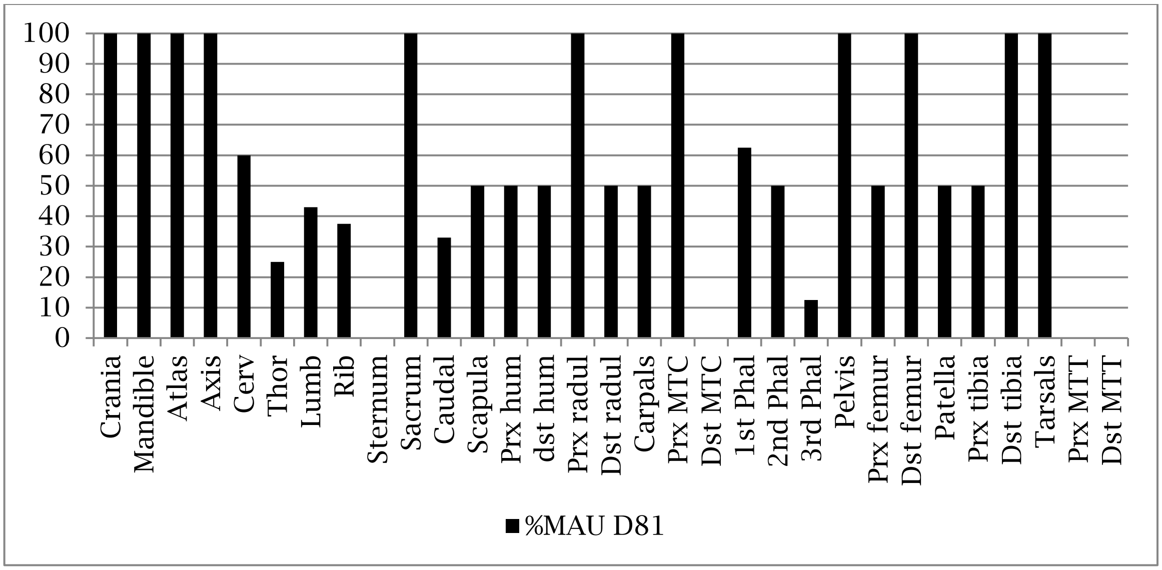
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D46


100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D71



100
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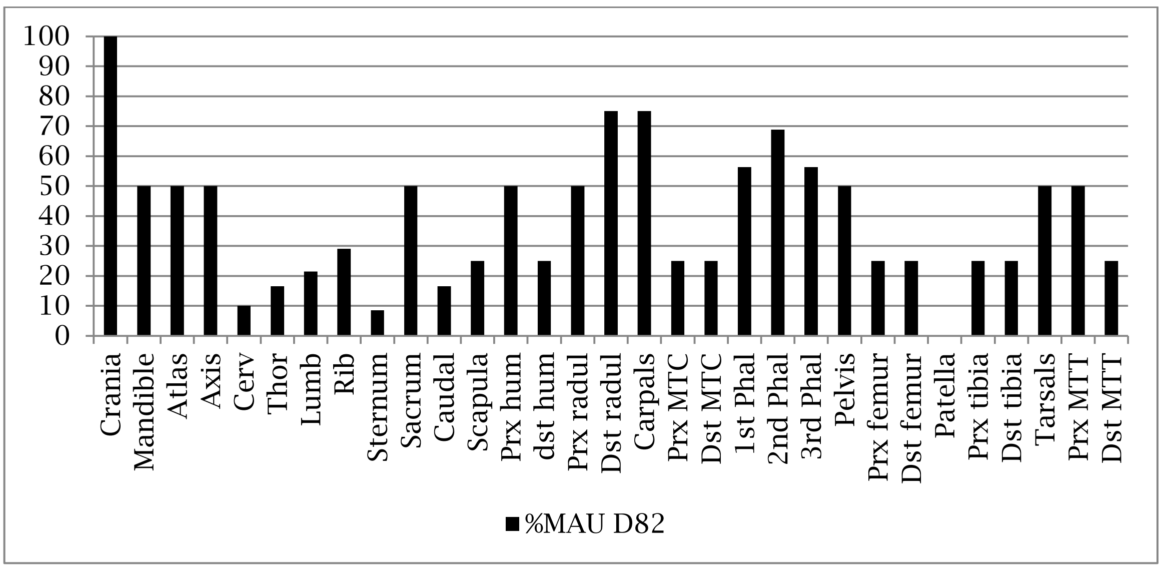
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D81



100
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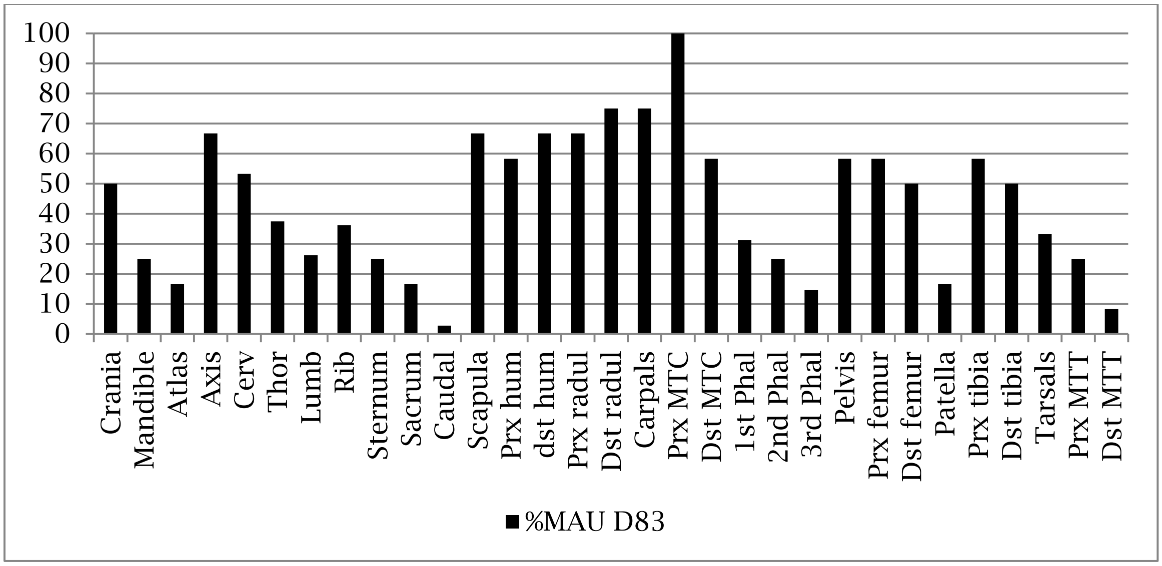
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D82


100
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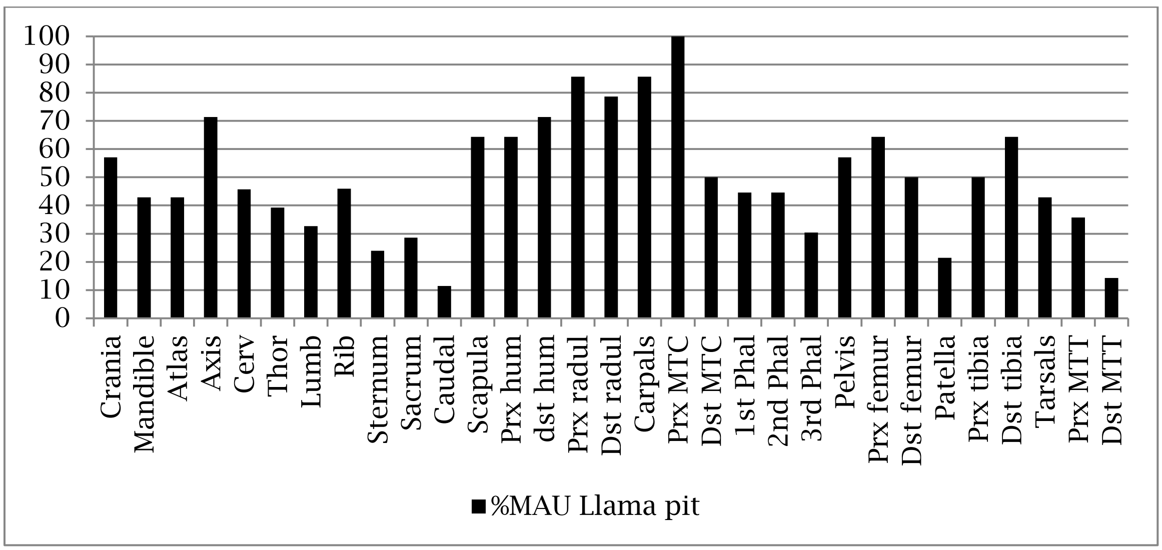
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU D83


100
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60
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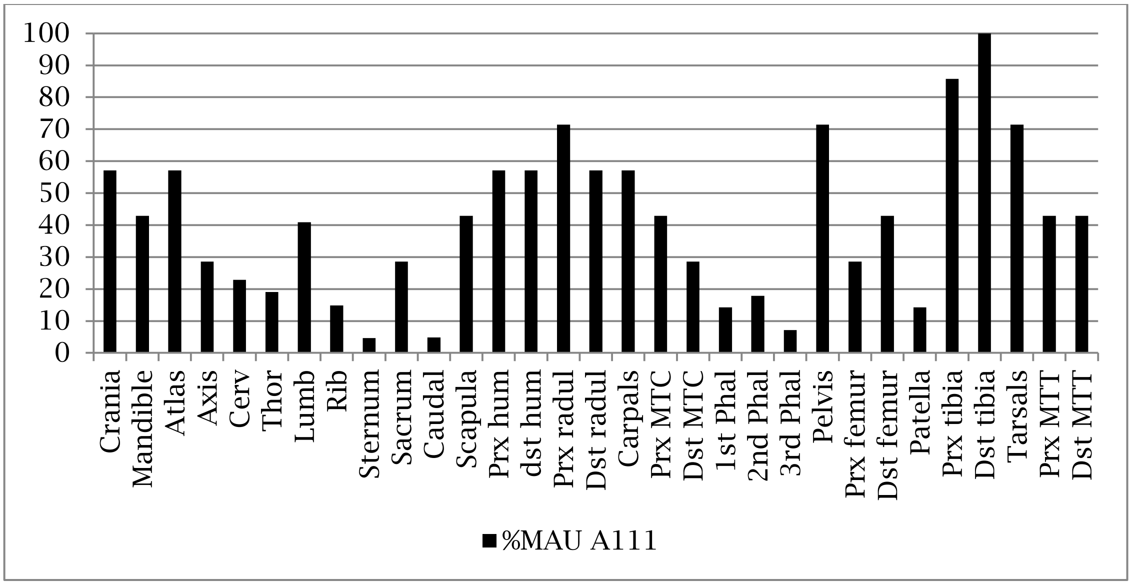
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU Llama pit


