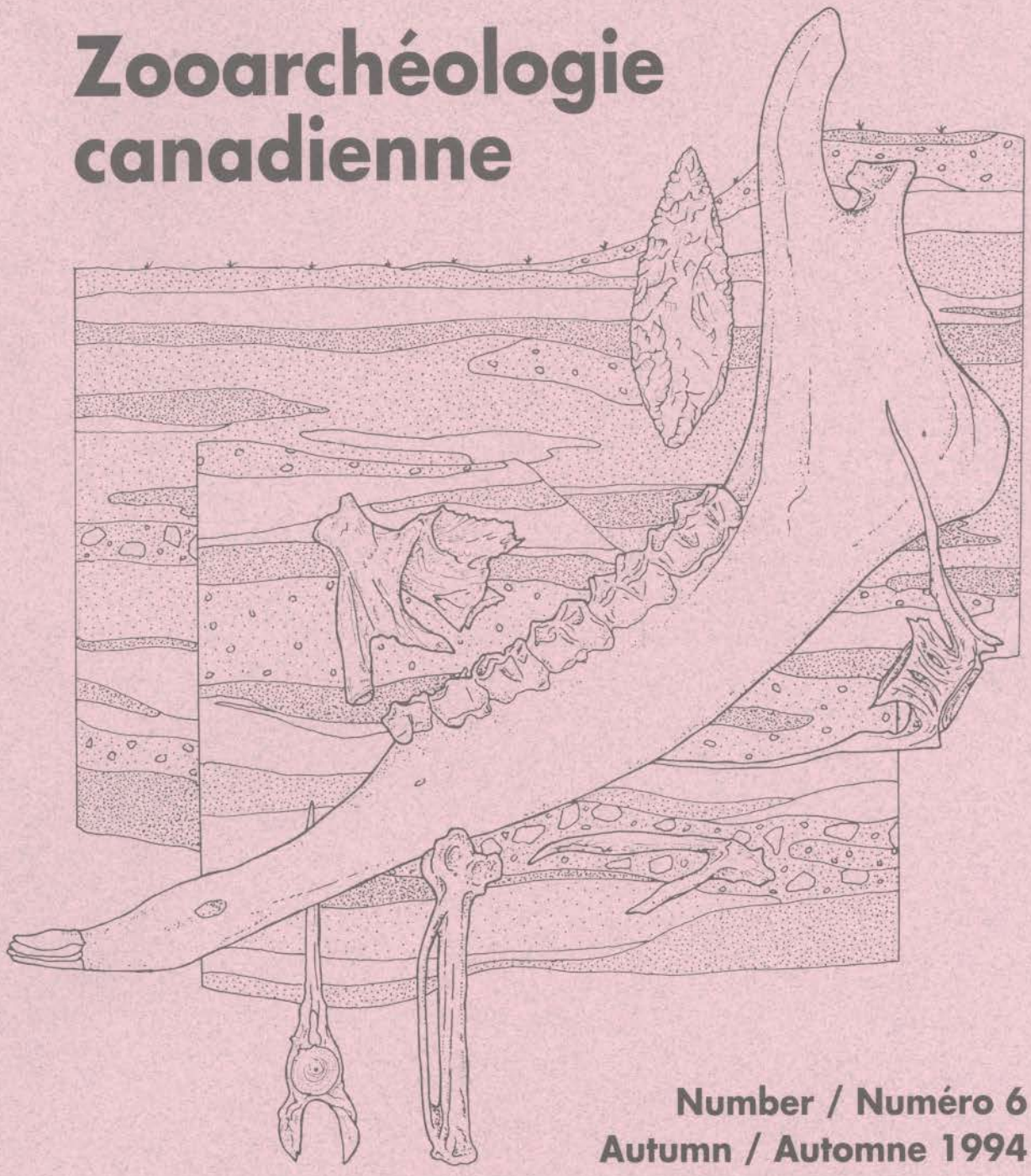
Canadian Zooarchaeology

Zooarchéologie canadienne



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EDITOR'S NOTE/NOTE DE L'EDITEUR

It's fall, which means a new academic year with a new flock of zooarchaeologists. We'd like to find out who is practicing zooarchaeology in Canada, so in the Spring 1995 issue we will feature a listing of those who are zooarchaeologists in Canada, or Canadians doing zooarchaeology abroad. If you'd like to be included, please send the attached form to *CZ* by March 31 1995. Thanks!

In this issue we've taken a break from our regional histories of zooarchaeology, with four articles which cover several facets of zooarchaeological research. Ariane Burke introduces us to skeletochronology, a technique for analysing growth structures in teeth, and some of its research applications. Then Anne Rick describes her faunal findings from two of the earliest French settlements in Québec. Dick Morlan introduces us to some backyard zooarchaeology, along with some insights into little-known bird skeletal remains. And Janet Cooper gives us a cautionary tale on treatment of bone in the field. Ariane Burke then critiques the faunal papers presented at the CAA in Edmonton. Thanks to Donna Naughton who was instrumental in putting this issue together. Happy reading! - *Kathlyn Stewart, Editor*

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Cover drawn by Debbie Yee Cannon

THE KILLING SEASON: ZOOARCHAEOLOGY AND SEASONALITY

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Zooarchaeology, perhaps more than any other subfield of archaeology, is well placed to tackle key questions about past environmental conditions. What the climate was like, how it affected animal communities, and how past human societies accomodated themselves to fluctuations in both conditions are the meat of zooarchaeological enquiries.

