RK-20037-93 Application

OMB No. 3136-0129
Expires: 11/30/93

NEH APPLICATION COVER SHEET

1. Individual applicant or project director

a. Name and mailing address

Name: Reinhard (last) Karl (first) J (initial)

Address: Department of Anthropology
University of Nebraska-Lincoln

Lincoln (city) NE (state) 68588-0368 (zip code)

b. Form of address: DR

c. Telephone number
Office: 402 (area code) /472-6858 Home: (area code)

d. Major field of applicant or project director: L1 (code)

e. Citizenship [X] U.S.
[ ] Other (specify)

2. Type of applicant

a. [ ] by an individual b. [X] through an org./institution
If a, indicate an institutional affiliation, if applicable, on line 11a.
If b, complete block 11 below and indicate here:
c. Type: State University
d. Status: Nonprofit

3. Type of application

a. [X] new b. [ ] supplement

4. Program to which application is being made

Archaeology Projects

Endowment Initiatives: (code)

5. Requested grant period

From: 1/1/92 (month/year) To: 12/31/94 (month/year)

6. Project funding

a. Outright funds	$ 253,960
b. Federal match	$
c. Total from NEH	$ 253,960
d. Cost sharing	$ 59,546
e. Total project costs	$ 313,406

100,000
10,000
110,000
Dol*

7. Field of project L1

8. Descriptive title of project: Archaeology and History of the Omaha and Ponca Tribes: 1775-1810 Mortuary Remains

9. Description of project (do not exceed space provided)

The analysis of Omaha and Ponca mortuary data will be used as the primary basis for the assessment of European contact on health and culture. Specific issues that will be addressed include the influence of contact on Native American technology, values, subsistence, work stress, disease level, and warfare. The results will be described in technical texts and in a popular format.

10. Will this proposal be submitted to another government agency or private entity for funding? no
(if yes, indicate where and when):

11. Institutional data

a. Institution or organization:
University of Nebraska-Lincoln (name)
Lincoln, NE 68588-0430 (city) (state)

b. Employer identification number: 47=0491-233

c. Name of authorizing official:
Sharon K. Davis, Director (last) (first) (initial)
Office of Sponsored Programs (title)

d. Name and mailing address of institutional grant administrator:
Davis, Sharon K., Director (last) (first) (initial)
Office of Sponsored Programs
303 Administration Building
Lincoln, NE 68588-0430 (city) (state) (zip code)
Telephone (402) 472-3171 (area code) Form of address: Dr

12. Certification

By signing and submitting this application, the individual or the authorizing official of the applicant institution (block 11c) is providing the applicable certifications regarding the nondiscrimination statutes and implementing regulations, federal debt status, debarment and suspension, a drug-free workplace, and lobbying activities, as set forth in the appendix to these guidelines.

Sharon K Davis (signature)

OCT 13 1992 (date)

Note: Federal law provides criminal penalties of up to $10,000 or imprisonment of up to five years, or both, for knowingly providing false information to an agency of the U.S. government. 18 U.S.C. Section 1001

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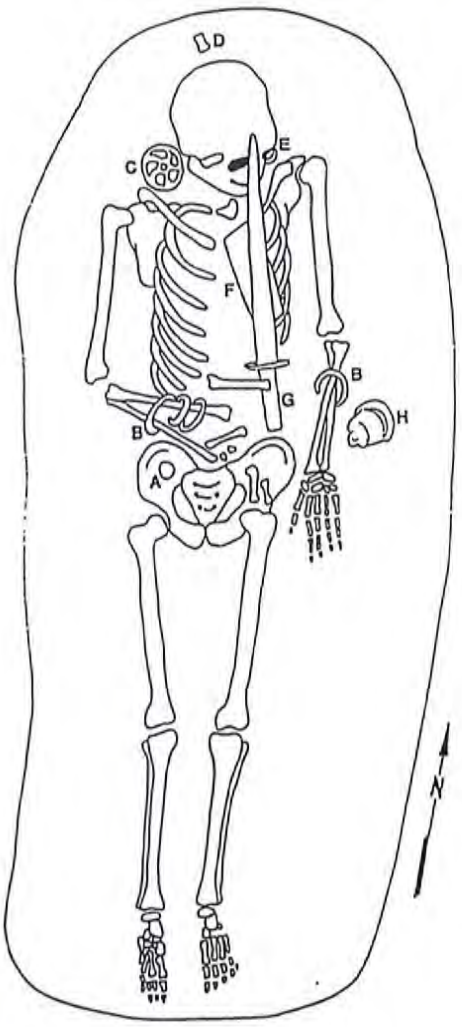
ARCHAEOLOGY AND HISTORY OF THE OMAHA AND PONCA TRIBES: 1775-1810 MORTUARY REMAINS



Submitted by:
Karl J. Reinhard
Department of Anthropology
126 Bessey Hall
University of Nebraska-Lincoln
Lincoln, NE 68588-0368
(402) 472-6858, -2411

Statement of Significance and Impact of Project

The culture and history of the Ponca and Omaha tribes are currently under study based primarily on mortuary remains. The studies were requested by the tribes to retrieve cultural, biological, and historical information from the late 1700s and early 1800s. It is evident from these analyses that the Omaha and Ponca represent a microcosm of the effects of European and Euroamerican expansion on tribal peoples. These effects include changes in diet, values, artistry, religious practices, and health. The goal of study is to produce both scholarly and popular works describing the lifestyles of Ponca and Omaha for this period.

The study will offer significant, new data relating to the positive and negative impacts of Euroamerican contact in the central Plains. For example, trade resulted in increased focus on Euroamerican manufactured objects in the daily lives of the tribes. Initially, Euroamerican trade affected artistry and ornamentation. Trade also resulted in increased efficiency in hunting, foraging, agriculture, and defense. However, it caused changes in cultural values towards the environment as the tribes hunted for commerce as opposed to subsistence. The processing of hides for trade placed a heavy work burden on the women of both tribes. This contributed to a compromised health status for women which, when combined with the effects of introduced disease and physiological demands of child bearing, lowered female longevity. It appears that the fur trade introduced toxic lead and mercury compounds to the tribes. The publication of these data in scholarly and popular formats will greatly expand the general knowledge of these peoples.

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NATURE AND SIGNIFICANCE OF THE PROJECT

The study of Euromamerican contact with and impact on Native Americans provides insight into the general interaction between imperialist powers and tribal peoples. Various issues of interaction are presently being debated including disease, warfare, and cultural disruption. Currently, the University of Nebraska is involved in the analysis of Omaha and Ponca archaeological remains, both skeletal and artifactual, dating between 1780-1820. The analysis indicates that Euroamerican contact had a pronouced, multifacted impact on these peoples. Euroamerican expansion which dislodged tribes in the midwest, forced the Ponca and Omaha through a long migration which eventually led them to Iowa, South Dakota, and finally Nebraska. The Nebraska remains are particularly conducive to answering several important research questions. 1) What was the impact of the introduction of horses? It appears that equestrian lifestyle enlarged the areas available for foraging and increased the efficiency of hunting, thus, broadening the subsistence base. 2) What was the impact of the introduction of firearms? Ethnihistorical data suggest that the Omaha control of trade in goods such as firearms, resulted in an Omaha military ascendency which allowed successful settlement of northeastern Nebraska. 3) What drove the contact between Omaha-Ponca and Euroamericans? It is probable that cultural survival depended on the pragmatic adoption of aspects of Euroamerican technology and particpation in the fur trade. 4) How did the fur trade affect cultural values? The data at hand suggest that the fur trade

required thousands of hides per year led to extensive non-subsistence hunting. This in turn led to the alteration of cultural values away from resource conservation and towards resource exploitation. 5) Did the fur trade result in increased social demarkation? Analysis indicates a marked social stratification emerged as evident by trade good associations with burials, a direct outcome of the fur trade (O'Shea 1985). 6) What was the impact of contact on health? The evidence, both skeletal and documentary, shows a decline in the health of the tribes and near extinction in the 1800s. Although introduced diseases such as smallpox are generally thought to have had primary importance in this health decline (Trimble 1989), skeletal analysis indicates that female health was jeopardized by a variety of factors. In addition, trade in pigments and artifacts containing toxic elements may have added to the decline in health.

The research goals of this study are to illuminate the nature and result of cultural contact. Our research strategy involves a four part approach: 1) bioarchaeological analysis of the skeletons, 2) evaluation of grave goods, 3) interpretation of skeleton-artifact associations in the light of ethnographic accounts, and 4) placing the data in ethnohistorical context based on published ethnohistorical accounts of the tribes. These data are then integrated to address the questions mentioned above and others. The study has a strong bioaarchaeological component which has allowed the reconstruction of individual activity patterns, lifestyle, and health. The analysis of the skeletal remains has

provided a wealth of information about individual lives that could not have been achieved from artifactual study alone. Therefore, this aspect of the analysis is a strength which, in combination with the artifact data, provides an especially clear picture of Omaha-Ponca life between 1775 and 1800.

In summary, the Omaha-Ponca archaeological remains reflect many consequences of Euroamerican contact and serve as a microcosm of Native American response to contact. Therefore, there are a variety of research questions that can be addressed by the analysis of the remains. Most, if not all, of these questions apply to other Native American groups as well and the answers to the question can be generalized to other tribal peoples and will provide a significant and new model of the impact of contact.

In addition, the study provides historical documentation of a particularly dynamic period in the history of the Plains from a Native American perspective. Up until now, ethnohistorical documentation through trader's journals and ledgers has provided only a narrow perspective on this history through the eyes of exploitative Euroamericans. Often these documents are viewed by scholars as impartial desriptions of western tribes. Howver, they frequently emphasize the violent nature of interaction and do not attest to more typical interaction between Plains peoples, nor do they document the detail and complexity of Plains cultures. These undocumeted aspects of Plains tribes can be approached by archaeological study.