100
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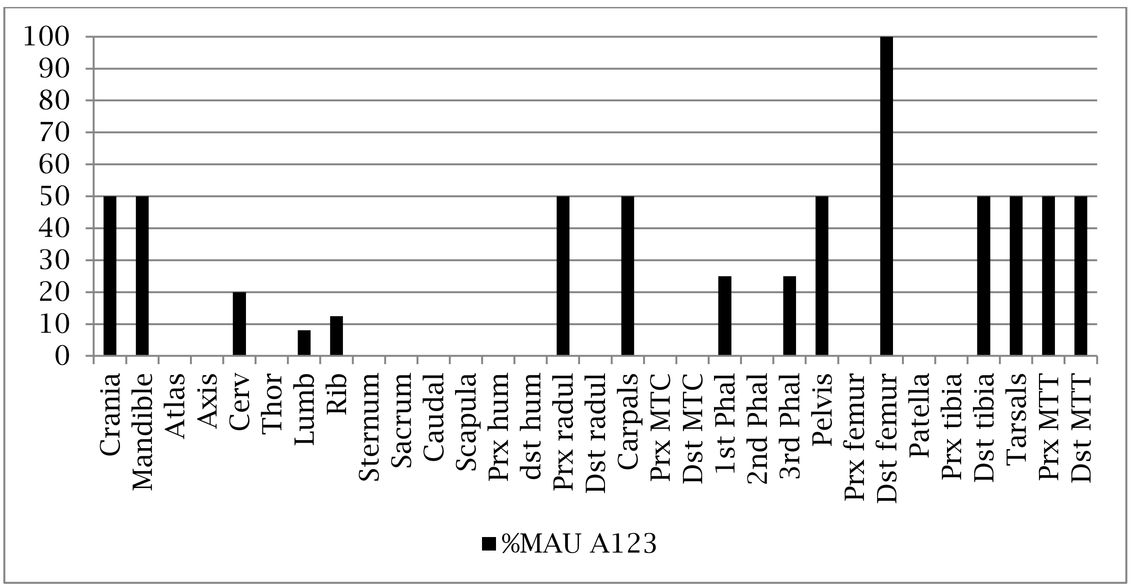
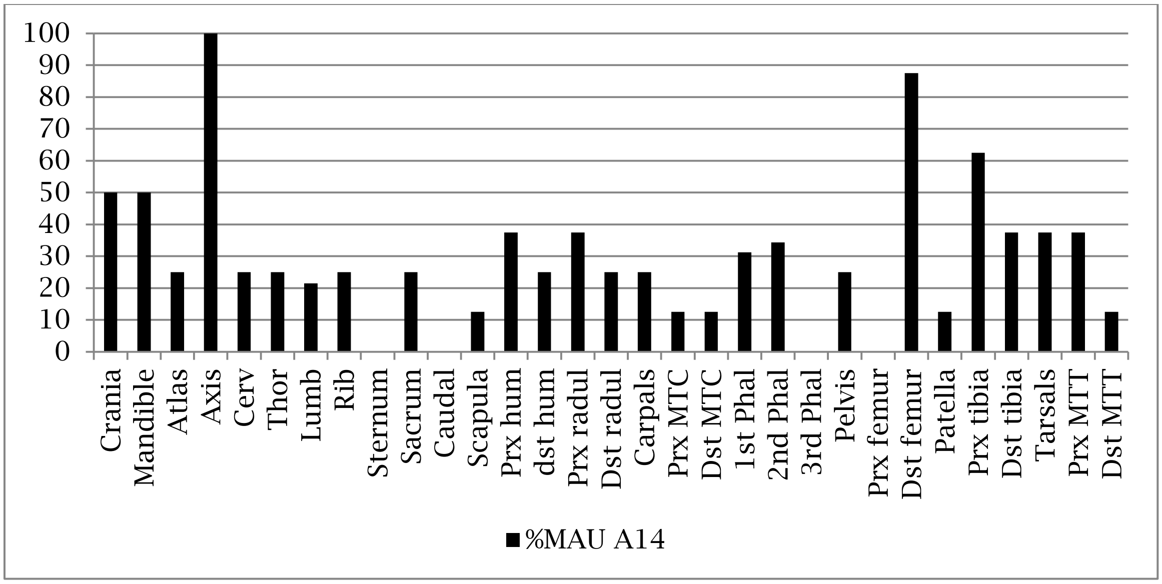
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU A111


100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU A123


100
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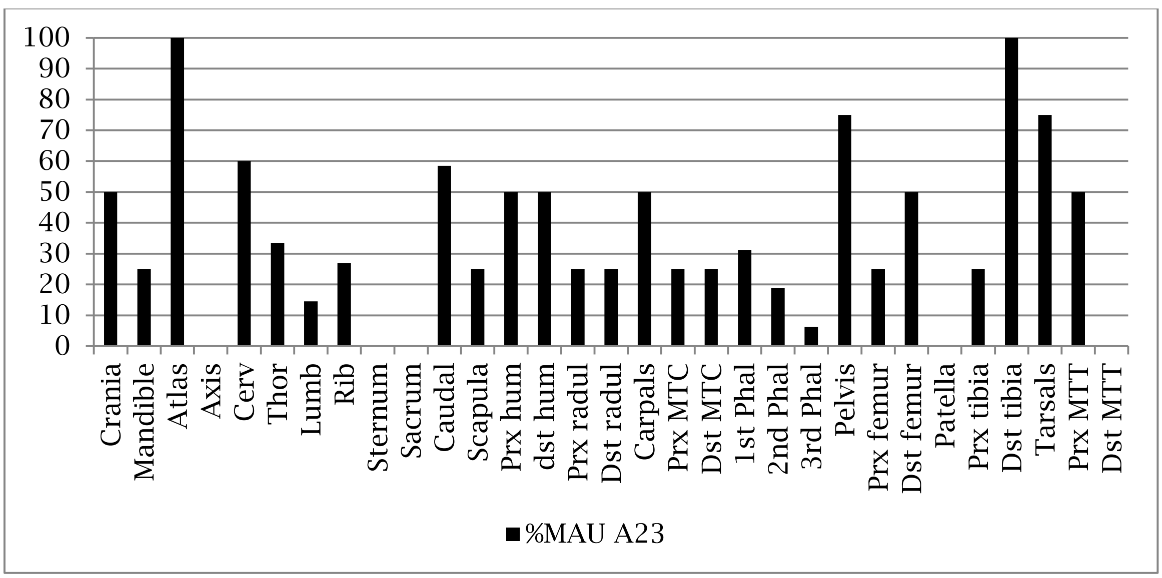
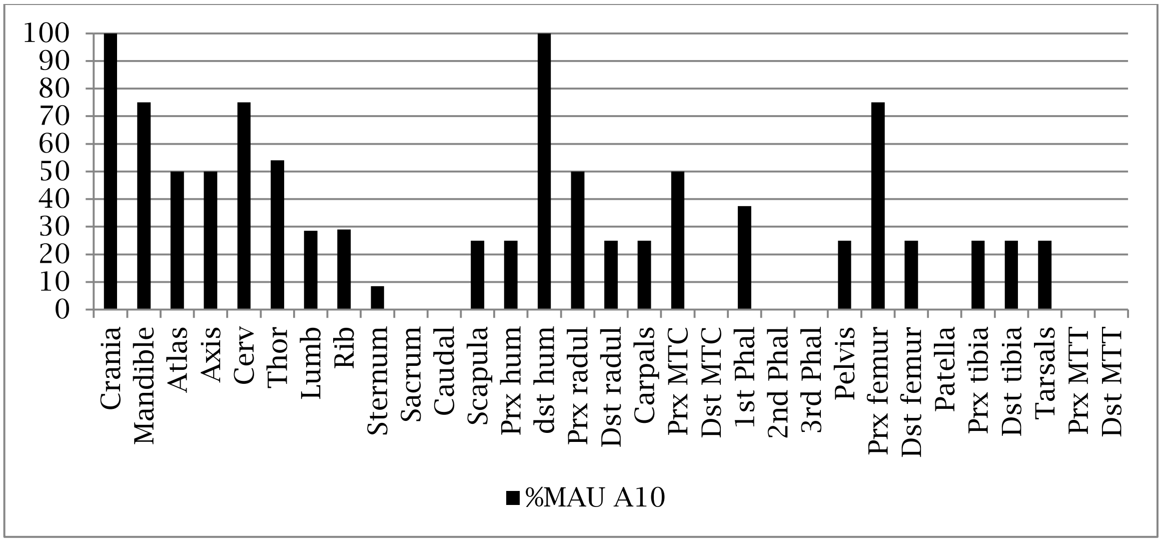
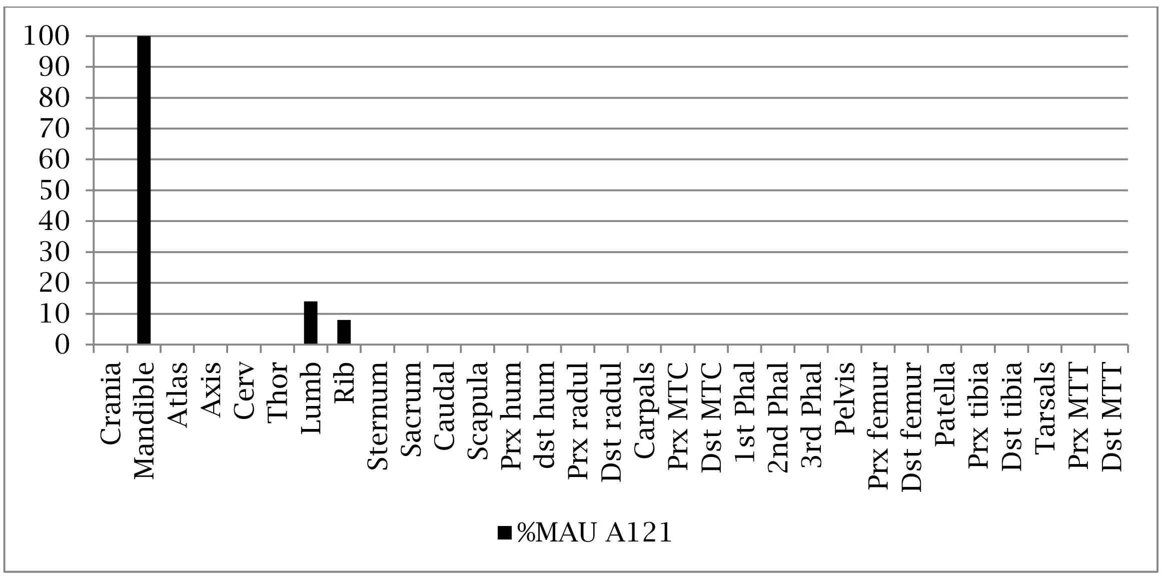
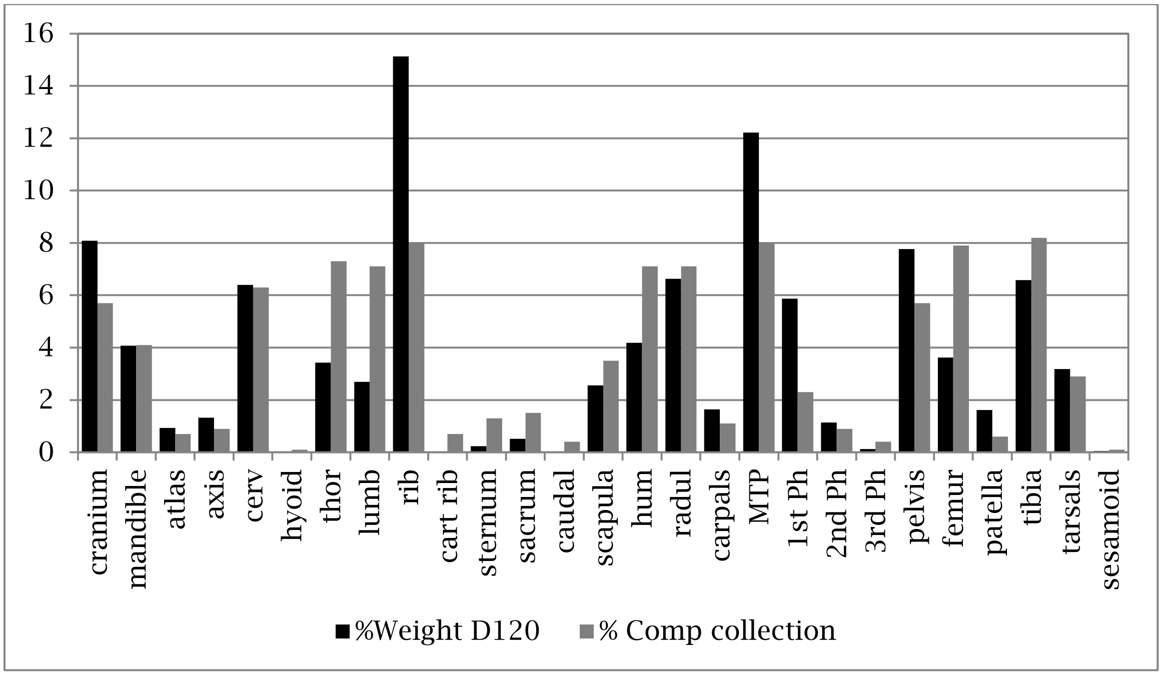
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU A14