Zooarchaeological investigation can focus on species of human prey as well as on microfaunal remains, which can also be profitably studied for clues to past climate conditions. Arguably however, the scale of environmental change to which humans would have been sensitive is best represented by the large-bodied animals they also preyed upon. The prey communities around human settlements would have responded on two distinct levels to environmental change. On one level, medium to large-bodied prey species such as ungulates would have responded slowly, through changes in body-size and population distribution to long-term climatic change. On another level, they would have responded to predictable short-term seasonal fluctuations in climate through equally predictable changes in population distribution and seasonal migration.

Studies of patterns of mobility among hunting and gathering peoples can focus on either level. Adaptation to large-scale changes in climate implies substitution and/or change in the relative frequencies of different prey species, and subsequent economic shifts which may be reflected in other cultural components such as the tool kits (Kuhn 1992; Stiner and Kuhn 1992). These changes can determine the cultural trajectory of a regional human community.

On the second level, the seasonal economic activities of hunter-gatherers are a reflection of cyclic seasonal climatic changes. Depending on the regional environment being investigated, these may be more or less marked and will affect animal communities to varying degrees. Regardless of their markedness and duration however, they too will have shaped human economies and thus, social organisation as it relates to economic activity.

There are several ways that zooarchaeologists can identify both the frequency and degree of significant seasonal variation (variation which had a significant impact on human economies, that is). First is identification of seasonal variability in the composition and dispersal of the animal communities which were preyed upon. This can be done, for example, by identifying dispersed prey populations through analysis of butchering patterns (e.g., Boyle 1990) or of specific hunting strategies. Second is determination of the seasonal mortality patterns of different prey species, to define not only patterns of seasonal economic change but also patterns of site use and site occupation.

In some cases, the age profiles obtained through bone fusion and/or tooth eruption and wear patterns are

indicators of economic activity. However, reconstructions of prey communities based on the analysis of mortality profiles from archaeological sites obviously needs to be mitigated by careful consideration of the ethology of the prey species. Seasonality affects the sex and age distributions of many animals in their social groups, especially the relatively gregarious herbivore species (e.g. caribou, equids). In other words, seasonality needs to be considered before mortality/age profiles can be profitably used to reconstruct predatory behaviour when dealing with many gregarious prey species.

Age determinations (based on fusion or tooth eruption tables) can sometimes provide the required seasonal data, as can other seasonal indicators such as antler growth cycles. However when the assemblages being studied do not include the youngest age categories, due to taphonomic factors, or when the assemblages represent potentially multi-seasonal or longer depositional histories, another means of assessing seasonality must be found.

One technique which can be used to determine season of death of individual fossil prey or to determine multi-seasonal use of a site is a technique borrowed from wildlife management (Grue and Jensen 1979; Klevezal 1988; Miller 1974; inter alii).

This technique is variously referred to as dental incremental analysis, dental annular study, cementum analysis, or skeletochronology; the latter term is used in this paper (for recent reviews see: Gordon 1992, Monks 1981). It involves the production of thin-sections from fossil teeth and analysis of the growth structures visible in the dental cementum under transmitted light. A method for thin-sectioning fossil teeth has been adapted from standard geological techniques for preparing thin-sections of loosely amalgamated rocks such as sandstone (Burke 1992; Burke and Castanet *in press*; Gordon 1988; Lieberman *et al* 1990; Pike-Tay 1991). Thin-sections are viewed under polarised light and the growth structures visible in the dental tissues can be used to determine the season of death. Cementum is preferred over dentine and enamel as the two latter structures "turn over", or are resorbed, during the life-span of the tooth. Other techniques for viewing growth structures in dental cementum have also been used successfully (Beasley 1992).

Skeletochronological analysis has refined our knowledge of seasonal site use in hunter-gatherer communities living in Southwestern France during the Aurignacian period (Pike-Tay 1991) and during the last Full Glacial, or Magdalenian period (Burke 1992). It has also been applied in the Near East, to the study of Natufian populations (Lieberman *et al* 1990. In all of the above, multi-seasonal site use is indicated, suggesting a more complex pattern of mobility among Upper Paleolithic hunter-gatherers than the simple residential patterns defined by Bordes *et al* (1972) and Binford (1982). A model of regional human population movement, applied to Southwestern France by Gordon (1988), was also invalidated by skeletochronological data showing multi-seasonal use of sites in the Aquitaine Basin, based on seasonal mortality patterns of two dominent prey species (Burke 1992).