The bioarchaeological and archaeological analysis of mortuary remains provides detailed information regarding individuals recovered from cemeteries and general cultural patterns on a population level. At the request of the Omaha and Ponca Tribes of Nebraska, the University of Nebraska has been involved in the analysis of mortuary remains, both corporeal and artifactual. The nature of this analysis is unique in that it is done in response to tribal needs and with tribal guidance. Our approach to the analysis therefore incorporates responsible analysis of skeletal and artifactual remains in conjunction with and in response to the desires of Native Americans. The nature of the project is ultimately a reflection of the desire of the tribes to learn about their ancestors. Thus, the policy carried out by the University of Nebraska is a union of the concern of the tribes with their ancestral past, and the scientific responsibility on the part of the University.

The goals of the project are to produce technical and popular texts concerning the culture and history of the tribes. They will provide significant and new information regarding the details of past tribal life and culture to both the academic audience and the reading public. Perhaps most significantly, the studies are providing the descendants of archaeological cultures with important cultural and biological information. In this case, archaeological investigations are a vehicle by which the Omaha and Ponca stand to benefit from new information about their history and culture.

HISTORY AND DURATION OF THE PROJECT

The University of Nebraska has been working with Native Nebraskan tribes since 1989 in the recovery and interpretation of Native American culture in the high Plains. This has included the storage of sacred and secular artifacts for the Omaha Tribe at the University of Nebraska State Museum, the development of exhibits and interpretive kits by the Museum, and the planning of an Omaha Cultural interpretive center by the College of Architecture. At the request of the Ponca Tribe, university anthropologists reviewed the history and status of the Ponca as part of the process of obtaining congressional tribal status for the Nebraska Ponca. In 1990, the Nebraska Ponca were officially recognised as such an entity.

At the request of the Omaha tribe, researchers in the Department of Anthropology have been studying skeletal and artifact collections from burial contexts to reconstruct Omaha lifeways at the most tumultuous period in Omaha history, AD 1775 to 1820. The study was initiated to recover cultural and biological information before the Omaha skeletons were reburied on April 4, 1991. The Omaha chose not to rebury the artifacts associated with the remains, and will keep and display these in a planned Omaha cultural interpretive center. In 1991, the Ponca tribe requested that the University initiate a study of their mortuary remains. The Ponca are related to the Omaha geographically, historically, biologically, linguistically, and culturally. We anticipate the reburial of the Ponca remains in one year. To date, studies

focussed on the analysis of Omaha skeletal remains and burial artifacts curated in the University of Nebraska State Museum. The University of Nebraska has contributed in excess of $100,000.00 towards the anthropological study before fiscal restraints cut funding (Appendix A).

The time between 1775 and 1820 was a critical period for both tribes. During this period, the Omaha rose to dominate neighboring tribes economically, and in some cases militarily. This was due to their geographic position in the Spanish and USA fur trade which they controlled by 1800. However, a smallpox epidemic reduced the vitality of the tribe in 1800 and killed their leader, Chief Blackbird. After 1800, the grasp of the Omaha on the fur trade loosened and neighboring groups, most importantly Siouan sub-tribes, began to ascend and dominate the northern Plains. Later Siouan groups began a war of extermination against the Omaha.

Unlike the Omaha, the Ponca were a small tribe that was militarily weak. Through the later part of the 1700s, they were dominated by the Omaha, and by the early 1800s they were dominated by the Sioux. During the mid-1800s they fused with the Omaha Tribe in a successful attempt at mutual survival (O'Shea and Ludwickson 1992). More than any other single time period, the years between 1775 and 1820 were critical in defining the tribes' subsequent cultural and historical trajectories.

Despite what appears superficially to be extensive documentation of the tribes in the ethnohistoric literature, little is really known about the details of the tribe's culture and

history for this period. To gain these details, we are employing archaeological study of burial artifacts and bioarchaeological study of skeletons and interpreting the results in context of ethnographic and ethnohistorical data. We have found that the information from the archaeological remains provides details of life that go beyond the ethnographic and ethnohistorical documents. Thus, for the Omaha and Ponca, archaeology provides details of their past not available in written documentation (Appendix B).

The studies are based on archaeological collections excavated in 1937-1941. Collections from these excavations include burial artifacts, human skeletal remains, and well-documented domestic remains. The domestic remains, including house structures, storage pits, and artifacts, have been previously studied (Wood 1960; O'Shea and Ludwickson 1992). The mortuary remains and associated skeletons are currently under study.

The data collection for the Omaha Tribe was heavily subsidized by the University of Nebraska from 1989-1991. The University sponsored the initial analysis for the Ponca Tribe in 1990-1991. The 1991-1992 and 1992-1993 academic years have been especially difficult economically for the University and funding for continued study was unavailable. Therefore, we are requesting funds to:

1) finish writing up the Omaha study in a scholarly format,
2) work the scholarly study of the Omaha into a popular format,
3) finish the Ponca analysis,
4) write up the Ponca results in a scholarly format,

5) rework the Ponca write up into a popular format.

This work will focus primarily on mortuary remains, both artifactual and osteological, augmented with published descriptions of domestic remains, and interpreted in the light of ethnographic and ethnohistorical accounts.

BACKGROUND TO THE SITES

The archaeological remains were excavated as part of W.P.A. programs in the late 1930s and 1940s. These focussed in part on the historic Omaha village of Tonwatonga (Figure 1) and its two associated cemeteries in Dakota County, 25DK2 and 25DK10. Also excavation efforts were directed towards the historic Ponca Village of Ponca Fort and associated cemeteries (Knox County). In addition, two other Ponca cemeteries were sampled and are known as 25KX6 and 25KX12. In comparison to other W.P.A. projects, Nebraska W.P.A. archaeology was very progressive. The burial excavations included 100% sampling of skeletons, and usually thorough field mapping and photography. The one exception was of one Omaha cemetery which was not documented with field maps. Fortunately, O'Shea and Ludwickson (1992) reconstructed this site with the help of the late John Champe who excavated the cemetery. Therefore, documentation is now available from this site as well.

Over 10,000 objects represented by 1,400 catalogue numbers were recovered from the burials of some 200 Omaha and Ponca. For the Omaha, over 95% of the artifacts found with 106 skeletons are of European or Euroamerican manufacture. The artifacts suggest

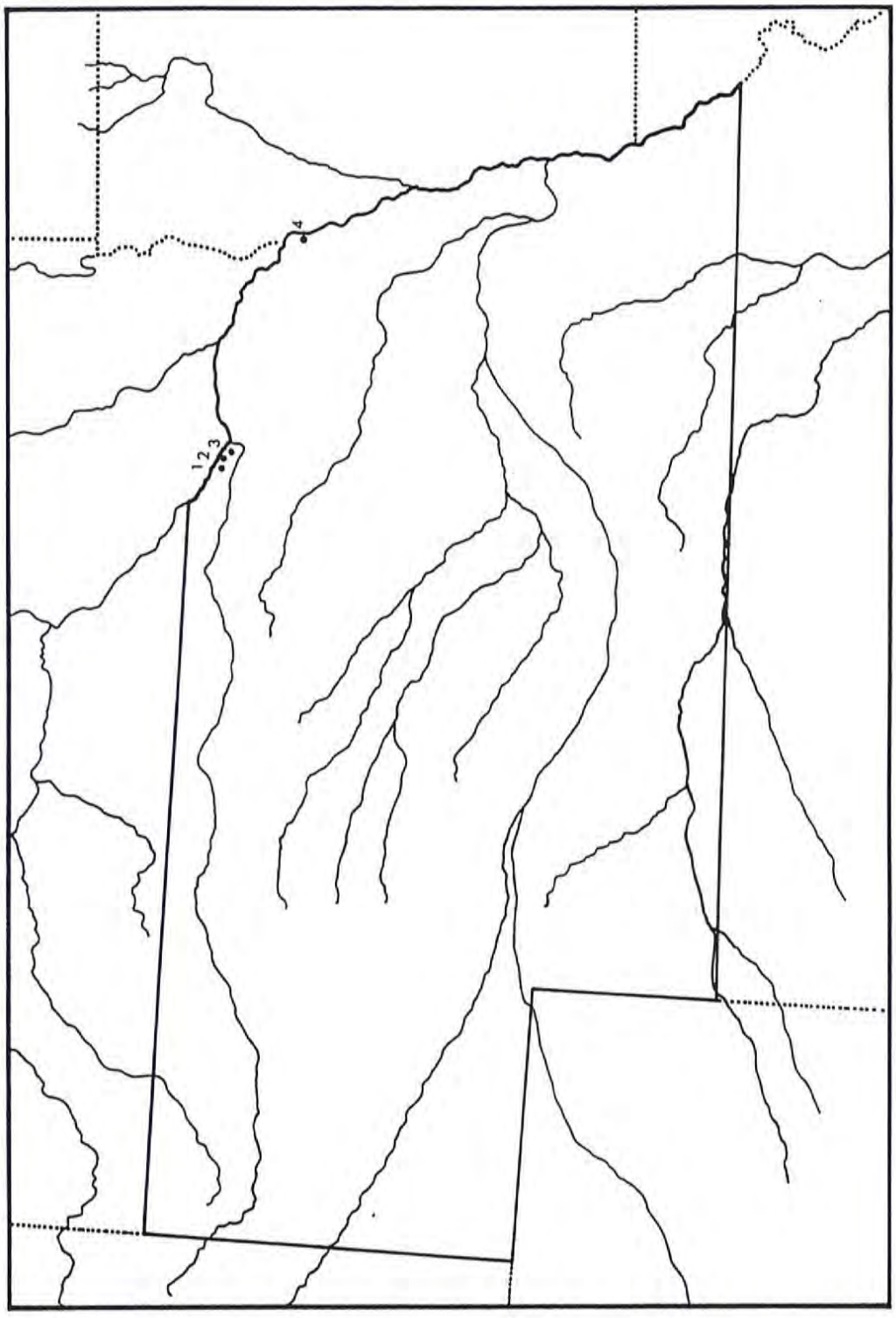

FIGURE 1: The location of the study sites in northeastern Nebraska are shown here. 1, 2 , and 3 = 25KX6, 25KX1, 25KX10; 4 = 25DK2, 25DK5, and 25DK10. The KX numbers are Ponca sites in Knox County and the DK numbers are Omaha sites in Dakota County.