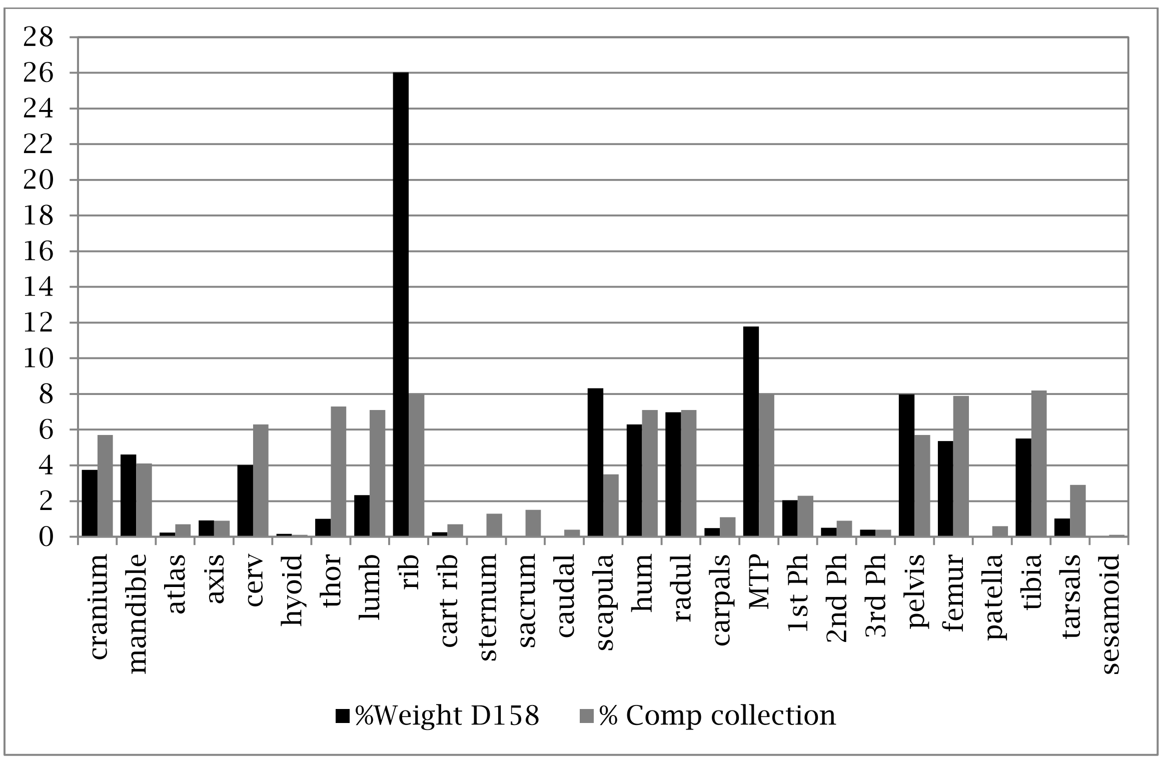

100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU A23

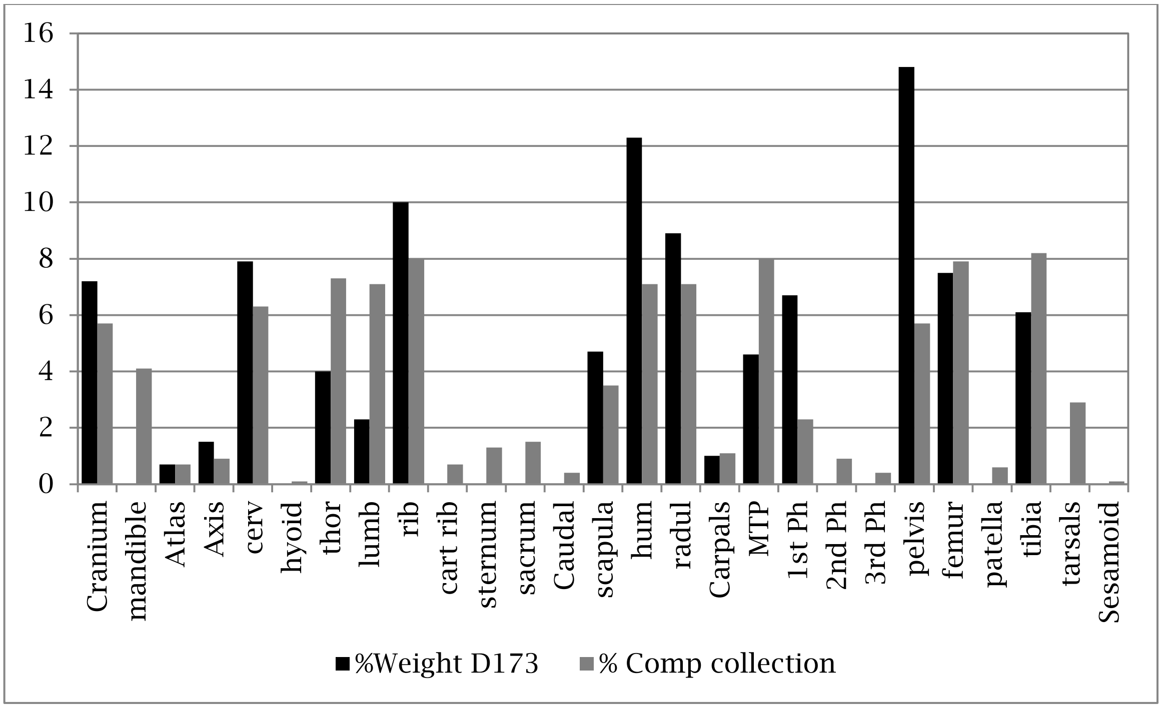

100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU A10


100
90
80
70
60
50
40
30
20
10
0
Crania
Mandible
Atlas
Axis
Cerv
Thor
Lumb
Rib
Sternum
Sacrum
Caudal
Scapula
Prx hum
dst hum
Prx radul
Dst radul
Carpals
Prx MTC
Dst MTC
1st Phal
2nd Phal
3rd Phal
Pelvis
Prx femur
Dst femur
Patella
Prx tibia
Dst tibia
Tarsals
Prx MTT
Dst MTT
%MAU A121

Skeletal Part Frequencies Using %Weight for All Assemblages



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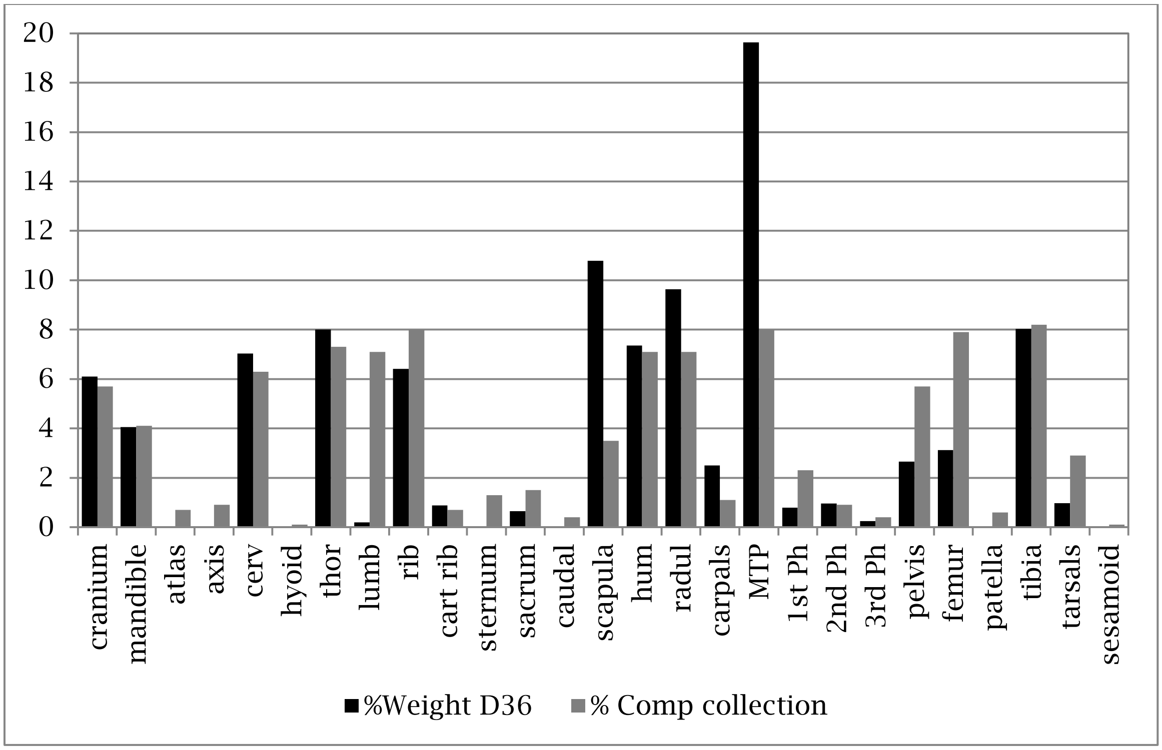
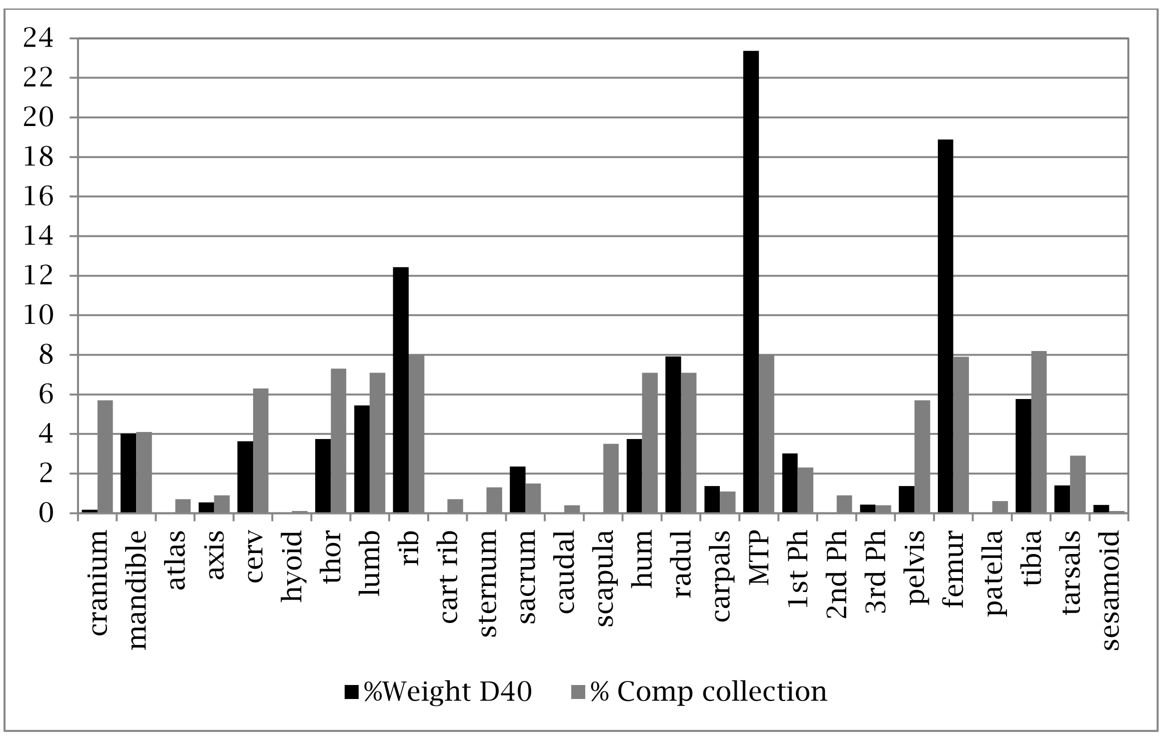
14
12
10
8
6
4
2
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight D173
% Comp collection



20
18
16
14
12
10
8
6
4
2
0
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D36
% Comp collection



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4
2
0
cranium
mandible
atlas
axis
cerv
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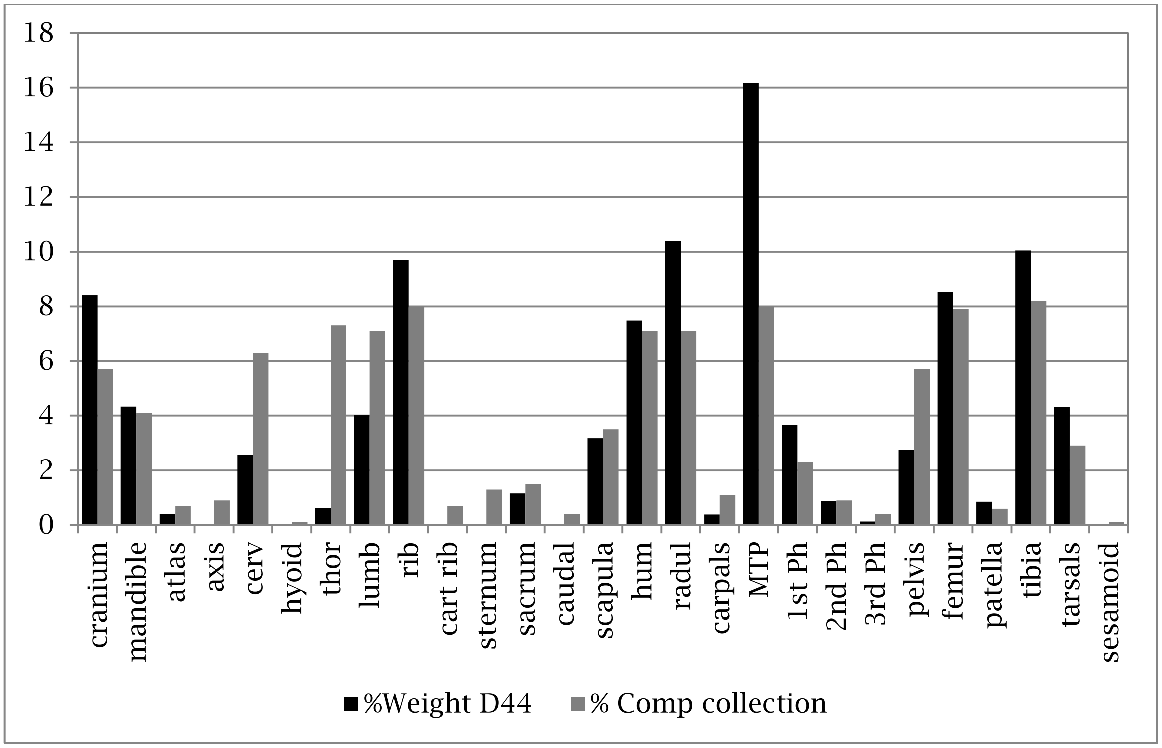
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D40
% Comp collection