Skeletochronology can help refine paleoethological reconstructions. An investigation of the pattern of seasonal mortality of horse and caribou at the Bluefish Caves, Yukon Territory is currently underway (Burke & Cinq-Mars 1993, nd). The nature of the deposits at Bluefish Caves does not allow a straightforward interpretation of seasonal mortality profiles for either species in terms of human economic activity. Deposits in all three caves at Bluefish accumulated over a period of approximately 10,000 years, and several agents other than human are responsible for the bone accumulations (e.g., Cinq-Mars 1990). Analysis of the season of death of dominant species in the Bluefish assemblages, such as *Equus lambei* (a small Late Pleistocene horse) and *Rangifer tarandus* (caribou), should provide us with interesting ethological data on two members of what Guthrie (1985) has baptised the Mammoth fauna (Burke & Cinq-Mars nd).

The ethology of the large-bodied animals comprising the Mammoth fauna, such as horse and caribou, is as yet relatively poorly understood. This is largely a result of the unique associations of animal communities observed in this paleoenvironment. The resultant hesitation on the part of zooarchaeologists to extrapolate from modern ethological data, given the novelty of the associations and their potential effect on animal behaviour, is understandable. However, by determining what the seasonal movements of equids around Bluefish Caves were, and comparing them to known equid ethology in roughly similar environments (marked seasonal change and harsh winter conditions in an area with altitudinal contrasts), I hope to be able to determine whether or not *Equus lambei* was behaviourally similar to equids living in the wild today. Conversely, this data might allow us to refine paleoenvironmental reconstructions for the Bluefish Basin, by helping us establish what conditions on the margins of the basin were like on a seasonal basis.

This brief note is merely an attempt to pique the reader's curiosity about what is quickly becoming a "regular" tool in archaeological analysis-skeletochronology. The technique is at heart a simple one but it is time consuming and sometimes costly, which means that it may be overlooked in favour of cheaper, "traditional" tools. My aim was also to reinforce the importance of issues relating to seasonality in archaeozoological investigation. Or rather, I hope to have shown that seasonality is related to a number of important archaeological issues!

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CHAMPLAIN WAS HERE: ANIMAL REMAINS FROM EARLY SETTLEMENT AT QUÉBEC AND CAP TOURMENTE

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Samuel de Champlain founded Québec City in 1608, thus making it the first permanent French settlement in the New World. On a point of land overlooking the St. Lawrence River, he and his men set about constructing an ambitious habitation consisting of several buildings enclosed by a moat, with an exterior gallery at the second level. There was even an elaborate dovecote. Here Champlain and 23 of his men endured a gruelling winter; by April only he and 7 others were left alive. After this inauspicious start the settlement began to grow (not without setbacks), to 55 souls in 1626 and about 200 by 1635.

Because cattle and various other large domestic animals were introduced to Québec early in the 17th century, providing sufficient feed and fodder was always a problem. Some salt hay grew near the habitation, but it was plentiful in a large marsh about 50 km to the east at Cap Tourmente. Champlain's journal for 1623 states that about 2000 bundles of hay were collected there to feed his cattle at Québec. In 1626 he and Gillaume de Caen had a stable and two small dwellings constructed at Cap Tourmente so that laborers need not make the long journey back and forth for haycutting. Life at this farm was dangerous as well as lonely: two cowherds were killed by the Montagnais in October, 1627. In the summer of 1628 the buildings were burned to the ground by the Kirke brothers, whose English fleet was on its way to seize Québec. Thereafter the area remained essentially abandoned for over 30 years. The Seminary of Québec purchased the land in 1664, and kept it for the next 300 years, until 1969. Now owned by the Canadian Wildlife Service, Cap Tourmente is a wildlife preserve for migrating greater snow geese.

Archaeological excavations carried out at Québec in the 1970s by Francoise Niellon (Québec Cultural Affairs Department) and at Cap Tourmente in 1992 by Jacques Guimont (Parks Canada) yielded faunal remains from occupations contemporaneous with Champlain. These are (for Québec): 1) the first French settlement 1608-1624 and 2) a warehouse constructed in 1624 and destroyed by fire in 1632. At Cap Tourmente, there is one early occupation, Champlain's farm of 1626-28. Bone quantities are small; identified remains are approximately 560 pieces for Québec 1608-24, 320 for Québec 1624-32 and only 30 for Cap Tourmente.

Given that these dates mark the period before Europeans in New France substantially altered their environment, the bone remains give a remarkably broad picture of the region's fauna at that time as well as animal exploitation

by the first French settlers. Many different native vertebrates were utilized, despite the presence of domestic species from the habitation's beginnings. Most or all of the wild forms found here were probably eaten although some remains may be from fur preparation, other human activities, or adventitious deposition. Those early years were harsh, often reducing the inhabitants to near starvation. Farming was minimal although Champlain encouraged it. Supplies from France were undependable, so there was no choice but to turn to local resources. Fish and game were varied and abundant most of the time, but in lean years the Québecers were reduced to eating whatever meat they could catch or receive in trade from Native peoples.

Both French and Portuguese explorers brought domestic animals with them on their early voyages and by 1606 at least cattle, goats, sheep, pigs and pigeons had been introduced to Canada, mainly to the east coast but sometimes further west. According to old records, cattle and pigs were at Québec by 1609, donkeys and chickens by 1620 and cats by 1624. Horses, goats and turkeys are recorded from Québec by the 1660s. We know that Champlain had cattle driven from Québec to Cap Tourmente in 1626 when he established his farm. Domestic species brought to Québec often did poorly because of harsh conditions and a lack of expertise on the part of their owners. Yet fresh pork (as well as salt pork from France) and beef were major meat contributors to the early 17th century diet.