that the Omaha cemeteries were not used synchronously and that the Ponca cemeteries may predate the Omaha cemeteries. It is clear from silver artifacts with marker's stamps that the two Omaha cemeteries were used between 1780 and 1812. Ornamentation differs between the cemeteries with the individuals from 25DK10 being heavily painted with a lead-mercury red pigment and consistently wearing copper coil ear ornaments (Figure 2). Firearms and firearm parts are more abundant from 25DK2 and included powder horns, gun flints, gun parts and, in one, a complete flint lock pistol. In contrast, only 2 burials from 25DK10 contained artifacts associated with firearms amounting to only 4 musket balls. If abundance of firearms can be assumed to increase with time, then it is possible that the presence of more firearms with the 25DK2 burials indicates a later use of the cemetery. It would thus seem that 25DK10 was used earlier in the 1780-1812 period and 25DK2 used later in the period. We have started the study of one Ponca cemetery from the Ponca Fort Site (25KX1). Although feild notes indicate that 44 individuals were recovered, preliminary skeletal analysis in 1991 showed that at 60 individuals are represented. These include 31 adults (26 women and seven men). In comparison with the Omaha, relatively few trade goods (represented by 100 catalogue numbers) and many more indigenously produced artifacts were found with the burials. The Ponca Fort site was occupied at the same time as the Omaha sites, 1790-1800 (Wood 1960). The analysis of the other two Ponca cemeteries has not begun in earnest, although some individuals from these cemeteries have been sampled for chemical

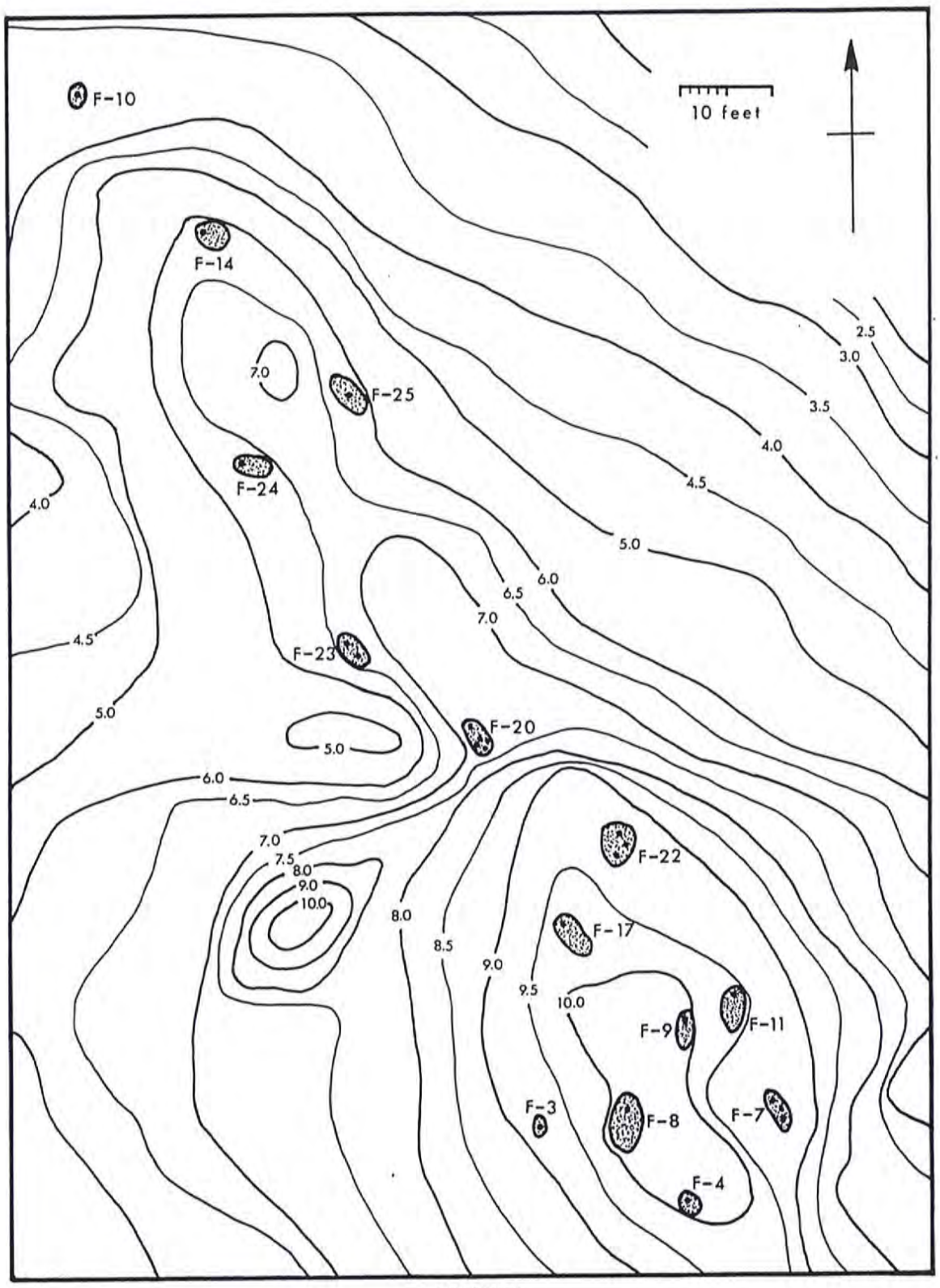

Figure 2a: Site map of 25DK2. F-numbers indicate burial pits. Because some burials were pre-Omaha and are not shown on this map, the reader will note that the burials are not in numerical order.

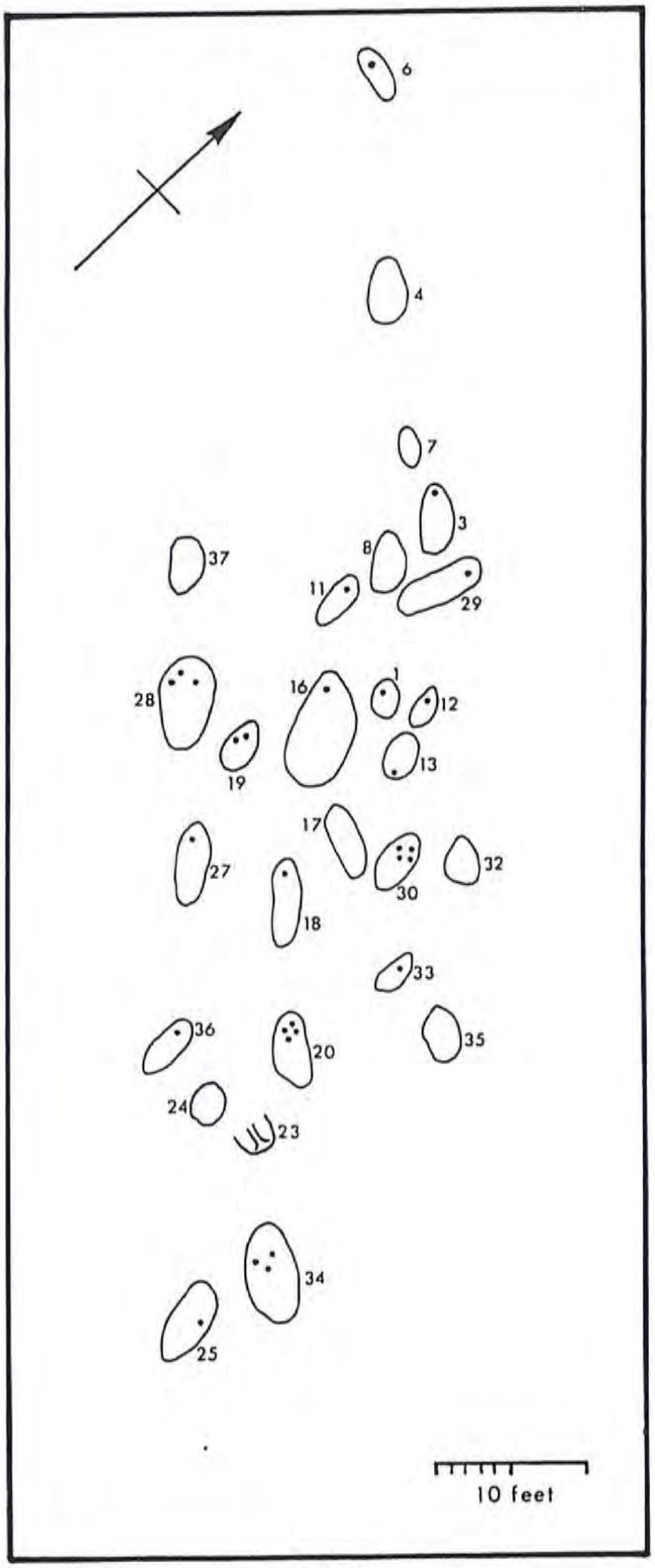

Figure 2b: Site map for 25DK10 redrawn from O'Shea and Ludwickson (1992).

analysis. Analysis of stable carbon and nitrogen isotope ratios from the three Ponca cemeteries demonstrates remarkable variance in diet between the Ponca cemeteries. This suggests that 25KX6 and 25KX10 were not used at the same time as Ponca Fort. Further analysis of artifacts will hopefully clarify the temporal relationship of the Ponca cemeteries. The state of preservation of the colections and excavation methodology are presented in Appendix C.