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16
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12
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6
4
2
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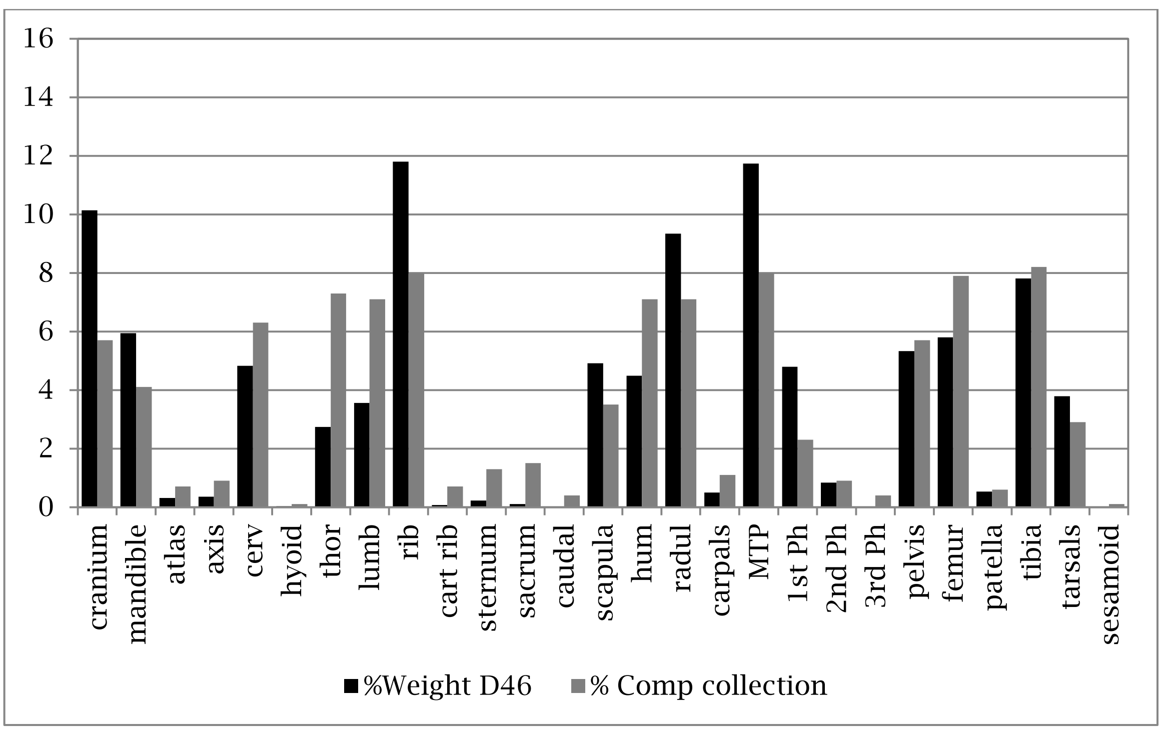
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D44
% Comp collection



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14
12
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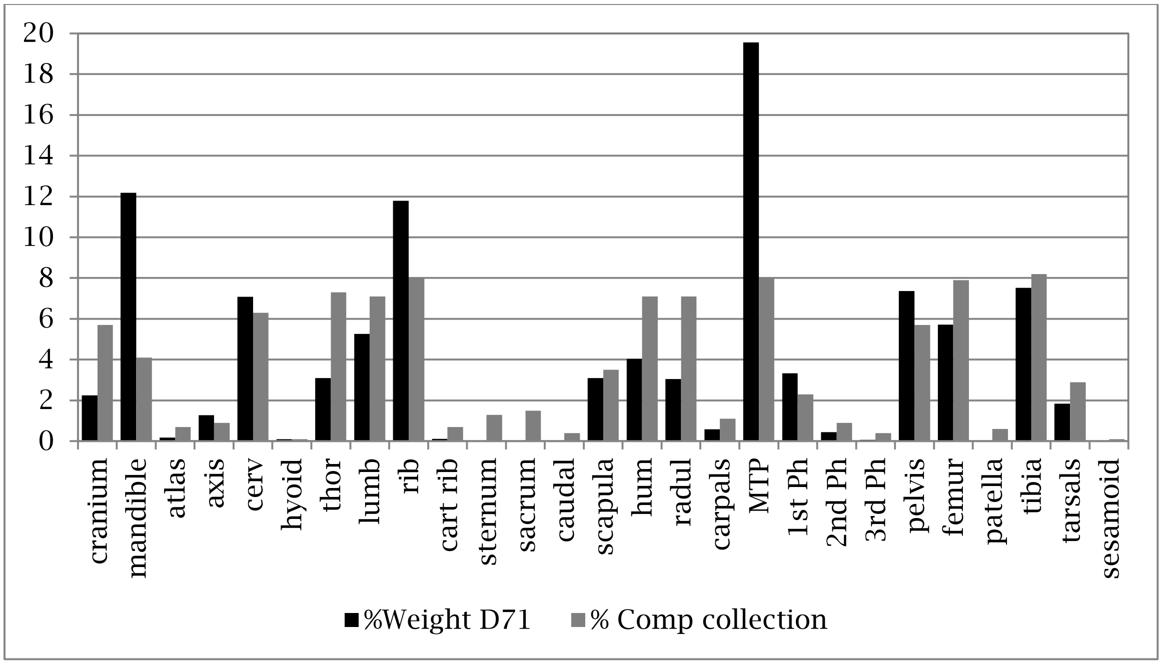
8
6
4
2
0
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D46
% Comp collection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18
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14
12
10
8
6
4
2
0
cranium
mandible
atlas
axis
cerv
hyoid
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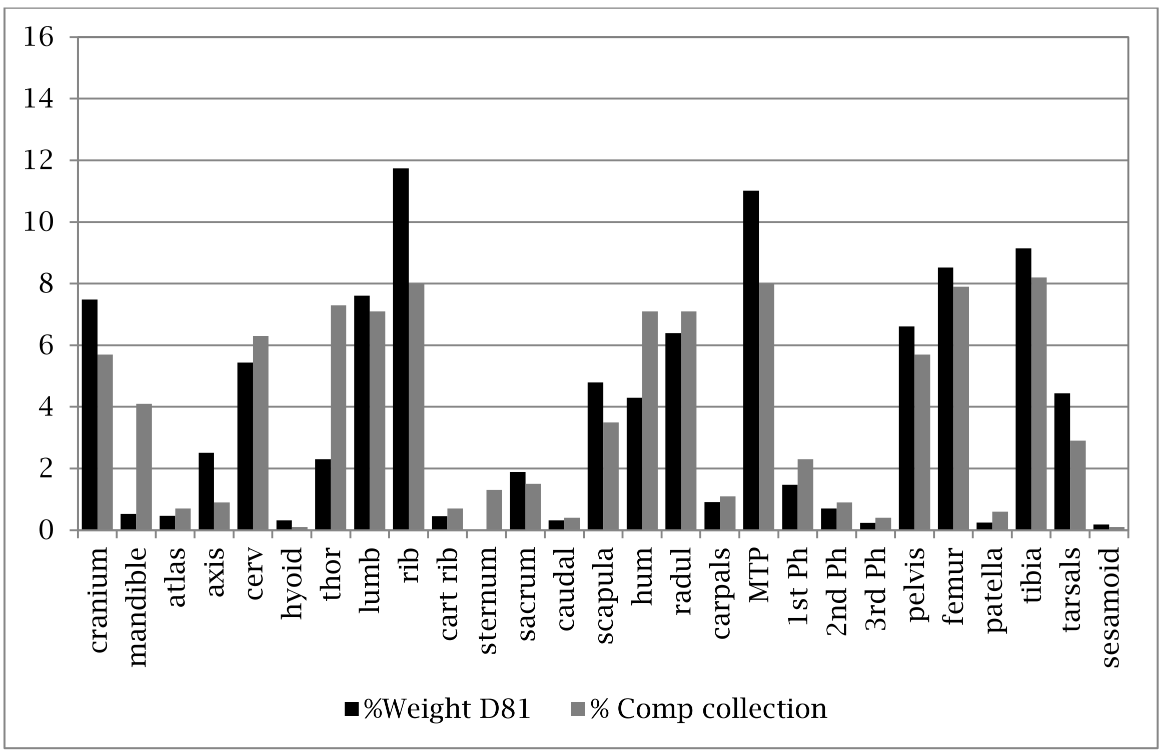
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D71
% Comp collection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10
8
6
4
2
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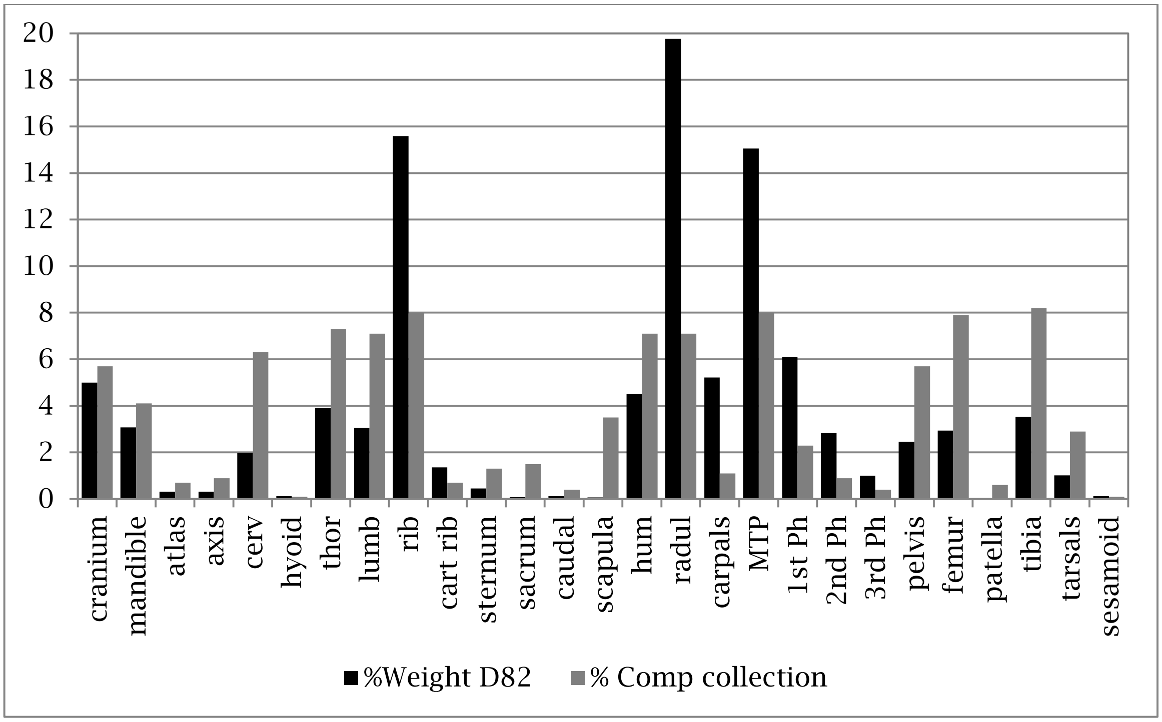
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D81
% Comp collection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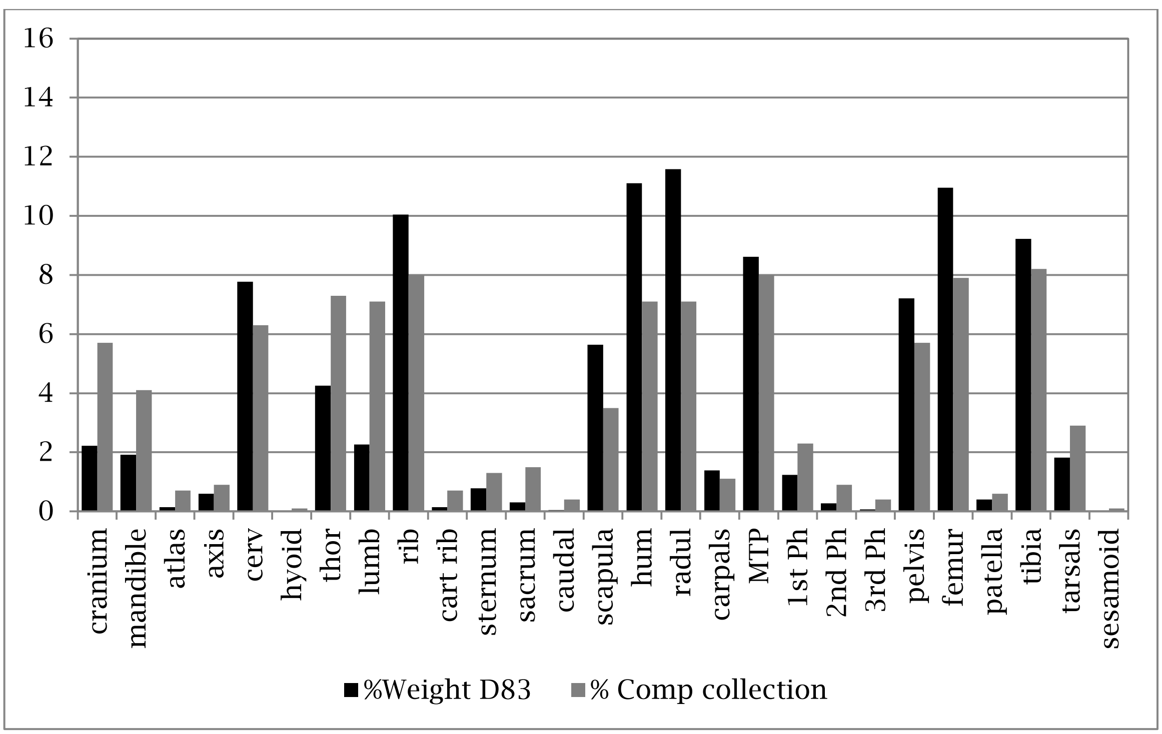
14
12
10
8
6
4
2
0
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D82
% Comp collection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8
6
4
2
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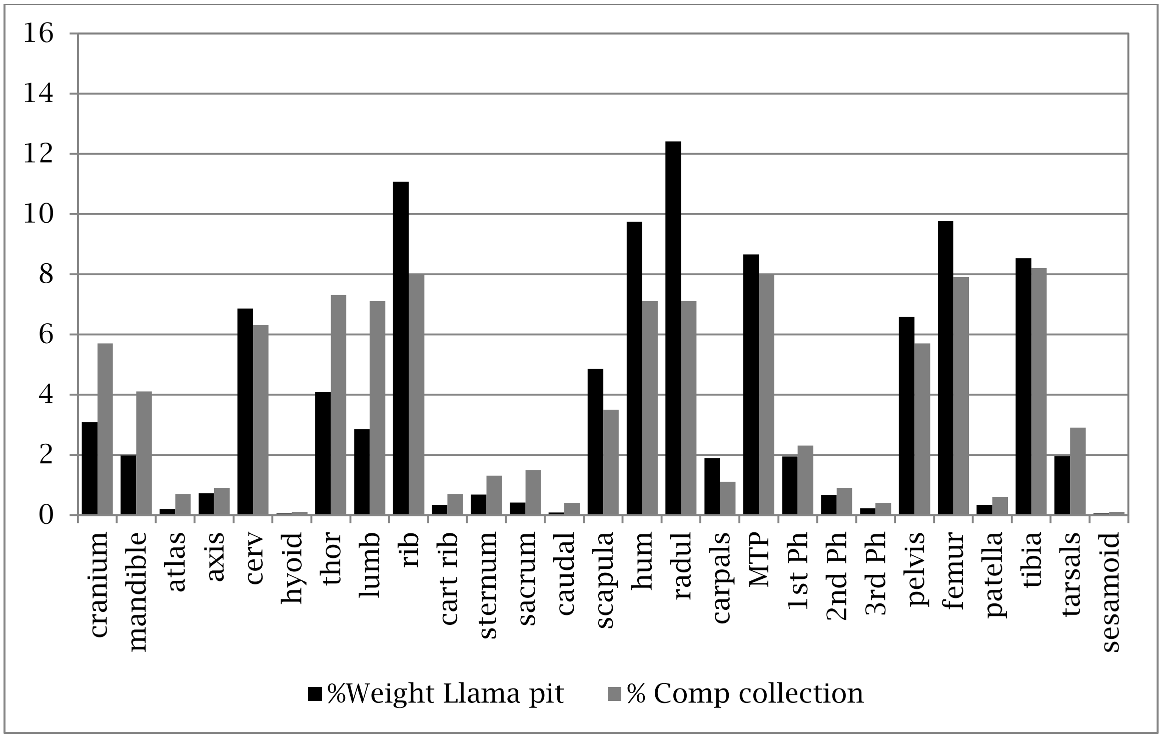
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight D83
% Comp collection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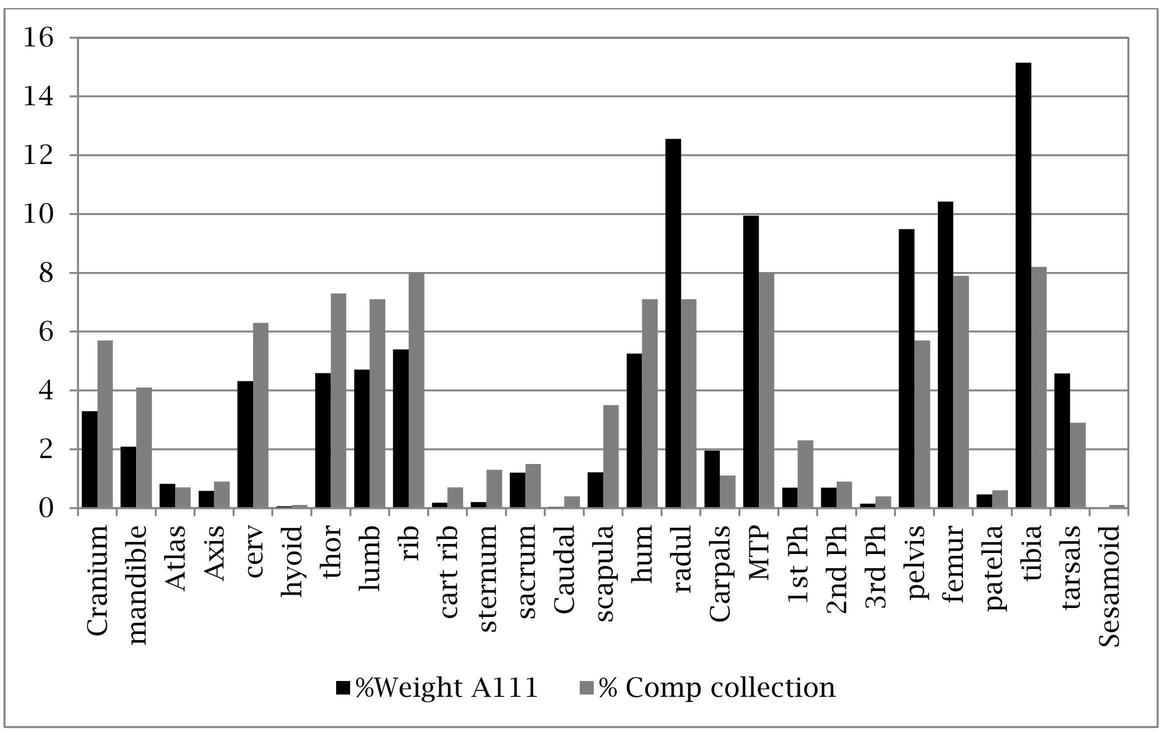
14
12
10
8
6
4
2
0
cranium
mandible
atlas
axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
caudal
scapula
hum
radul
carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
sesamoid
%Weight Llama pit
% Comp collection