Table 1 lists animals identified from early European occupation at Québec and Cap Tourmente. Unidentified bone and miscellaneous categories have been omitted for brevity.

Because there is later 17th century zooarchaeological data for the two sites, we can look for changes from early to later occupations. At Québec, construction and occupation of the Marquis House basement can be dated to 1675-1701, while at Cap Tourmente there are remains from the early Seminary of Québec, approximately 1664-1700. These samples consist of about 270 identified pieces at Québec and 560 at the Cape.

Table 2 lists species that appear only in deposits from the last half of the 17th century, as described above.

Although a slight increase in domestic animal remains occurs by the end of the 17th century, wild fish and game remain important. Some wild species not seen in earlier deposits have shown up and a few are no longer represented. Nonetheless, we can see that it was still a broad-based system that depended in large part on local natural resources. This dependence on nature is not really evident from the early Cap Tourmente sample because of its small size, but is obvious in the later occupation where many wild forms appear in the species list.

The faunal record from these two sites confirms the presence of at least 3 domestic food animals in Québec and its environs between 1608 and 1632: pigs, cattle and sheep and/or goats. Cats, dogs, chickens, pigeons and feral rats also occur in these deposits. Only the domestic turkey is added in the latter part of the century. The early French settlers thus had a barnyard complement reminiscent of home, to give them both food and comfort in a foreign land.

Table 1 TAXON	QUÉBEC 1608-24	QUÉBEC 1624-32	CAP TOURMENTE 1626-28
MAMMALS			
Snowshoe hare	X		
Woodchuck	X		
Beaver	X	X	
Muskrat		X	
Rat (Rattus sp.)	X	X	
Porcupine	X		
Beluga (white whale)	X	X	
Domestic dog	X	X	X
Black bear	X		X
Marten		X	
Fisher	X		
Otter	X		
Domestic cat	X		
Seal	X		
Pig	X	X	X
Caribou	X		
Moose	X	X	
Cow	X	X	X
Sheep/Goat	X	X	
BIRDS			
Black-crowned night heron		X	
Swan	X		
Canada goose	X	X	
Brant goose		X	
Snow goose		X	
Canada/Snow goose	X	X	X
Mallard/Black duck	X	X	X
Green-winged teal	X		
Ring-necked duck		X	
White-winged scoter		X	
Common merganser		X	
Bald eagle	X		
Ruffed/Spruce grouse	X		
Chicken	X	X	
American coot	X		
Black-bellied plover	X		
Knot	X		
Ring-billed gull	X		
Passenger pigeon	X	X	
Domestic pigeon	X		

Table 1 TAXON	QUÉBEC 1608-24	QUÉBEC 1624-32	CAP TOURMENTE 1626-28
AMPHIBIANS AND REPTILES			
American toad		X	
Snapping turtle	X		
Wood turtle	X		
FISH			
Sturgeon	X	X	
American eel	X	X	
Pike/Muskellunge	X		
Brown bullhead	X		
Channel catfish	X	X	X
Atlantic cod	X	X	
Striped bass	X		
Walleye		X	

Table 2 TAXON	QUÉBEC 1675-1701	CAP TOURMENTE 1664-1700
MAMMALS		
Star-nosed mole		X
Mink		X
BIRDS		
Horned grebe	X	
Pied-billed grebe	X	
Pintail duck	X	
Blue-winged teal	X	
Lesser scaup	X	
Hooded merganser	X	
Red-breasted merganser		X
Red-tailed hawk		X
Golden eagle		X
Ruffed grouse	X	X
Domestic turkey	X	
Herring gull	X	
Gray jay	X	
Raven	X	
FISH		
Longnose gar	X	
White sucker		X

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SOME BONES THAT OFTEN GET AWAY BUT MAY COME BACK TO HAUNT US

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"Would you look at that!" said my neighbour, George, pointing with the toe of his shoe. George and I grow our gardens on opposite sides of a fence in Nepean, Ontario, and he was pointing to a perfectly macerated bird skeleton on his side of the fence. Having known him for years, George was not at all surprised when I asked permission to enter his yard to collect the skeleton. He once offered to till my garden when a conference forced me to miss the traditional planting weekend (Victoria Day), and at that time he slightly raised an eyebrow when I showed him the "Pet Cemetery" where I bury carcasses for recovery the following year. Since George knows about motors, I gave him a dead garden tiller that he restored and I can borrow back: and I get access to any carcasses he finds on his land -- an even trade if I ever heard of one.

But back to the bird skeleton. There was enough feathers lying around to show that it was an American Robin (*Turdus migratorius*), and the bones show that it was skeletally mature at death. The cause of death is not known but could easily be ascribed to one or another of the large domestic cats that roam our neighbourhood, tired of "Tender Vittles" but clueless or easily distracted once the kill is accomplished. The bird's body remained on top of the grasses growing tall along the fenceline where it was missed by George's lawn mower. Invertebrates and bacteria

thoroughly cleaned the skeleton without consuming ligaments that loosely held the bones in articulation.