EXISTING OMAHA AND PONCA LITERATURE

Two recent works on the tribes provide comprhensive reviews of the extensice published and unpublished relevent ethnohistoric literature. Wood (1960) summarises the thenhostoric literature relevent to the Ponca and to Ponca Fort. O'Shea and Ludwickson (1992) completed the same task for the Omaha. These are key works for gaining insight into the ethnohistory of the tribes.

Ethnohistorical mention of the Omaha and Ponca extends back to 1795 when traders documented their interactions with the tribes. It is clear that the Omaha exercised control over the Missouri River trade. In 1794 Zenon Trudeau writes that:

> "The village of the Omaha would be a most propitious place to establish a post for merchandise and provisions to supply the trade on the Upper Missouri . . . In order to pass above, this is absolutely necessary, in order to place the great chief of the Omahas in our interest as well as for the commerce with his nation as with those of the Upper Missouri, which will not be easy to do without his consent" Nasatir (1990:285).

Trudeau goes on to state that trade with the Mandan and Arikara living upstream from the Omaha could be done only with the permission of the Chief (referring to Chief Blackbird). Prior to this the Omaha had been able to control the flow of trade and occaisionally barred the trade. Jacques Clamorgan wrote in 1801:

> "The Maha (Omaha) Nation, through who it is necessary to pass by water, after we leave the Octocta Nation, has declared war upon the Company by presenting themselves, weapons in hand, to pillage the merchandise . . .This nation . . . no longer wishes to permit the passage by water the transporting of any effects to the nations of the Upper Missouri. They declared themselves by a combat and have fired on whites attached to the service of the Company who have been obliged to retire to the Octocta Nation . . . Surrounded by these circumstances . . . the Company no longer has the power to have its convoys pass through the land of the Mahas or through the lands of the Ponca nation." Nasatir (1990:285-286).

These comments, and others, clearly indicate that the Omaha controlled the Missouri River where it passed into their territory and by their main village. The Ponca also exercised a degree of control over the trade, mostly by raiding trading parties (Wood 1960).

The ethnographies of Dorsey (1884; 1896), Fontenelle (1885), and Fletcher and LaFlesche (1911) provide thorough background information regarding many aspects of Omaha/Ponca culture. Ritual, burial practices, activity patterns, diet, material culture, marriage patterns, and many other aspects of Omaha/Ponca culture are described. Importantly, Fletcher and LaFlesche attempted to document the change in culture in the early 1800s, a time not too distant from the occupation of Tonwatonga. By the time that these ethnographies were written, the Ponca and Omaha Tribes had

intermingled and much of the information applies to both tribes. Ethnobotanical references are available that thoroughly document Omaha and Ponca diet (Gilmore 1913; Kinscher 1987; Yanovsky 1986).

Non-mortuary Omaha and Ponca archaeology has been studied and is currently the subject of continued study. Most recently, O'Shea and Ludwickson (1992) presented descriptions of houses and artifacts recovered from Tonwatonga. Wood (1960) originally published the Ponca Fort site in 1960 and is now revising that work based on reexamination of artifacts and excavation records.

The mortuary remains have not been thoroughly examined by anyone prior to the initiation of this study, although some published data is available. O'Shea (1985) evaluated variance in status for the Omaha based on analysis of mortuary artifacts. O'Shea and Ludwickson (1992) provide descriptions of the burials. Neither of these studies involved direct examination of the skeletal remains but rather were based on burial records and excavation forms. In the course of the Omaha skeletal analysis, I have found numerous errors and omissions in the burial records. Consequently, the studies by O'Shea and Ludwickson under-represent the number of people present in the cemeteries. Also, they under-represent the number of artifacts originally placed with the burials. The mortuary artifacts were not interpreted with respect to their cultural and historical significance and modern bioarchaeology of the Omaha cemeteries was never done beyond craniometric studies (Jantz 1973; Key 1984).

The Ponca Fort study (Wood 1960) provides a major contribution to Ponca archaeology. It focusses on the domestic remains and general discussion of burial features. The discussion of burials was limited to a more general nature due to the provenience system used in the excavation which made it very difficult to establish the specific locations of the skeletons at the time of excavation and the association of artifacts with specific burials. When we initiated this study, it was thought that sorting out the burial provenience for skeletons and artifacts would be impossible. However, patient reexamination of excavation forms, excavation photographs, and decipherment of the provenience system has allowed us to reassociate the skeletons with artifacts and excavation features. Skeletal analysis of the Ponca Fort burials was done in 1939-1940 and the data from these analyses were summarised by Wood (1960. Modern bioarchaeological analysis of Ponca skeletons was never attempted before this study, beyond craniometric study by Jantz (1973) and Key (1984).

In 1989, 106 skeletons and associated artifacts were offered to the Omaha Tribe for reburial. The Omaha Tribe requested analysis of the skeletons and artifacts prior to reburial and that analysis was initiated by myself in the fall of 1989 and finished in the fall of 1991. In the fall of 1990, Dennis Hastings, Omaha Tribal Historian, joined in on the interpretation of the remains.

PROJECT METHODOLOGY

RESEARCH GOALS

The following research questions related to Euroamerican contact can be addressed by the Omaha/Ponca data.

1) What was the motivation for Omaha/Ponca migration into Nebraska?

2) What was the motivation for Omaha/Ponca participation in the fur trade?

3) How pervasive was the use of the horse among members of the tribe?

4) What was the role of the horse in Omaha/Ponca subsistence?

5) How important were firearms among the Omaha/Ponca?

6) How pervasive was warfare among the Omaha/Ponca?

7) What were the typical activity patterns for males and females and how did Euroamerican contact affect these activities?

8) What was the nature of childhood health and was childhood health affected by contact?

9) Is their evidence of infectious disease among the Omaha/Ponca and can that disease be traced to contact or to indigenous factors?

10) What was the typical horticultural pattern among the Omaha? What foods were cultivated? How much did foraging play a part in Omaha subsistence?

11) The decline in Omaha population has variously been attributed to infectious disease or warfare, both resulting from Euroamerican contact. In additon, it is possible that poor infant health, poor maternal health, and toxic element poisoning contributed to the

population decline in the 1800s. Can these various factors be ranked in importance based on the archaeological/ethnohistorical literature?

RESEARCH STRATEGY

The research questions will be addressed by examination of archaeological remains, skeletal remains, ethnohistory, and ethography as follows:

Question 1 can be addressed by reviewing recent publications on the Omaha/Ponca migration (Myers 1992; O'Shea and Ludwickson 1992) which describe the migration in a historic setting. Myers especially explores the reasons behind the migration.

Question 2 can be address by examining the ethnohistoric lterature and by reviewing the type and quantity of trade goods found with the burials and at the village sites. The type of goods commonly traded for will indicate whether the trade was primarily for utilitarian items, weapons, or ornaments. This will provide insight into the kinds of objects most needed or desired by the tribes. Ethnohistorical documentation of the trade by Nasatir (1990) provides specific comments by traders regarding objects most frequently traded to the tribes.

Question 3 can be addressed by examining the numbers of people that show changes associated with horse riding. Previous research with Omaha skeletons revealed a number of skeletal changes that are due to extensive horse back riding (Miller 1992). By assessing these changes on a skeleton by skeleton basis, the number of horse riders

in the entire population, and the number of riders of each sex, can be determined.

Question 4 can be addressed by examination of the ethnographic literature, especially of Fletcher and LaFlesche (1911) who provide specific information regarding subsistence practices involving the horse. The stable carbon and stable nitrogen analysis of the bones also provides quantifiable information regarding the amount of meat, and of what type, in the diet. Hunting strategies are especially important with regard to the use of horses. The ethnographic literature also describes the use of horses for foraging for wild tubers. The use of horses for this purpose will be signalled by the stable isotope data.

Question 5 relates to the importance of firearms among the tribes. This can be addressed by review of the artifact collections for firearms or firearm parts. The ethnohistoric literature specifically decribes gun trade, and specifies the numbers of firearms traded. Both the archaeological and ethnohistorical records indicate that at least the Omaha had gunsmiths. The fact that firearms were repaired may testify to their importance in the cultures.

Question 6 related to a recent hypothesis that warfare was a significant part of Omaha life by the 1800s (O'Shea and Ludwickson 1992). Warfare can be assessed by examining skeletal remains for warfare-related trauma and by surveying the ethnohistoric literature for documentation of conflicts.

Question 7 refers to the identification of activity patterns for men and women. A number of osteological changes related to specific activities has been noted among the Omaha skeletons. These have been tabluated to discern sex differentiated activities. Similar research will be carried out for the Ponca skeletons. The ethnographies, both of Dorsey (1884; 1896) and Fletcher and LaFlesche (1911), also contain data regarding activity patterns. Both bear testimony to the changes in activity patterns that are associated with the fur trade.

Infant and childhood health is the concern of Question 8. A thorough bioarchaeological including assessment of childhood growth, childhood stress, infectious disease, and trauma will be completed for the Ponca as it has for the Omaha remains. The resulting data will be used to address this question.