16
14
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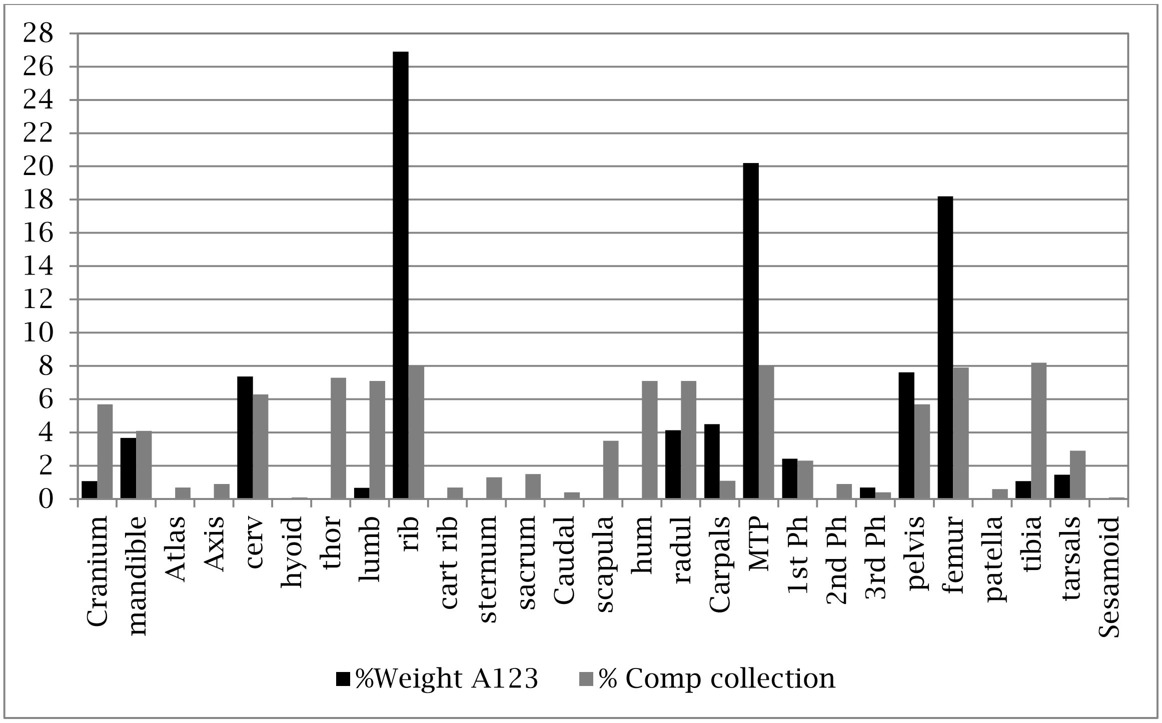
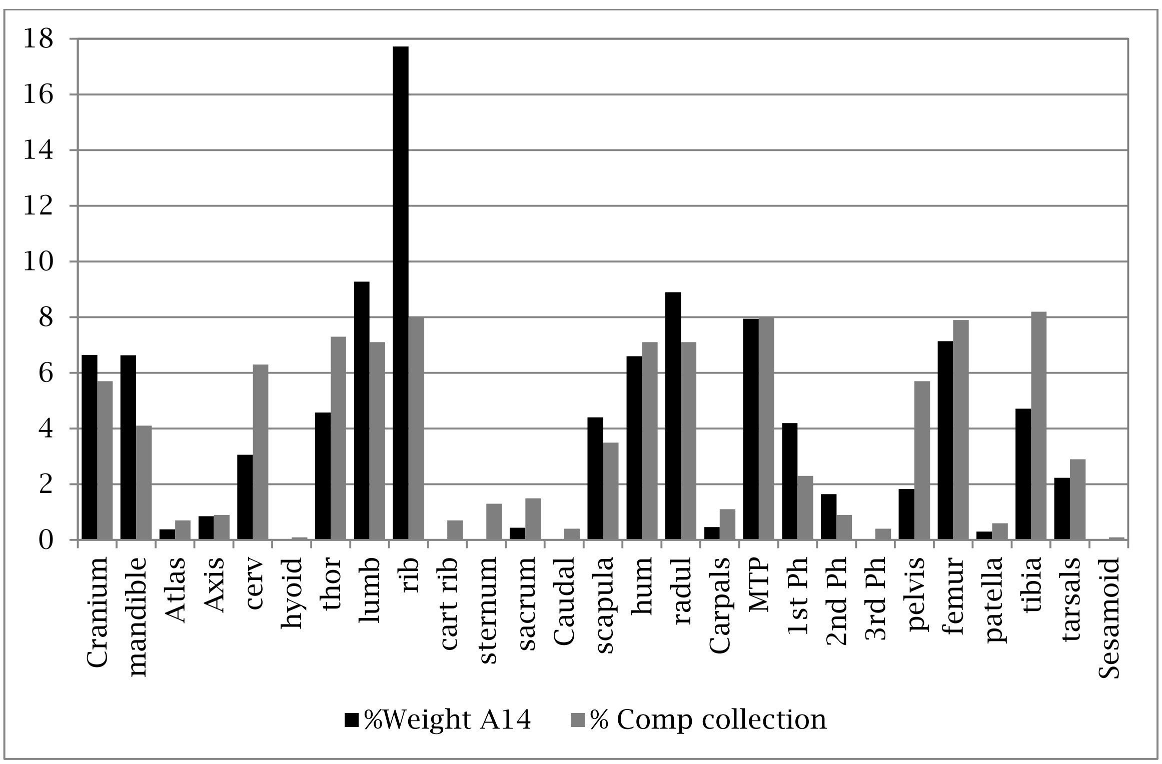
10
8
6
4
2
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight A111
% Comp collection