Armed with a magnifying lens and jeweller's forceps I collected every bone I could find. These included several skeletal elements I had seldom seen in reference collections: orbital sclerites, tracheal rings, and the complete hyoid apparatus (Fig.1). All of these bones can "get away" if a bird is skinned before its skeleton is macerated. And all of them had "come back to haunt" me as I studied microvertebrate remains from the Tipperary site (FbNp-1) in Wanuskewin Heritage Park near Saskatoon, Saskatchewan (see Walker 1988; Wilkins 1994). I had seen each of these elements in the water-screened samples from Tipperary, and only the tracheal rings had been familiar from previous experience.

The orbital sclerites comprise a bony sclerotic ring (Olsen 1968: Fig. 4N) that supports and protects the eye during flight. The stippled areas in Figure 1A are articular surfaces that receive adjacent sclerites, and the thin hachured shape shows the cross-section of the bone.

The tracheal rings (Fig.1B) are familiar to most zooarchaeologists; occasionally they are found in contexts suggesting their use in necklaces worn by people (e.g., Millar 1978: Fig.130).

Only a portion of the hyoid apparatus is shown in Figure 1C where stippling marks articular surfaces. It is the central process that is most distinctive, and long branches each comprised of several straight segments attach to either side of it. Either lateral view of the central process reveals a nearly circular articular surface in the position shown.

Completely new to me as I examined this robin skeleton was a pair of bilaterally symmetrical bony processes that form the most anterior parts ofthe hyoid apparatus and support the cartilaginous framework of the tongue (Fig. 1D, where stippling marks cartilage). Although the sketch in Figure 1D implies that the cartilage is attached to the bones, in fact the bones are embedded in the cartilage.

I doubt that any of these bones, found alone, is identifiable to species. But all of them are distinctive, easily recognizable, and diagnostic of Class Aves. One can easily imagine circumstances in which they might comprise important evidence for the presence or use of birds. Bird skins are widely used to ornament clothing, shields and other artifacts (e.g. Gilbert, et al. 1981: Fig.2), and these small heterotopic bones should be recoverable evidence of such practices.

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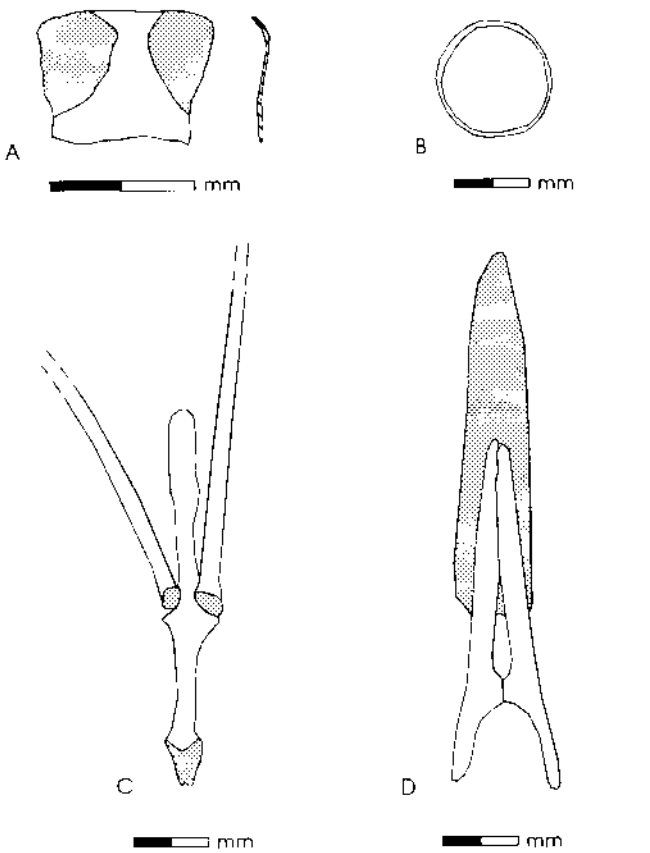

Figure 1. Some small, seldom noticed bones from an American Robin (*Turdus migratorius*): A. Orbital sclerite (one segment of sclerotic ring); B. Tracheal ring; C. Central process of hyoid apparatus; D. Paired bony elements embedded in cartilage of the tongue.

OF ELBOW GREASE AND THE FRAGILE PIECE

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It is to be hoped that bones from the ground are, as standard procedure, no longer routinely washed in either the field workshop or the lab, before being handed over to the zooarchaeologist for analysis.

However, exposure to procedures at a recent field school in Ontario demonstrated that even the dry brushing of bone specimens may not be a desirable thing.

Almost by definition, field school participants are both novices and enthusiasts; this is a combination that can produce the "double-edged sword" effect, not only in archaeology but also in other fields of endeavour, with repercussions felt down the line.

Seeing bone specimens being dry-brushed to within an inch of their lives is an unsettling experience. It's fascinating to watch surfaces developing a lovely polish with such attention.