Question 9 results from the hypothesis that infectious disease had the most significant impact on Omaha/Ponca population decline. Analysis of skeletal remains for evidence of infectious disease will be done as well as a review of the existing literature on introduced diseases.

Question 10 addresses general subsistence patterns for the Omaha and Ponca. Although the ethnographic literature provides valuable information on what plants and animals were eaten, the stable carbon and nitrogen isotope data collected for the Ponca and Omaha provide quantitative values relating to foraging, hunting, and agricultural components of the diet. This the chemical data will be used most extensively for subsistence pattern reconstruction.

Question 11 refers to a synthesis of the disease data to assess the relative impact of different aspects of contact on the decline of the Omaha/Ponca populations. It will be addressed by synthesizing the information gained in addressing Questions 6, 7, 8 and 9.

This study involves the integration of bioarhaeological data from skeletal analysis into archaeological context to more fully reconstruct patterns of Omaha/Ponca life. In order to complete a thorough bioarchaeological analysis we followed analysis guidelines established by the Paleopathology Association for the collection of skeletal data prior to reburial (Table 1). The methods for examination of skeletal and artifactual remains are extensive and are summarized in Tables 2 and 3. The various lines of analysis listed in Table 1 provide a thorough data base. Several methods provide data relating to childhood health such as demographics, growth assessment, harris lines, enamel hypoplasia, and genetic disorders. Others reflect differing health status among the adults and between men and women. These analyses include demographics, skeletal metrics, nutritional deficiencies, degenerative conditions, trauma, and dental pathology. Others evaluate

TABLE 1: Minimal data collection categories as established for reburial analysis by the Paleopathology Association.

Analysis Type	Main Purpose of Study
1. Demographics -	Life expectancy
2. Growth assessment -	Childhood nutritional disease
3. Skeletal metrics -	Activity patterns
4. Dental metrics -	Genetic relationships
5. Skeletal inventory -	Preservation conditions
6. Harris lines -	Childhood starvation
7. Enamel hypoplasia -	Childhood illness
8. Nutritional deficiencies -	Nutritional disease
9. Infectious lesions -	Nature & prevalence of infection
10. Degenerative conditions -	Lifestyle and activity
11. Trauma -	Lifestyle and warfare
12. Neoplasms -	Benign and malignant tumors
13. Dental pathology -	Cavities, tooth wear and loss
14. Dental attrition -	General diet reconstruction
15. Bone radiography -	Trauma, infections, tumors
16. Bone histology -	Age, metabolic disease
17. Stable isotopes -	Detailed diet reconstruction
18. Trace elements -	Diet reconstruction/toxic element poisoning
19. Nonmetric genetic markers-	genetic disorders
20. Postmortem skeletal modifications	
21. Premortem skeletal/dental modifications	
22. Nonspecific anomalies -	genetic relationships

TABLE 2: Protocol summary for analysis of burials. * indicates completed for Omaha, ** indicates completed for Ponca ** indicates partially completed.

Stage 1: Organization of collections

Inventory of bones * **

Sorting of bones by individual * **

Identification of pathological elements * **

Storage of bones by individual *

Examination of premortem/postmortem modifications * **

Stage 2: Preliminary data collection

Radiography of dentition for aging purposes * **

Radiography of tibiae and femora for Harris Lines * **

Radiography of femora for cortical bone thickness * **

Radiography of pathological elements * **

Identification of age and sex * **

Recording of copper or cinnabar stains on skeleton *

Stage 3: Basic analyses

Demography *

Analysis of Dentition *

Analysis of degenerative disease related to activity *

Paleopathology related to issues presented in Table 1 *

Stage 4: Specialized analyses and procedures

Trace element analysis for diet and toxic elements *

Stable carbon isotope analysis *

Stable nitrogen isotope analysis *

Dental casting in Labstone for semi-permanent record *

Dental casting in epoxy resin for SEM analysis *

Examination of bone changes for activity pattern analysis *

Histological sectioning for age determination *

Growth assessment using long bone lengths of children *

Interpretation

Integration of data collected to assess:

Male health *

Female health *

Childhood health *

Reproductive potential *

Male Activities (general) *

Female Activities (general) *

Individual health and activity *

TABLE 3: Protocol summary for analysis of burial artifacts. * indicates completed for Omaha, ** indicates completed for Ponca <u>**</u> indicates partially completed.

Stage 1: Organization of Collections

Inventory of artifacts * **

Sorting of artifacts by burial provenience *

Printing of excavation photos to reveal precise location of artifacts *

Stage 2: Analysis of artifacts

Examination of form and function of artifacts *

Examination of individual status by artifact distributions *

Examination of metallurgical technology *

Stable Lead isotope analysis to determine sources of lead trade *

Assessment of intensity of trade by calculation of percentage of trade artifacts *

Dating by examination of manufacturer touch marks *

Stage 3: Incorporating artifacts and skeletal data

Interpretation of relative status of males and females

Temporal placement of cemeteries to each other *

Individual activity pattern analysis *

Reconstruction of ornamentation and adornment *

infectious disease, presence of tumors and cancers, and interpersonal violence. For assessing the interpretive value of the collection regarding preservation conditions, the skeletal inventories, and analysis of post-mortem changes in the bone are significant. Dental, trace element, and stable carbon and nitrogen isotope analyses provide dietary information. The trace element analysis has also yielded evidence of lead exposure and lead posioning.

Inherent in our methodology is the interpretation of the remains in the light of the cultural context provided by tribal members. We discussed the analysis with members of the Omaha Tribal Council to determine specific topics of particular interest to the Omaha people. Their concerns fell into two categories, biological and cultural. With respect to biological concerns, they requested that the analysis address the antiquity of cancer and infectious disease among Omaha peoples and to address the cause of diabetes among modern Omaha peoples. They also requested that we investigate the health problems that lead to population decline in the 1800s. Their cultural concerns included recovery of data regarding traditional dress, adornment, artifact use, and to gain a picture of Omaha life 200 years ago. They specifically requested that the results of the anlyses be written in non-jargon, plain English for dissemination to the tribe.

The extensive analysis of skeletons provided significant information regarding a variety of aspects of activity, reproductive biology, marriage patterns, and health. The relation

of the artifactual remains to the burials provided more cultural data such as patterns of trade, adornment, dress, manufacture of cradle boards, technology, individual status, burial patterns, and individual activity patterns. Thus, cultural and biological information were collected on both an individual and population basis. Importantly, the analyses led to discoveries regarding the nature of Euroamerican contact and the impact of that contact. Some of these findings are presented in Appendix B.

GOALS OF CONTINUED WORK

The progress of the study is indicated in Tables 2 and 3. Clearly, the Omaha analysis has advanced much further than the Ponca. The Omaha Tribal Council members specifically asked that the analysis be written in plain English for the benefit of tribal members. A popular publication would be of interest to the general reading public as well. To accomplish the goal of writing a public oriented treatment, the data must be summarized and prepared in a monograph form. The over-all goal of the Omaha component of the study is to finish the nearly completed monograph, and then to summarize the study in a shorter, non-jargon, popular format. Thus, two works will be derived from the Omaha effort: a technical text and a summary text in lay English. The Ponca study is not as advanced as the Omaha study. The bones and artifacts from the burials must be studied. Following the study, a technical monograph and popular summary will be written.

PROJECT STAFF

The key personnel involved in the project will include an archaeologist with special expertise in Ponca ethnohistory and archaeology (Steven Holen), a bioarchaeologist already familiar with the Ponca remains who will study activity patterns (Elizabeth Miller), an broadly trained osteologist to collect the data specified by Paleopathology Association guidelines (Shelly D. Burgess), the Omaha Tribal Historian to assist in the production and publication preparations for the popular summaries (Dennis Hastings), and myself to finish the Omaha monograph, over-see the Ponca Analysis, and work with Dennis Hastings in writing the popular works. In addition, it will be necessary to incorporate an illustrator/photographer to prepare figures for the works, and an graduate student assistant to assist in artifact analysis. The special qualifications of the key personnel for this project are summarized below and Curriculum Vitae are presented in Appendix C.

Reinhard has been working intensely with Nebraska Plains cultures for three years. His training is in archaeology and bioarchaeology and has supervised the analysis of Omaha and Ponca mortuary remains. He is interested in the presentation of archaeological data in popular formats. In the past he participated in the writing of technical and popular works based on southwestern archaeological excavations sponsored by NEH (Gregonis and Reinhard 1979). Most recently, he has participated in the presentation of bioarchaeological data from Palestine (Cahill et al. 1991).

Steve Holen in a Ph.D. candidate at the University of Kansas and Research Archaeologist, Department of Anthropology, University of Nebraska. Holen is a specialist in Plains archaeology with a special interest in historic Nebraska tribes. He has extensive experience in Ponca archaeology and ethnohistory, mostly from his cultural impact assessment of the development of Niobrara State Park which is established in the heart of Ponca tribal territory. He will analyze the artifacts associated with Ponca burials.

Shelly Burgess will finish her Ph.D. in anthropology in December 1992 at the University of Chicago. Burgess is an osteologist with broad training in demographics, non-metric studies, metric analysis, paleopathological studies, and many other subfields of osteology. She has gained this extensive experience in osteological studies in both North and South America. Most recently, she completed a pilot reburial analysis with a new computerized data base system on the Dickson Mound display skeletal collections. With this background, she is indispensable for the data collection from the Ponca and computerization of both the Omaha and Ponca skeletal data bases and write up of the technical aspects of the analyses.