28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight A123
% Comp collection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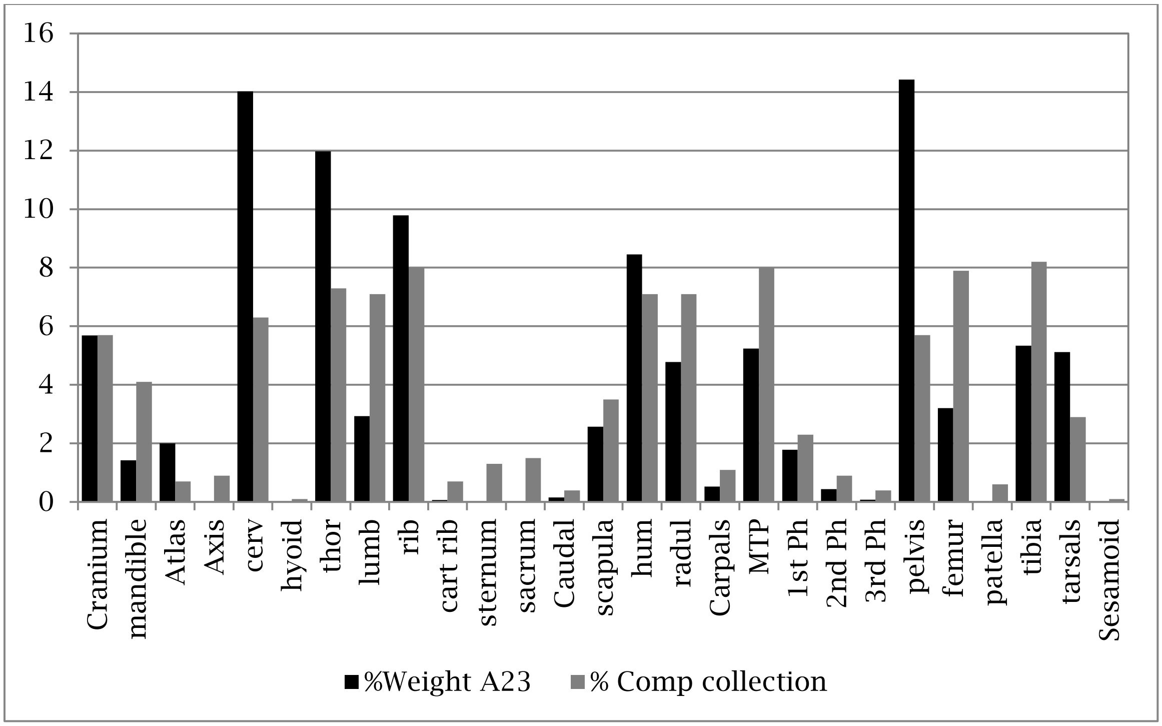
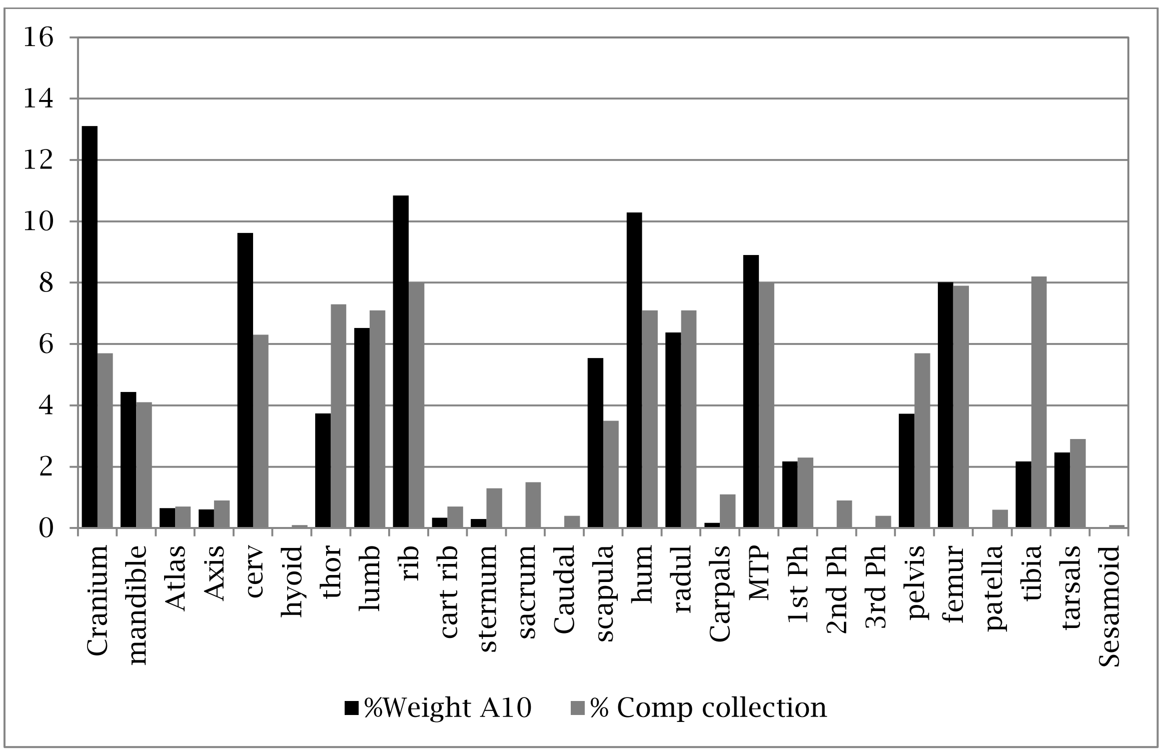
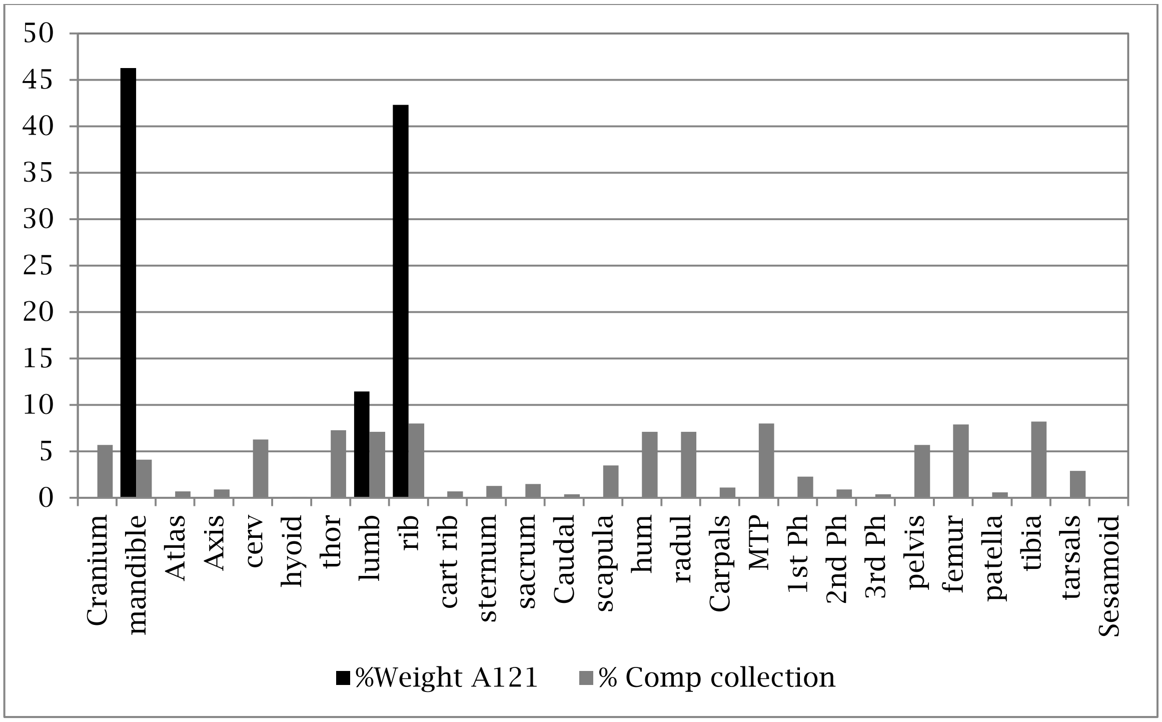
12
10
8
6
4
2
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight A14
% Comp collection



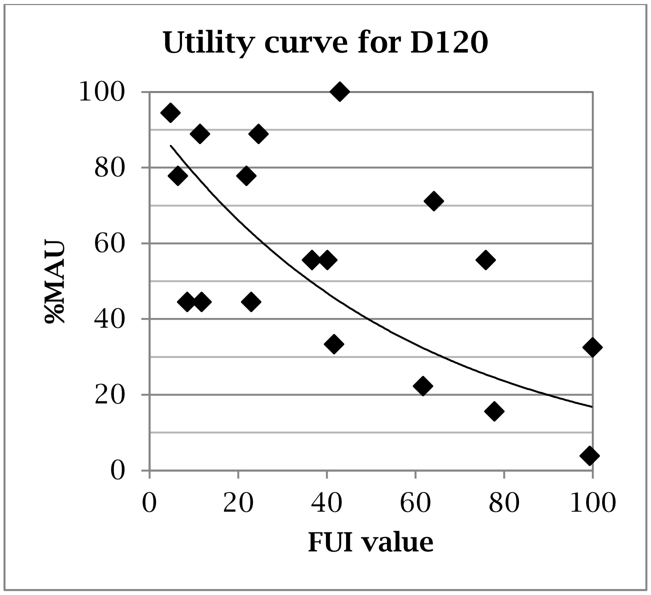
16
14
12
10
8
6
4
2
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight A23
% Comp collection

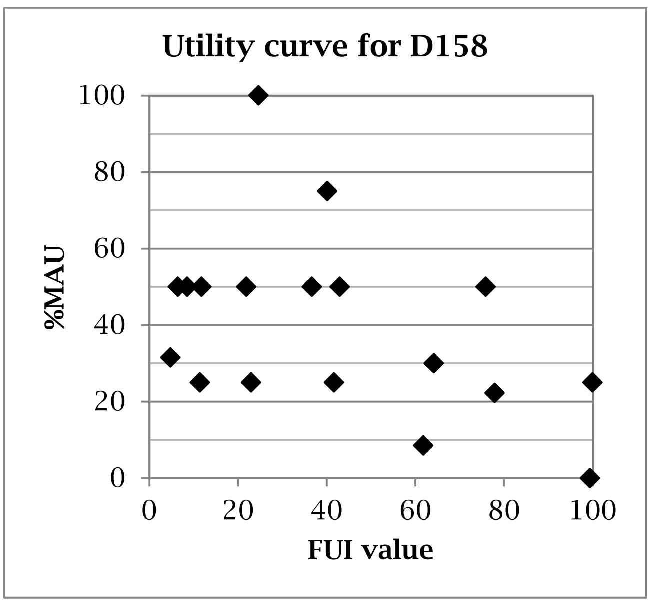


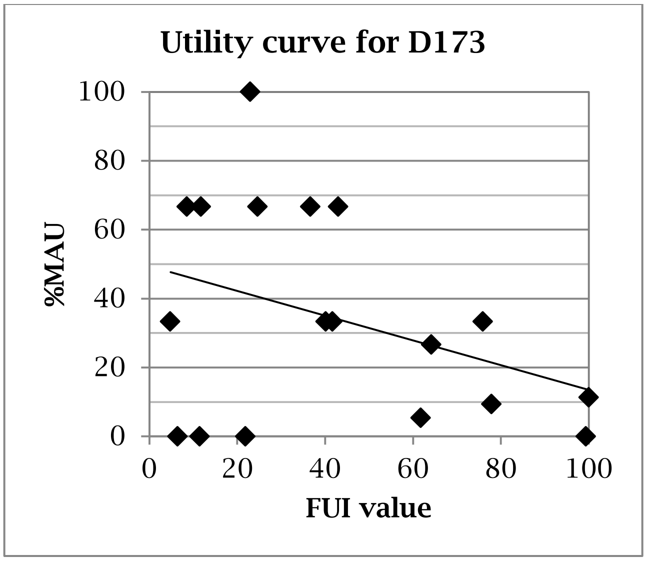
16
14
12
10
8
6
4
2
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight A10
% Comp collection