Quite possibly, the effects of vigorous application of modern elbow grease may not fool an experienced zooarchaeologist when he/she is separating the modified from unmodified specimens. But often, and especially in today's climate of restricted funding for post-excavation analyses, faunal collections are given out to trainee zooarchaeologists as course-work material. Under such circumstances, it isn't difficult to predict that specimens will be noted as exhibiting use-wear polish when, in fact, they have simply

been over-zealously treated during the cleaning process.

In this connection, it would be very comforting to believe that the more fragile bone and shell specimens are given some protection from heavy-duty ones at the time they are recovered, and not after they have been jostled about in their paper field bags. For such purposes, film canisters-- ideal for small specimens like fish and amphibian bone and snails-- are readily available in quantity from commercial film processors absolutely free of charge. Exposed films are routinely taken out of their canisters before shipment to processing labs, so it's a simple matter to call by the local camera shop and retrieve all the canisters in their rubbish bins. Usually, a single visit can net hundreds and it's often possible to make an arrangement whereby they'll be saved for collection after a mutually-agreed interval of time.

The bottom line is, of course, ensuring that everyone working in the field is fully aware of the valuable information faunal material can provide about the subsistence activities on a site. Also important is the role that the careful primary treatment of such remains plays in providing the zooarchaeologist with a sample that resembles as closely as possible its condition when initially recovered.

CONTRIBUTIONS TO ZOOARCHEOLOGICAL RESEARCH: Papers presented at the Faunal session, Canadian Archaeological Association: Edmonton, May 1994

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Quite a broad range of paper topics was presented at the faunal session of the C.A.A. meetings held in Edmonton, May 4-8, 1994. The session entitled "Contributions to Zooarchaeological Research", was chaired by Jim Woollett.

Munro and Woollett, in their respective papers, related the zooarchaeological database to broader issues such as changing residential patterns and socio-economic transformations. Stewart and Stewart showed the need for similar investigations in the Pacific Northwest Coast area.

On the methodological front, Friesen et al. and Lello shared the results of their control experiments, investigating the use of incremental analysis in the construction of mortality profiles for archaeologically relevant prey species, demonstrating applicability of this technique in two different archaeological contexts. Morlan introduced methodology for the more refined use of fragmentary bone in intra-site investigations of patterns of bone survivorship, and inter-site comparability of bone fragmentation patterns.

Preliminary results of the incremental analysis and standard morphometric analysis of dental remains of *Equus lambei*, from the Bluefish

Caves assemblages (Yukon), were presented by Burke and Cinq-Mars. Rick and Balkwill presented a classic faunal report, exploring the non-cetacean fauna from the Gupuk midden (N.W.T.).

Each of the papers presented in the session are reviewed below.

Natalie Munro. "The relationship between population aggregation and faunal intensification. A view from the Mesa Verde Region, Colorado".

Munro gave a very interesting paper on the intensification of turkey production in the 13th Century, Colorado Plateau Anasazi economies. She related this phenomenon to other contemporary, 13th Century, social and economic developments on two distinct levels. On one level, the relationship between intensification of turkey production and social aggregation was explored. On another level, the relationship between intensification/aggregation and population pressure, causing resource stress and decreased mobility, was made clear. It is apparent from this research that the need to intensify was not a cause for aggregation among Mesa Verde Anasazi populations, but rather, that the same factors which created the need for intensification initiated the trend towards aggregation. The value of this paper lies in its extension of faunal analysis into the realm of archaeological hypotheses on many different levels.

A. Burke and J. Cinq-Mars. "Seasonal indicators at Bluefish Caves, Yukon Territory: Seasonal mortality and age profiles for horse (*Equus lambei*)". (*For obvious reasons, this review is contributed by the Editor*) Burke and Cinq-Mars present an impressive accumulation of data from a large number of equid teeth recovered from the three Bluefish Caves. Using skeleto-chronological means they determine the season of mortality, and the individual age of each specimen. Assemblages from the three caves are compared and used to help reconstruct the Full and Late Glacial landscapes in the Bluefish Region and eastern Beringia. In the process, considerable ecological information is presented on the extinct small Beringian horse, *Equus lambei*.

Max Friesen, James Savelle and Thomas Smith. "Refinement and application of beluga whale mandible ageing techniques".

Difficulties are inherent in constructing mortality profiles for beluga whale (*Delphinapterus leucas*), partly due to the generalised morphology of whale teeth, which make this an excellent species upon which to apply the techniques of incremental analysis. The authors have tackled the incremental analysis of beluga mandibles for the purposes of ageing individual animals from a sound methodological perspective. In this paper, a control sample for beluga is presented. The data derived from this control sample is then successfully applied to an archaeozoological population of over 50 beluga from Elwin Bay.

Jim Woollett. "The paleoecology of Eskimo Island: A preliminary zooarchaeological report".

Woollett presented preliminary results of the faunal analysis of a number of historic (1600-1760 A.D.) Hamilton Inlet, Labrador Inuit sites.

Significantly, faunal assemblages from a selection of all of the house types present at Hamilton Inlet are being analysed. There is demonstrated change in house type through time for the faunal period studied at Hamilton Inlet, linked to acculturation. The faunal data collected here, therefore, will provide an interesting means of testing models of acculturation. The usefulness of the faunal database as a means of testing acculturation models is demonstrated here by Woollett in a re-examination of the origins of communal residence patterns at Hamilton Inlet, and their relationship to changing patterns of Inuit labour organisation and to whaling.