Elizabeth Miller is a Ph.D. candidate at Arizona State University where she is studying the impact of Euroamerican contact on Native American population in the 1700s and 1800s. She also specializes in the reconstruction of activity patterns. With Reinhard and others, she has completed an activity pattern study for the Omaha analysis. She has worked on the Omaha analysis for

four months and is familiar with the Ponca collection. She will complete an activity pattern analysis of the Ponca and produce a manuscript describing that work.

Dennis Hastings has been the director of the Omaha Tribal Historical Project for 12 years and has recently been designated as the Omaha Tribal Historian. Under his sponsorship, many cultural projects have been completed by the OTHP. Some of these are the recovery of traditional Omaha songs recorded on wax cylinders in the 1800s, an on-going Omaha language recovery project involving linguists from Wayne State University, the return of sacred and secular Omaha artifacts from the Peabody Foundation, the sponsorship of reburial analysis of Omaha mortuary remains, the production of two award winning Omaha ethnological films, (Return of the Sacred Pole and Dancing to Give Thanks), the completion of travelling and static exhibits on Omaha culture through the University of Nebraska State Museum, and the production of a popular books dealing with significant Omaha personalities. He has help in the guidance of the mortuary analyses since 1990. In his role as Omaha Tribal Historian, Hastings will be critical in focussing Omaha and Ponca tribal concerns and input into the written products of this project. He will participate in the write up of the popular works.

WORK PLAN

The draft of the technical summary of the Omaha summary is nearly completed (Table 4). An intensive period of continued

writing will allow the completion of the draft in 3 months. This will be completed in the spring semester of 1993 by Reinhard in the months of January through May. In the summer of 1993, the popular summary, amounting to 150-200 pages, will be written by Reinhard and Hastings (Table 5). This manuscript will be completed by September of 1993.

The Ponca analysis must be finished. Although the inventory, radiography, and basic demographic analysis has been completed for about half of the burials, the artifacts and detailed osteological analyses has not been done. Therefore, the spring and summer of 1993 will be devoted to the analysis of burial remains. In the fall of 1993 and spring of 1994, the technical monograph summarizing the Ponca analysis will be completed by the key personnel described above (Table 6). Then in the summer of 1994, Reinhard and Hastings will write the popular version of the text for the reading public (Table 7).

EXPENSE AND EQUIPMENT JUSTIFICATION

The Omaha analysis was done on an IBM system. The new data collection system developed by Jane Buikstra and George Armelagos and applied at Dickson Mound by Burgess is designed for a MacIntosh system. Therefore, it would facilitate the analysis to have a MacIntosh system. Other requirements of the system besides skeletal data collection and analysis will be the need to scan and manipulate the Ponca burial field drawings and produce pamphlets documenting the progress of the work for the tribes involved.

With regard to full reconstruction of Ponca burial associations, the available field drawings show the location of bones, but not the complete artifact associations. Additional artifact associations are evident in the field notes and field photographs. The field drawings must be scanned into the system, stored, and then be modified as additional information regarding burial associations is obtained. Once the data is collected from all three sources, field drawings, field notes, and photographs, the data can be more easily superimposed on the drawings by computer than by hand.

When the project was originally discussed with the Omaha Tribe, members of the Tribal Council requested that pamphlets be prepared for the public schools describing in simple english with illustrations aspects of the findings. With a scanner, such pamphlets could be easily designed and provided to the tribe for duplication. Also, as the analysis progresses, the production of such pamphlets at regular intervals (approximately 2 months) for distribution to both tribal councils would be an effective way of keeping the tribes abreast of the analysis developments. I have discussed these requirements with the Campus Computing Center as well as the staff of the Nebraska State Museum who frequently produce pamphlets with graphics. Both groups recommend the purchase of a MacIntosh Quadra 950 system for the work because of its large memory, speed, and ability to optimally handle graphics and graphic packages.

The expenses are needed to facilitate communication between Hastings and Reinhard. Hastings lives on the Omaha Reservation, 410 miles round trip from Lincoln. Thus, telephone and travel expenses will be needed to aid communication as the project progresses.

FINAL PRODUCT AND DISSEMINATION

The Omaha technical manuscript is near completion and is outlined in Table 4. The popular version is outlined in Table 5. Tentative outlines for the Ponca texts are presented in Tables 6 and 7. As opposed to the Omaha technical report which has one author (Reinhard), the Ponca technical text will be and edited volume with individual chapters written by the key personnel. Several publishers have expressed interest in the final manuscripts. These include the University of Arizona press (verbal interest expressed to Reinhard), Lerner Publication (verbal interest expressed to Hastings), and the University of Nebraska Press. Because of the University of Nebraska Press's long term interest in Plains peoples, this seems to be the best choice. A letter of interest from the University of Nebraska Press in presented in Appendix D.

TABLE 4: Outline for technical version of Omaha analysis. The number of double spaced manuscript pages taken by each chapter is also presented.

Forward by Dennis Hastings: The Omaha perspective on burial and burial analysis . . . . . 10 pages

Chapter 1: Descriptions of Burials: Individual Identity . 75 pages

Chapter 2: Cultural FLux Reflected in Burial Patterns . . 30 pages

Chapter 3: Appearance and Adornment . . . . . 27 pages

Chapter 4: Demography and Life Expectancy . . . . . 20 pages

Chapter 5: Subsistence: Equestrian Adaptation to hunting, agriculture and foraging . . . . . 45 pages

Chapter 6: Dental Health Relating to Activity and Diet . 29 pages

Chapter 7: Activity Patterns of Men and Women . . . . . 45 pages

Chapter 8: Marriage, Reproduction and Infant Health . . . 24 pages

Chapter 9: Trade in Toxic Elements . . . . . 25 pages

Chapter 10: Trauma and Infectious Disease . . . . . 30 pages

Chapter 11: Impact of Euroamerican Trade on Omaha Culture 15 pages

Chapter 12: Learning from the Ancestors: What Archaeology Can Tell About Modern Omaha Health Problems . . . . . 25 pages

Appendix A: Chemical Analysis Protocol . . . . . 5 pages

Appendix B: Long Bone Lengths . . . . . 3 pages

Appendix C: Dental Pathology Data . . . . . 4 pages

Appendix D: Radiographic studies . . . . . 15 pages

Appendix E: Histological Protocol . . . . . 10 pages

TABLE 5: Outline for popular version of Omaha analysis. The number of double spaced manuscript pages taken by each chapter is also presented.

Chapter 1: The Omaha World . . . . . 20 pages

Environment

Early migration

Traditional lands

Chapter 2: Omaha in the Fur Trade 1780-1815 . . . . . 15 pages

Early accounts of the Omaha

Omaha dominance of the fur trade 1780-1800

1800 Death of Chief Blackbird and Omaha decline of power

Chapter 3: Omaha Technology . . . . . 15 pages

Permanent, winter houses

Temporary tepees

Manufacture of tools

Chapter 3: Appearance and Adornment . . . . . 20 pages

Physique

Clothing

Ornamentation

Chapter 4: Traditional Omaha Diet . . . . . 20 pages

Seasonal rounds

Role of the bison hunt in culture and subsistence

Agricultural production

Foraging from the environment

Chapter 5: Lifestyle of Omaha Men . . . . . 25 pages

Traders

Hunters

Warriors

Craftsmen

Chapter 6: Lifestyle of Omaha Women . . . . . 25 pages

Women's crafts

Horticulture

Support of household

Chapter 6: Childhood . . . . . 20 pages

Growth and development

Childhood work responsibilities

Maturation and marriage

Chapter 7: Impact of Euroamerican Trade on Health . . . . 25 pages

Role of smallpox in tribe's decline

Role of lead and mercury poisoning

Affect of fur trade on women's health

Chapter 8: Learning from Burials . . . . . 15 pages

Inference based on artifactual association

Inference based on skeletal studies

TABLE 6: Outline of Ponca technical work.

Chapter 1: Ponca ethnohistory by Steve Holen

Chapter 2: Description of Ponca cemeteries bySteve Holen and Joan Baker

Chapter 3: Ponca Mortuary Associations by Steven Holen

Chapter 4: Ponca Mortuary Customs by Steven Holen and Karl Reinhard

Chapter 5: Skeletal Remains by Shelly Burgess

Chapter 6: Demography by Shelly Burgess

Chapter 7: Physical Appearance by Shelly Burgess and Karl Reinhard

Chapter 8: Dietary Reconstruction by Larry Tieszen

Chapter 9: Dental Health by Karl Reinhard

Chapter 10: Bone Pathology: Evidence of Disease and Warfare by Shelly Burgess and Elizabeth Miller

Chapter 11: Activity Patterns by Elizabeth Miller

Chapter 12: Conclusions by Karl Reinhard

TABLE 7: Tentative outline of popular text on Ponca analysis.

Chapter 1: The Ponca in Environmental Context

Native lands

Environment of the Niobrara River

Chapter 2: The Ponca in Cultural Context

Relation to Omaha

Relation to Arikara

Relation to Sioux

Relation to Pawnee

Chapter 3: The interaction of cultural adaptation and environmental adaptation

Impact of warfare on settlement pattern

Shifting subsistence strategies related to predation

Chapter 4: Appearance and Physique

Clothing

Ornamentation

Chapter 5: Lifestyle of men

Chapter 6: Lifestyle of women

Chapter 7: Evidence of warfare and disease

Chapter 8: Relative impact of warfare and disease on Ponca 1775-1820

Chapter 9: Survival of the Ponca, 1840-present

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APPENDIX A

PAST UNIVERSITY COMMITMENT TO PONCA/OMAHA STUDY

The reburial issue and related analysis has involved several divisions within the University. The direct costs of this research are specified below. Support for the initial analysis during the fall of 1989 came from the Department of Anthropology and from the Nebraska State Museum which totalled $17,050.00. During this period, 50% of Reinhard's time, an additional (b) (6), was donated by the Department of Anthropology towards the organization and analysis of the skeletal material. Mr. Stan Parks was funded to examine and organize the artifacts from the burials. Analysis space was provided in Nebraska Hall by the Nebraska State Museum for skeletal study and by the Department of Anthropology for artifact analysis. Ms. Karin Sandness, Mr. Gary Toth, Mr. William Sabo, Ms. Marjorie Osborne and Ms. Susan Moorhead, all advanced anthropology students, volunteered to analyze the Omaha skeletal remains and excavation documents.