50
45
40
35
30
25
20
15
10
5
0
Cranium
mandible
Atlas
Axis
cerv
hyoid
thor
lumb
rib
cart rib
sternum
sacrum
Caudal
scapula
hum
radul
Carpals
MTP
1st Ph
2nd Ph
3rd Ph
pelvis
femur
patella
tibia
tarsals
Sesamoid
%Weight A121
% Comp collection

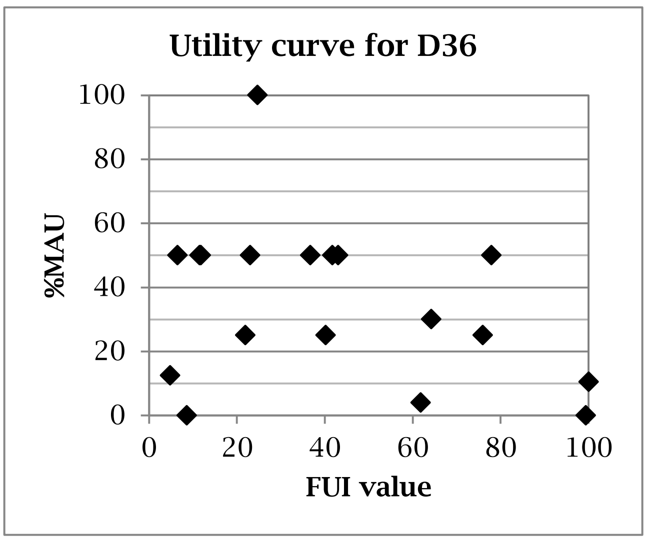
VII. Food Utility Graphs for All MK Assemblages



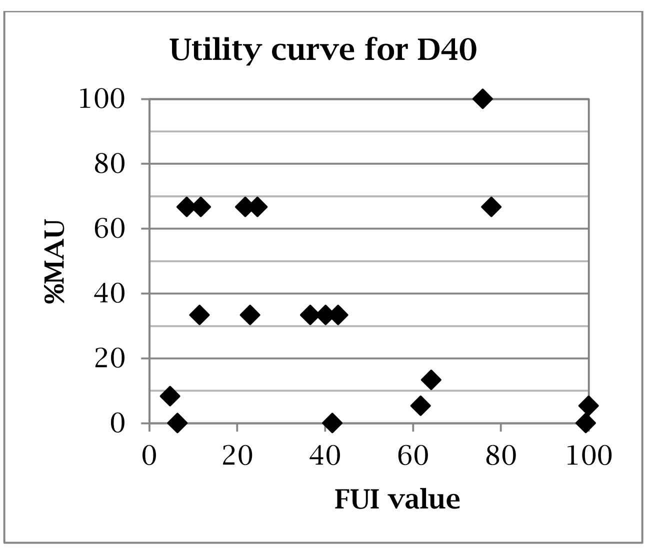




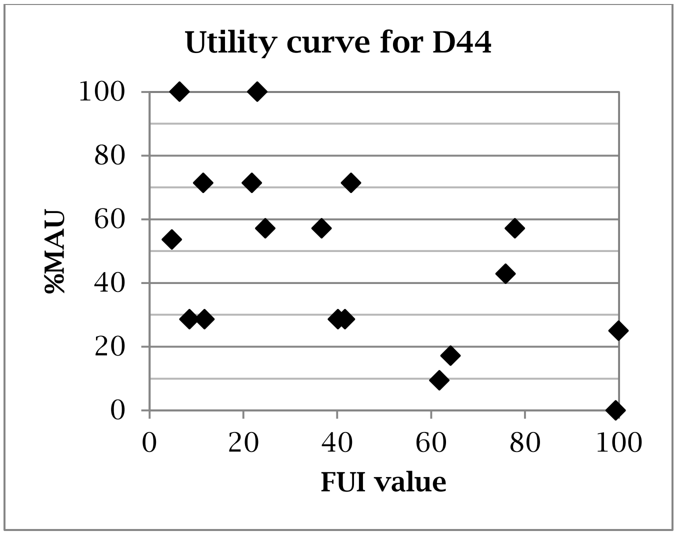
Utility curve for D173
%MAU
FUI value

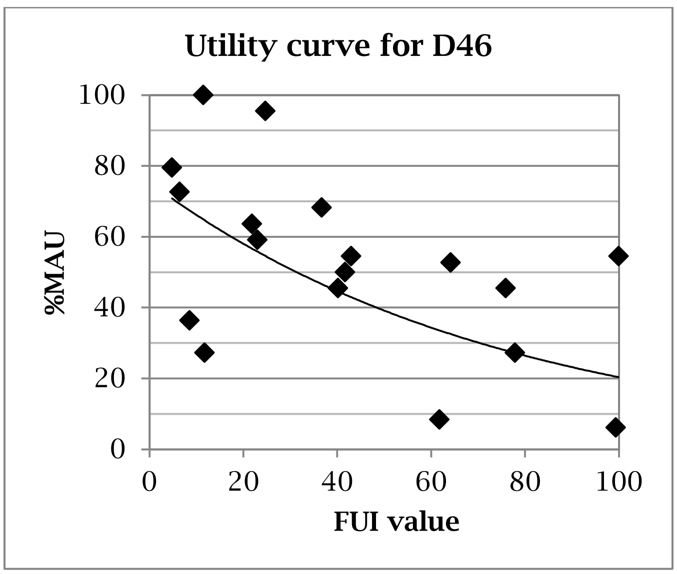


Utility curve for D36
%MAU
FUI value



Utility curve for D40
%MAU
FUI value


Utility curve for D44
%MAU
FUI value
0
20
40
60
80
100


Utility curve for D46
%MAU
FUI value
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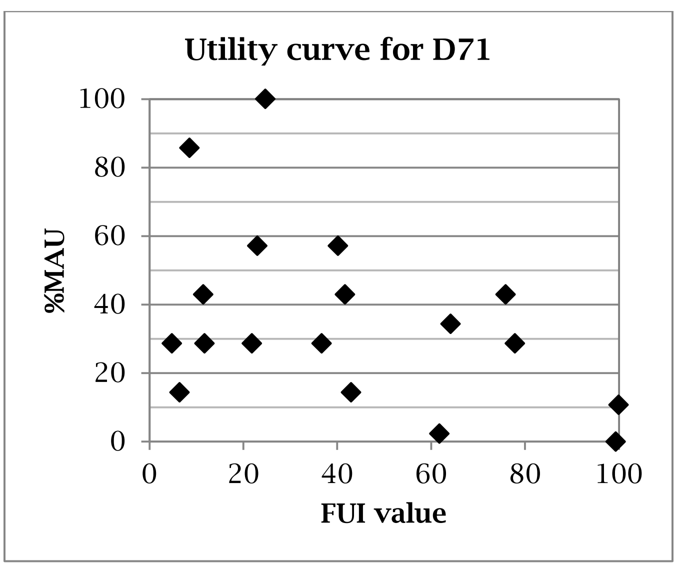
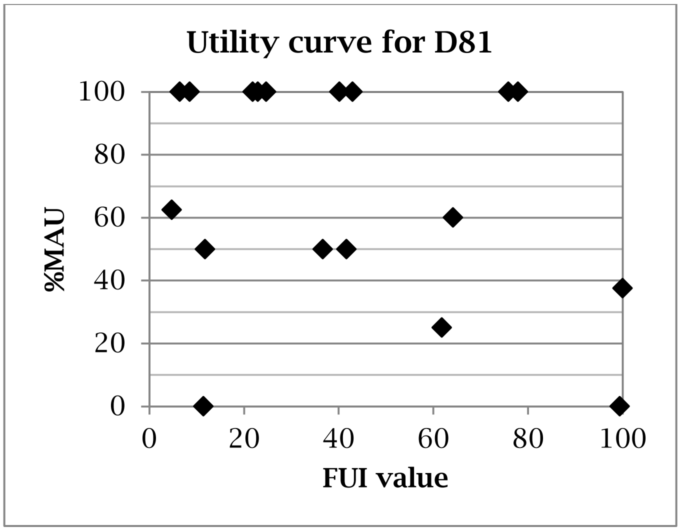
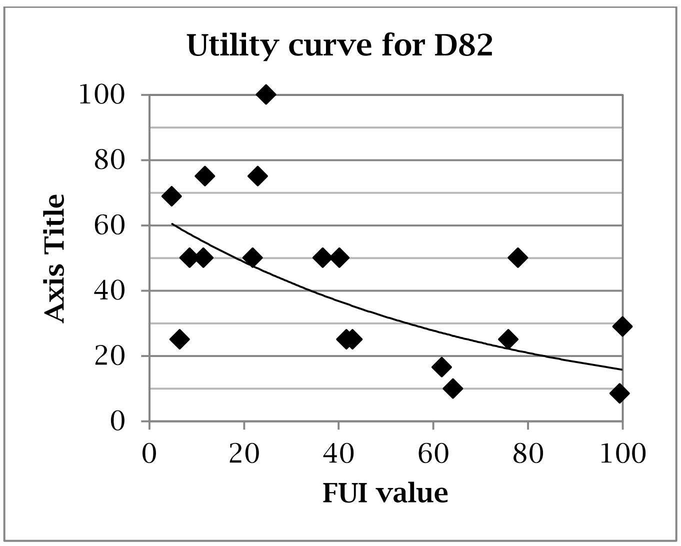
20
40
60
80
100


Utility curve for D71
%MAU
FUI value
0
20
40
60
80
100


Utility curve for D81
%MAU
100
80
60
40
20
0
0
20
40
60
80
100
FUI value


Utility curve for D82
Axis Title
100
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0
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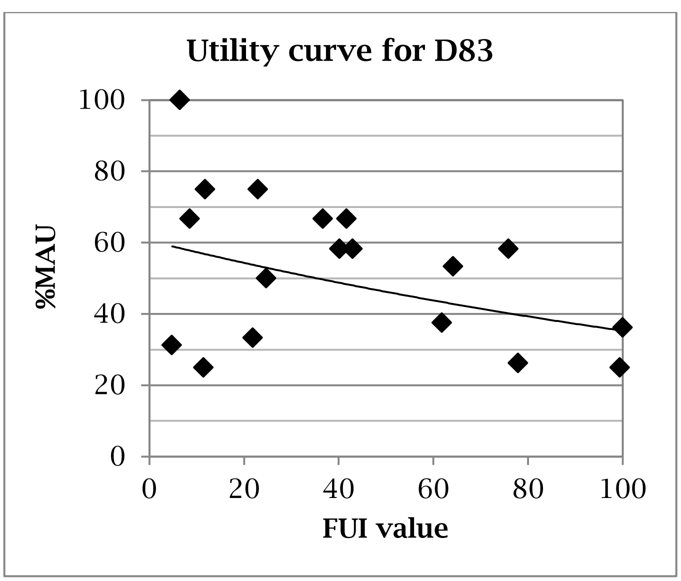
40
60
80
100
FUI value