Richard Morlan. "Bison bone fragmentation and survivorship: A comparative model".

Morlan presented a brief introduction to his paper (in press in the Journal of Archaeological Science) which presents suggestions for improving the recording and study of bone fragments. The more precise bone fragment coding suggested by Morlan should enable zooarchaeologists to better appreciate and understand bone fragmentation patterns, and their relationship with bone density. A consideration of the "% of completeness" of the bone elements at a site, suggested by Morlan, should provide a better measure of inter-site differences in bone survivability. Morlan suggests this measure could be used to characterise broad types of sites, such as kill-site/camp-site and processing site. Another advantage of the proposed methodology is the ability to make use of bone fragments, which are a frequently under-utilised dataset.

Richard Lello. "Shellfish and seasonality: An example from the Portuguese Mesolithic".

Lello presented preliminary results of a control experiment exploring the possibility of using incremental growth marks in shellfish (*Cerastoderma edule*, the common European cockle) to assess the seasonality of shellfish exploitation at the Portuguese Mesolithic site of Pandeiro. The formation of growth marks in shellfish is a complex, multifactorial process related to lunar tidal cycles and affected by such factors as distance from the tidemark and periodicity of the local tidal regime. Lello methodically tackles the variability in expression of the growth marks in cockles and the final results of his ongoing control experiment should prove fruitful and interesting to anyone contemplating the analysis of seasonality in midden sites anywhere.

F.L. Stewart and K.M. Stewart. "Prehistoric subsistence patterns in Prince Rupert Harbour, B.C.".

Faunal remains are used in this paper to investigate changing patterns of exploitation and the seasonality of site occupation among coastal Tsimshian. The faunal data collected by the authors challenge the assumption that economic patterns recorded for historic Tsimshian people can be projected into the past. Diachronic investigation of two sites from Rupert Harbour, Boardwalk and Grassy Bay, shows changes in the basic pattern of exploitation and seasonal site use. Seasonal variables in the faunal data, such as presence of migratory shorebirds and waterfowl for example, show a pattern of year-round site use for earlier Boardwalk occupations, and a

seasonally restricted pattern of site use at the "younger" (1600-1900 B.P.) Grassy Bay site. The pattern of seasonal site use at Grassy Bay is consistent with ethnohistoric data.

Anne Rick and Darlene McCuaig Balkwill. "Mammal, bird and fish remains from the Gupuk midden, Mackenzie Delta, N.W.T.".

Results of an analysis of the non-cetacean fauna from middens at Gupuk, shows the importance of fish as a resource in the Mackenzie Inuit economy (67% of total assemblage). Fish was supplemented by large numbers of muskrat (60% of identified mammal remains) and both grouse and ptarmigan (67% of identified avifauna). Nevertheless, the high degree of variability in the faunal assemblage, reflective of the local environment, is also a reflection of the length of occupation of this site. Significantly, faunal indicators do not show spring occupation of Gupuk, despite its situation near major spring staging areas for migrating waterfowl in the Mackenzie Delta.

INTERNATIONAL COUNCIL FOR ARCHAEOZOOLOGY (ICAZ) - SEVENTH INTERNATIONAL CONFERENCE 26 SEPTEMBER - 2 OCTOBER 1994, KONSTANZ, GERMANY.

Below is a selected list of Titles submitted for presentation at the ICAZ conference. The list includes titles of general and theoretical interest, as well as papers on North American faunas. Please contact *CZ* if you need addresses for the authors.

Albarella, U.- Shape variation of cattle metapodials: Age, sex or breed? Some examples from medieval and postmedieval sites.

Alhaique, F.- Do patterns of bone breakage differ between cooked and raw bones.

Bartosiewicz, L.; Van Neer, W.; Lentacker, A.- Spavin: A possible symptom of draft exploitation in cattle.

Bartram, L., Jr.- An ethnoarchaeological examination of the effects of assemblage fragmentation on zooarchaeological analysis.

Beasley, M.; Brown, W.A.B.; Legge, A.J.- Metrical discrimination between mandibular first and second molars in domestic cattle.

Brugal, J.P.- Classes de taille des grands mammifères quaternaires européens et africains - Implications écologiques et archéozoologiques.

ICAZ Papers continued:

Burke, A.; Cinq-Mars, J.- Late Pleistocene equids in eastern Beringia: Dental characteristics and mortality profiles of *Equus lambei* from the Bluefish Caves, Yukon Territories, Canada.

Chambers, K.E.; Purdue, J.R.- Bison bone beds and bottlenecks: A genetic analysis of bison from skeletal remains.

Choyke, A.M.- The bone tool manufacturing continuum.

Crader, D.C.- Pre-contact use of beaver and other small furbearers in coastal Maine.

Driver, J.C.- Zooarchaeology and social organisation in non-state societies.

Elliott, V.- Zooarchaeology - What's in a bone and other mysteries unravelled.

Espinoza, E.O.; Yates, B.C.; Mann, M.J.; Crane, A.R.; Goddard, K.W.; Lemay J.P.- Taphonomic indicators used to infer wasteful subsistence hunting in northwest Alaska.