For the second stage of analysis in the spring of 1991, funding for equipment and for the support of student assistants has come from four sources; the Office of the Vice Chancellor for Research, the Nebraska State Museum, the Department of Anthropology, and the College of Dentistry totalling $33,145.00. In addition, the College of Dentistry committed 1/2 of Dr. Tom Underhill's time to coordinate the radiographic study of the remains assisted by Ms. Susan Moorhead, an approximate $20,000.00 commitment. Moorhead was jointly funded by the Department of

Anthropology and the Nebraska State Museum. Facilities and support have also been provided by the College of Medicine. Dr. Phoebe Kaplan of the College of Medicine was also involved in the radiographic analysis with the radiography done in the University Student Heath Center. Certain chemical analysis of pigments found on and with the skeletal remains was completed by Dr. Mary Anne Holmes (Department of Geology). Stan Parks, the Reburial Laboratory Coordinator, and Mr. Mark Howe computerized the 1940 skeletal and artifact inventories from the Omaha burial sites.

During the 1990-1991 academic year, funding for the project came from the University of Nebraska State Museum, the Department of Geology, and the Vice Chancellor for research and totalled $39,080.00. This funding was used to support Ghazi and one other researcher, Karin Sandness, as well as for costs of specialized analyses.

Final funding for photography and dental casting amounting to $5,000 was provided by the University of Nebraska State Museum during the fall of the 1991-1992 academic year. During the summer of 1992, a $5,000.00 fellowship from the Center of Great Plains Studies was awarded to Reinhard to begin the technical write up of the Omaha analysis, preparatory for the production of a popular summary.

Thus, the initial investment in the Reburial Project came from the Department of Anthropology and the Nebraska State Museum in the fall of 1989. This was due to the fact that the artifacts, skeletal remains, and excavation records were housed in these

divisions. During and since the fall of 1989, the reburial issue has become a university wide, cross campus concern. The total amount of funding the University has thus far contributed to the project is $134,195.00.

APPENDIX B

NEW DISCOVERIES FROM THE BURIAL REMAINS

Bioarchaeology, by incorporating skeletal data and artifactual data, can provide especially detailed reconstructions of past lifestyles. The Omaha analysis is complete and some of the findings that demonstrate the range of information that can be recovered from the mortuary remains are presented below.

Examples of Findings

1) The Omaha diet deviated previous maize reliance of prehistoric Nebraska people and ate about 10% more meat and a greater diversity of plant foods (Figure 1). Bison was the major animal food for the Omaha and many cultural traditions documented by Fletcher and LaFlesche (1911) and components of social organization described by Dorsey (1884) developed around the bison hunt. Other animals including deer, birds, fish, and freshwater shellfish were also eaten (Figures 2 and 3). A variety of plant food was also consumed. Most important of these were wild tubers and maize (Figure 4). Interestingly, Omaha adult males had a greater meat component in their diets than females. Infant weaning occurred between ages 2 to 4 years of age (Figure 5).

2) In general, analysis of Harris lines indicates that childhood stress resulting from poor nutrition was relatively uncommon for the Omaha. Enamel hypoplasia are present in only two individuals. Thus, it appears that the nutritional base for the Omaha was essentially sound. However, growth rate is low between the ages of 1.5 and 6 years of age indicating post weaning stress

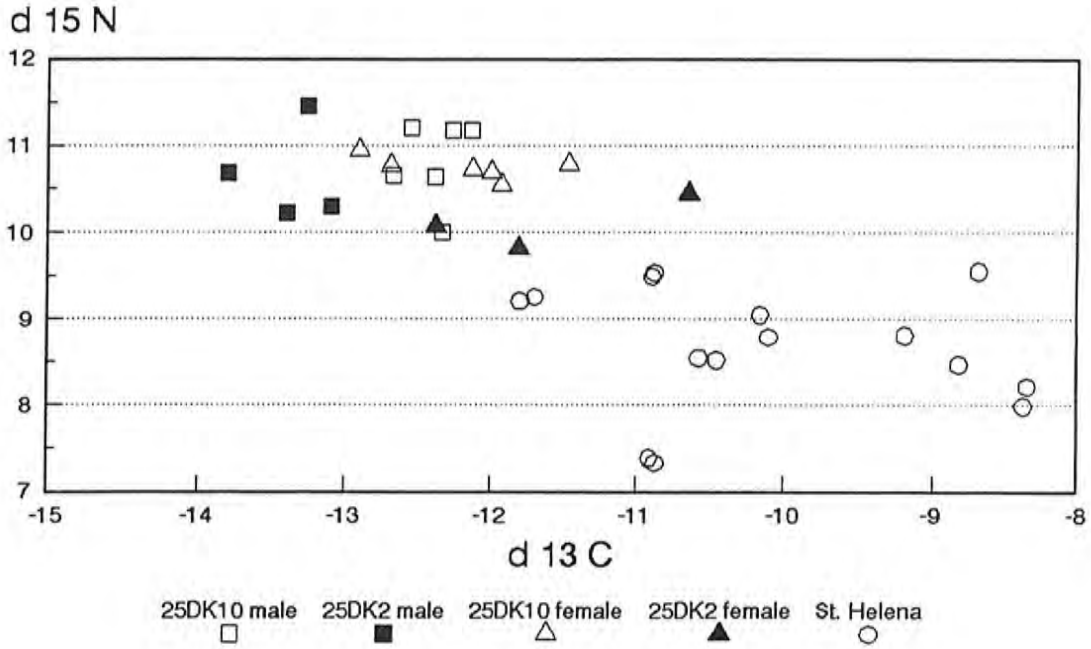

FIGURE 1: Stable carbon and nitrogen isotopic analysis shows that the prehistoric St. Helena Culture of northeastern Nebraska was reliannt on maize horticulture as a primary subsistence strategy. Ethnographic data indicates that the Omaha broke with this practice and incorporated more meat and wild plants, especially tuber forming plants, into their diet. This is indicated isotopically by high nitrogen values and more negative carbon values for the Omaha. Studies of carbon value spacing also indicate a higher meat component in Omaha diet.

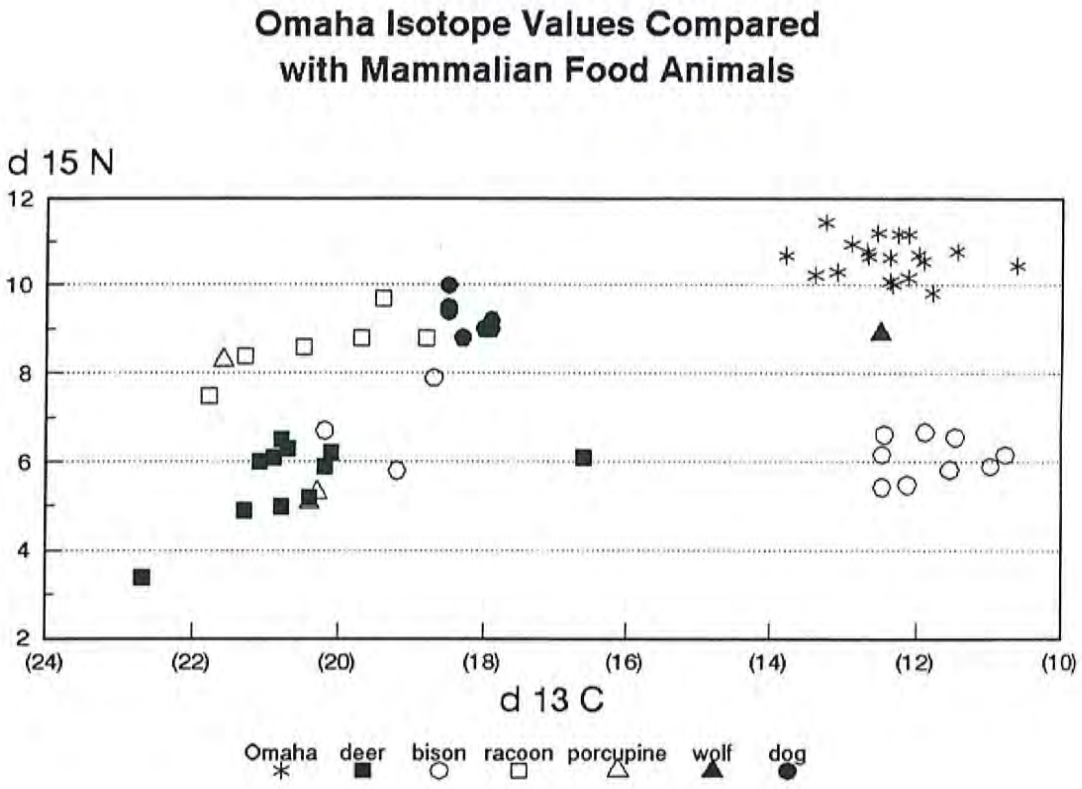

FIGURE 2: Stable carbon and stable nitrogen isotopic analysis was employed to evaluate Omaha meat diet. Presented here are values for animal bones excavated from Tonwatonga and Omaha skeletons. Preliminary analysis of these data suggest that bison was a more significant part of Omaha hunting. The values for other animals are too negative on the carbon scale to have played as a large a role in Omaha diet.