Utility curve for D83
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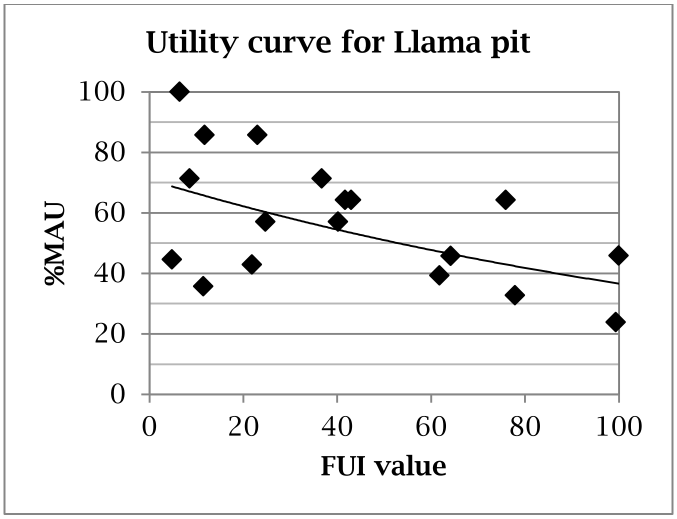
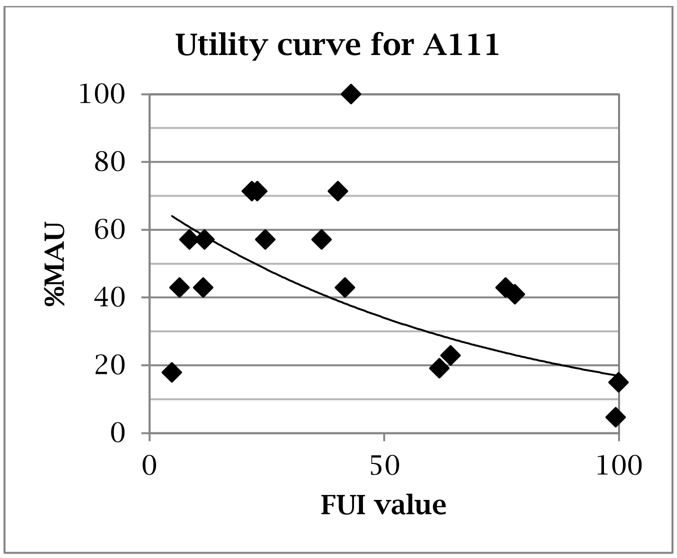
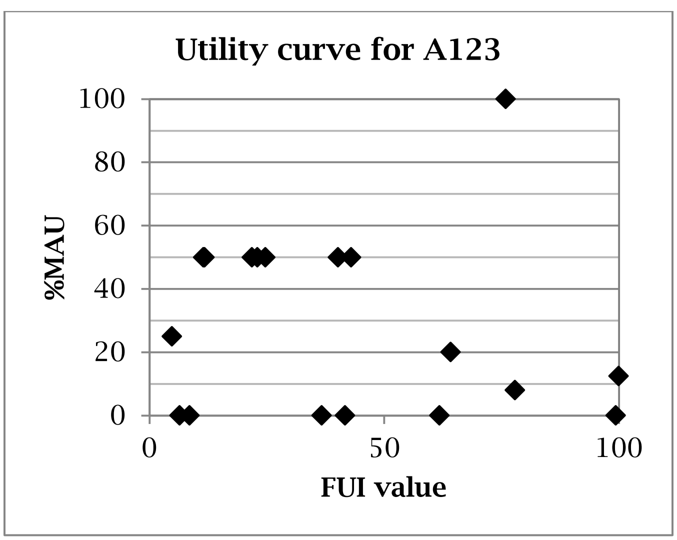
0
20
40
60
80
100
FUI value


Utility curve for Llama pit
100
80
60
40
20
0
%MAU
0
20
40
60
80
100
FUI value


Utility curve for A111
100
80
60
40
20
0
%MAU
0
50
100
FUI value


Utility curve for A123
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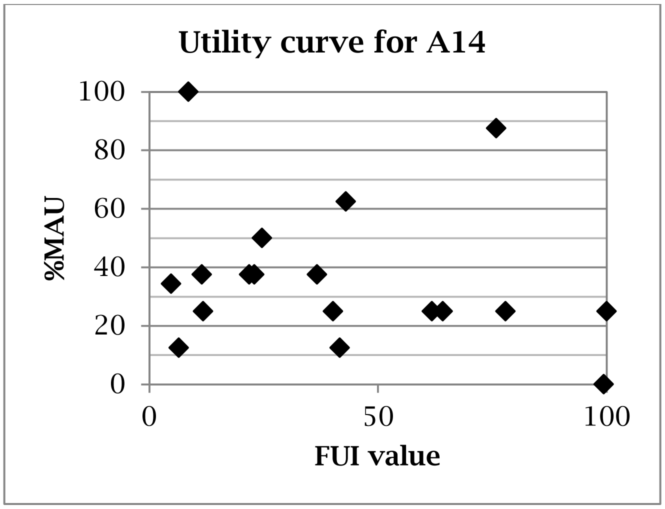
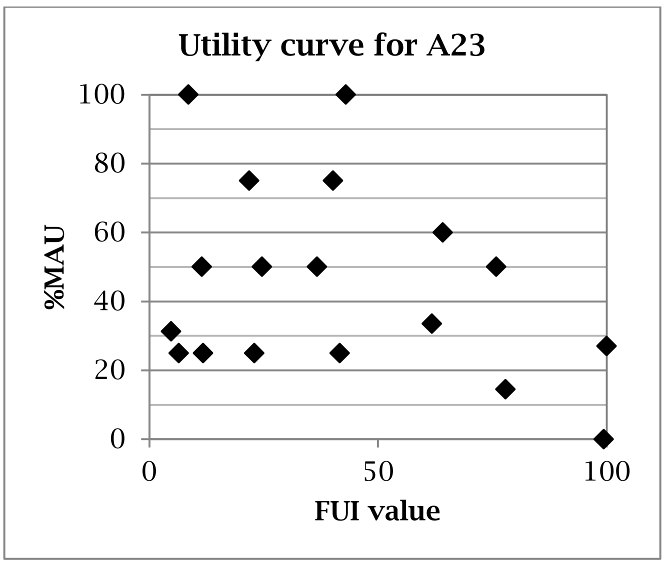
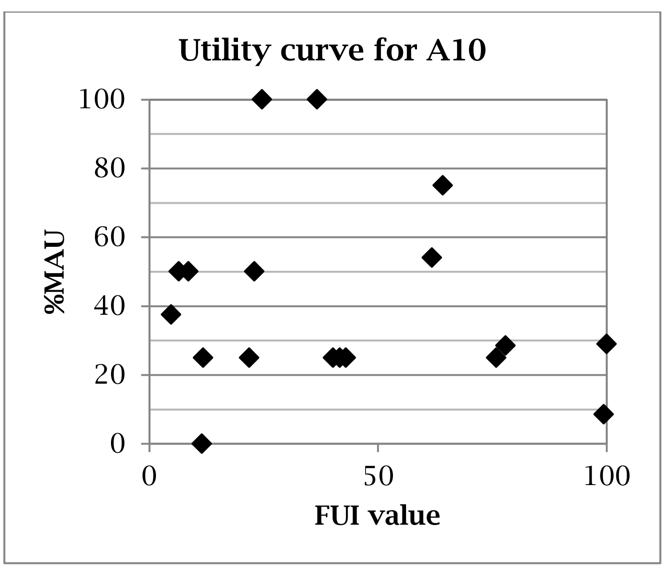
40
20
0
%MAU
0
50
100
FUI value


Utility curve for A14
100
80
60
40
20
0
%MAU
0
50
100
FUI value


Utility curve for A23
100
80
60
40
20
0
%MAU
0
50
100
FUI value


Utility curve for A10
100
80
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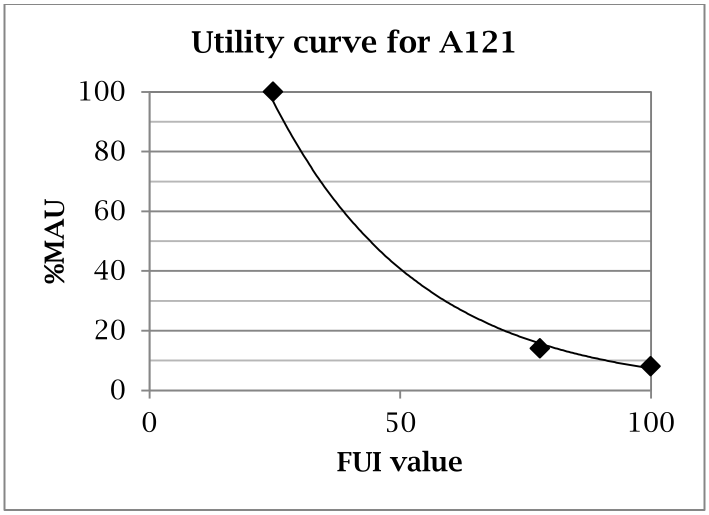
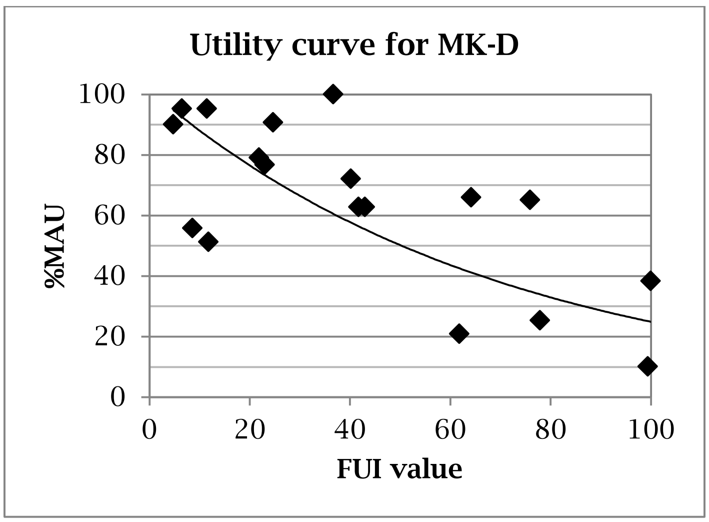
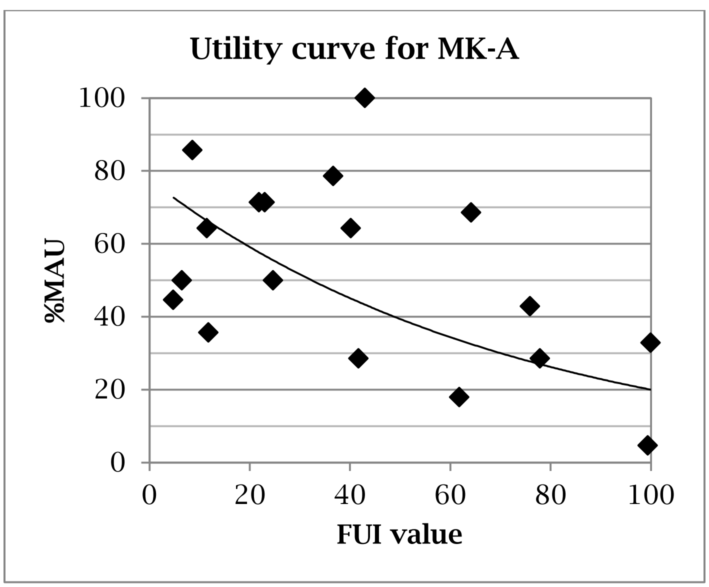
40
20
0
%MAU
0
50
100
FUI value


Utility curve for A121
%MAU
FUI value


Utility curve for MK-D
%MAU
FUI value


Utility curve for MK-A
%MAU
FUI value

VIII. List of Worked Bones

Event	Element	Type of modification
A10	1st phalange	shaft sawed off
A10	Long bone frag	polished point
A10	mandible	mandible tool
A10	mandible	slightly polished body fragment
A10	radio-ulna	double ended polished shaft
A10	rib	double ended polished rounded shaft
A10	unid	polished point
A111	metapodial	sawed off shaft fragment with rounded end
A111	radio-ulna	sawed off shaft fragment
A111	rib	polished and rounded end
A123	Long bone frag	polished point
A14	1st phalange	shaft sawed off
A14	canine	cut, shaped, and polished?
A14	femur	shaft sawed off
A14	metapodial	polished pointed shaft fragment
A14	metatarsal	shaft sawed off
A14	radio-ulna	polished and pointed shaft fragment
A14	rib	polished and rounded end
A14	scapula	rounded blade fragment
A23	1st phalange	attempt to saw off shaft
A23	radio-ulna	polished shaft fragment
A23	scapula	polished and rounded blade fragment
D120	mandible	mandible tool
D120	scapula	polished and rounded blade fragment
D158	scapula	polished and rounded blade fragment
D158	unid	fragment of carved figurine
D36	1st or 2nd phal	shaft sawed off
D40	mandible	mandible tool fragment
D44	Long bone frag	polished edge
D44	Long bone frag	polished point
D44	Long bone frag	polished point
D44	Long bone frag	polished point
D44	mandible	mandible tool
D44	metacarpal	shaft sawed off
D44	tibia	polished shaft fragment
D46	1st phalange	perforated shaft
D46	1st phalange	perforated shaft
D46	humerus	rounded edge of shaft fragment
D46	humerus	polished and pointed shaft fragment
D46	Long bone frag	shaft sawed off
D46	Long bone frag	shaft sawed off
D46	Long bone frag	shaft sawed off on both ends

D46	mandible	mandible tool fragment
D46	mandible	mandible tool fragment
D46	mandible	mandible tool fragment
D46	mandible	mandible tool
D46	mandible	mandible tool fragment
D46	mandible	mandible tool fragment
D46	mandible	mandible tool fragment
D46	mandible	mandible tool fragment
D46	mandible	mandible tool
D46	mandible	rounded body fragment
D46	metapodial	attempt to saw off shaft
D46	pelvis	rounded ilium fragment
D46	radio-ulna	polished shaft fragment
D46	radio-ulna	polished and rounded shaft fragment
D46	rib	polished and rounded distal end
D46	rib	polished and rounded distal end
D46	tibia	shaft sawed off
D46	tibia	shaft sawed off
D46	tibia	shaft sawed off
D46	tibia	polished and rounded shaft fragment
D71	mandible	mandible tool
D81	mandible	mandible tool fragment
D81	rib	polished distal end

BIBLIOGRAPHY

Albarracin-Jordan, J.

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