Gauthier, A.- The names of domestic animals.

Fisher, J.W., Jr.; Pac, D.F.- Age determination of Rocky Mountain mule deer (*Odocoileus hemionus hemionus*). Based on mandibular dentition.

Jones, A.K.G.- The role of archaeozoology in presenting archaeological research to the public.

Kelly, L.S.; Kelly, J.H.- Emerging patterns of faunal exploitation: The context of faunal assemblages from the Late Prehistoric Communities in the American bottom portion of he Central Mississippi Valley (USA).

Kenyon, D.M.E.- Patterning in butchery as a cultural residue.

Koike, H.- Exploitation dynamics and its influences on food strategy.

Köhler-Rollefson, I.- Animal breeds redefined.

Lefèvre, C.- Marine subsistence at Buldir Island (Aleutian Islands, Alaska). The zooarchaeological record.

Lupo, K.D.; Schmitt, D.N.- Meat and bone preparation techniques: Nutritional returns and archaeological reflections.

McGovern-Wilson, R.- Experimental weathering in a high latitude temperate zone.

Müller, H.-H.- Notches in animal teeth - Artificial or natural/pathological?

Needs-Howarth, S.; Cox Thomas, S.- Functional, cultural and seasonality differences between faunal remains from several disposal contexts at the Dunmore Site, an Iroquoian village near Lake Simcoe, Ontario.

Payne, S.- Environmental influences on skull shape.

Saint-Germain, C.- The production of bone broth: A study in nutritional exploitation.

ICAZ Papers continued:

Schnitger, F.W.- Which weight with which width?

Semken, H.A., Jr.; Graham, R.W.; Falk, C.R.- Correspondence analysis of mammalian remains from Late Holocene archaeological sites along the Missouri River in North America.

Serjeantson, D.- Human attitudes to animals in historic times: The bone evidence.

Shaffer, B.S.; Baker, B.W.- Historic and prehistoric animal pathologies from North America.

Shaffer, B.S.; Gardner, K.M.- Reconstructing animal exploitation by puebloan peoples in the southwestern United States using Mimbres Pottery, AD 1000-1150.

Snyder, L.M.- Ethnohistoric, archaeological and nutritional evidence pertaining to the dog as a Native American food resource on the plains of North America.

Spassov, N.; Iliev, N.- On the presence of two species of wild horses in the northern and western Circumpolar Region: Polyphyletic hypothesis on the origins of the domestic horse.

Stephan, E.- Chemical change in fossil bones and various states of bone preservation associated with soil features.

Stewart, K.M., Gifford-Gonzalez, D.P., and N. Rybczynski. Characteristics of modern foraging camps and their faunas from Lake Turkana, Kenya.

Wing, E.S.; Wing, S.- Introduction of animals as an adaptation to colonization of islands.

Yates, B.C.; Dratch, P.A.; Espinoza, E.O.; Storm, S.; Cooper, E.W.T.- Fraud and fakery in trade items of zoological origin: Twentieth Century ecofacts.

Selected List of Posters Submitted for the ICAZ Conference:

Tikhonov, A.- Some unusual damages on musk ox astragalus - Result of human or taphonomical peculiarity?

Wigen, R.; Greenspan, R.L.- So many bones, so little time: Issues in the identification and qualification of archaeological fish remains.

RECENT PUBLICATIONS/ PUBLICATIONS RECENTES

Balkwill, D. McC. & Rick, A. M. 1994. Siglit subsistence: Preliminary report on faunal remains from a large midden at the Gupuk Site (NiTs-1), Mackenzie Delta, N.W.T. In Bridges Across Time: the NOGAP Archaeology Project. Canadian Archaeological Association Occasional Paper no.2:95-116.

Fox, Wm. A. & Molto, J. E. 1994. The Shaman of Long Point. Ontario Archaeology 57:23-44.

Lepofsky, D. 1994. Plants and pit houses. Paleoethnobotanical investigations at the Keatly Creek Site. The Midden 26(3):3-4.

Mills, R.O. 1994. Radiocarbon calibration of archaeological dates from the central Gulf of Alaska. Arctic Anthropology 31(1):126-149.

Welsh, B. & Williamson, R.F. 1994. The Olmstead Site, a Middle Iroquoian village in the city of Hamilton. Arch Notes 94(4):11-34.

Williamson, R.F.;Thomas, S.C. & Steiss, D.A.1994. The Middle Archaic occupation of the Niagara Peninsula: evidence from the Bell Site (AgGt-33). Ontario Archaeology 57:64-87.

FORTHCOMING CONFERENCES/ CONFERENCES A VENIR

Hidden Dimensions: The cultural Significance of Wetlands Archaeology.

April 26-30, 1995. Programme Organizer Kathryn Bernick, UBC Museum of Anthropology, 6393 N.W. Marine Dr., Vancouver B.C., V6T 1Z2 (604) 822-6530, fax (604) 822-2974. Email stevenso@unixg.ubc.ca

Canadian Archaeological Association, 28th Annual Meeting, 1995.

Kelowna, B.C., Coordinator: Diana French, Okanagan College. Times TBA