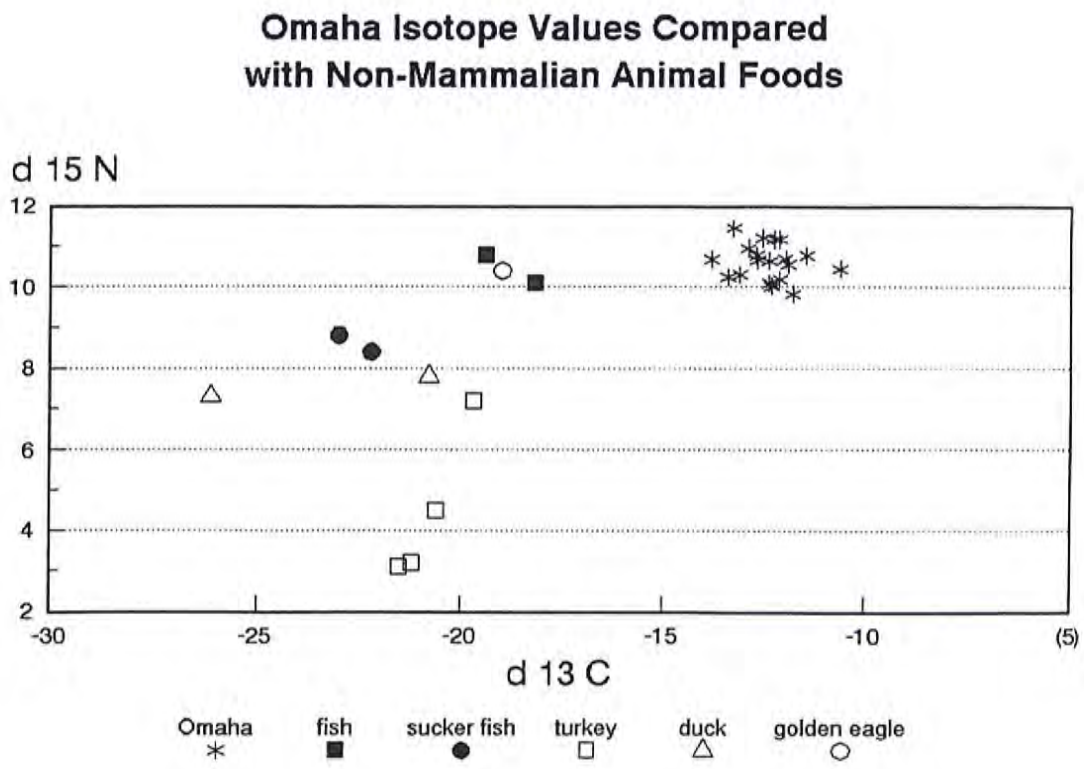

FIGURE 3: Stable nitrogen and carbon isotope values were obtained from non-mammalian vertebrates from Tonwatonga. This analysis indicates that these animals did not contribute significantly to Omaha meat diet.

Omaha Isotope Values Compared with Non-Mammalian Animal Foods

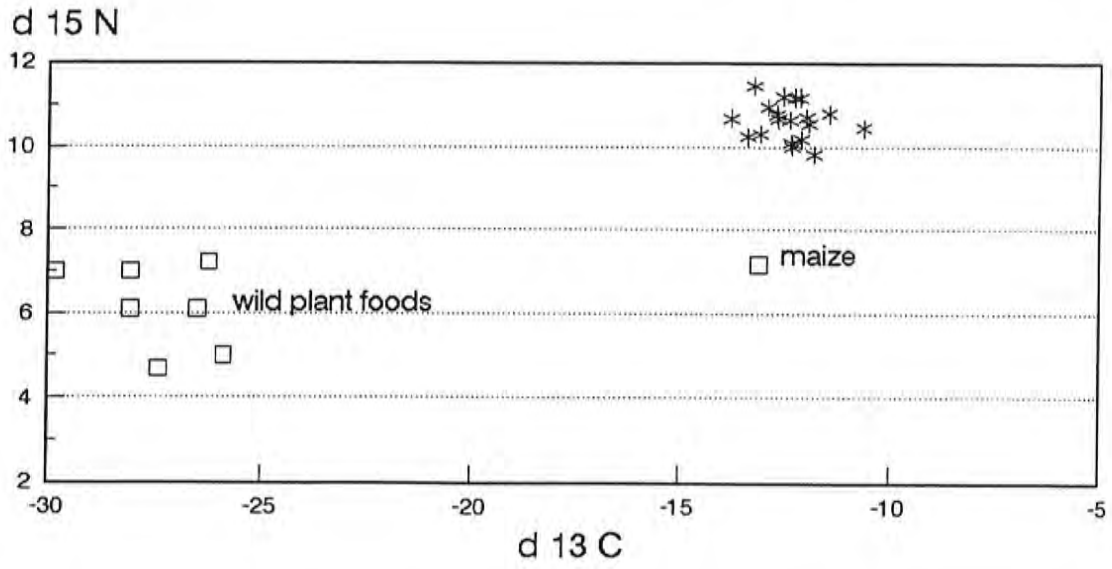

FIGURE 4: Omaha skeletal values when compared to maize from from burial offerings and wild plant foods mentioned in the ethnographies show a clearer association between maize as a major dietary component than wild plants. However, this apparent relation between the Omaha values and maize could be due to bison consumption as well. The wild plants used in this analysis are prairie turnips, jerusalem artichocke, wild raspberries, chockecherries, walnut, and oak.

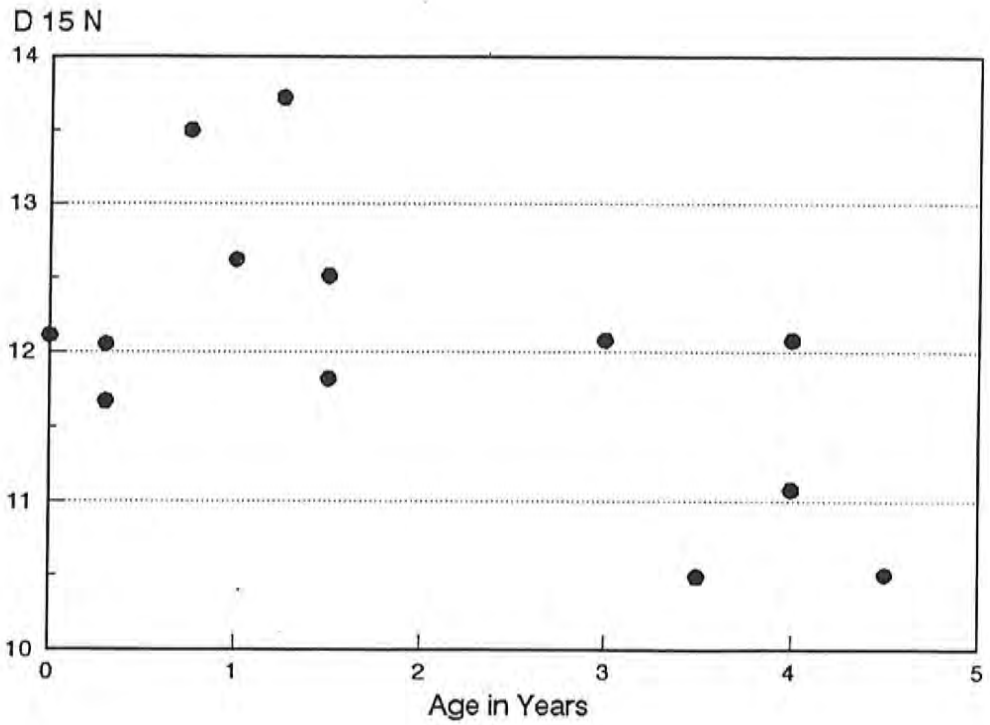

FIGURE 5: Stable nitrogen isotope values vary with the age of infants, depending on nursing and weaning patterns. Because milk is enriched in nitrogen 15 by about 2 parts per mil, a nursing infant incorporates more of this isotope in its bone. Thus, the nitrogen values of nursing infants are higher than newborns. During weaning, the nitrogen isotope ratios of food consumed by infants becomes more normal as the milk diet is replaced by solid foods. Therefore, the delta nitrogen values decline. This allows us to determine how long infants were nursed. In the Omaha case, the nitrogen values tend to increase through the first year and a half of life and than decrease. This suggests that infants were weaned at 1.5 years of age.

(Figure 6). This correlates with the age distributions of Harris lines which reflect childhood peak stress at this age range (Figure 7).

3) In comparison to prehistoric people, the Omaha had shorter lives. The data indicate the women died earlier than men (Figure 8). Early childhood is a period of great susceptibility to health problems as are child-bearing years for females.

4) Infectious disease has been cited as a cause of Omaha cultural decline in the 1800s. Fatal childhood disease is reflected in several multiple burials. For example, six individuals, five babies and one adolescent, were buried in an especially large grave. Because the bodies were not prepared in the same way, and they overlap to a small degree it is clear that they weren't buried at the exact same time. This suggests that the deaths occurred in rapid succession, but not necessarily simultaneously. The face of one child was so thickly covered with red paint, in areas nearly 1 mm thick, that the shape of the bridge of the nose is preserved to this day. The burial pit is abnormally large for an Omaha interment and therefore it was probably excavated in anticipation of several deaths. The adolescent was added to the burial after five babies had already been interred. His association with the other burials indicates that the burial remained open for a period, again indicating the anticipation of more deaths. The infants show significant evidence of disease in the form of multiple Harris lines and cribra orbitalia present in three of four infants. The thick paint applied to one infant may

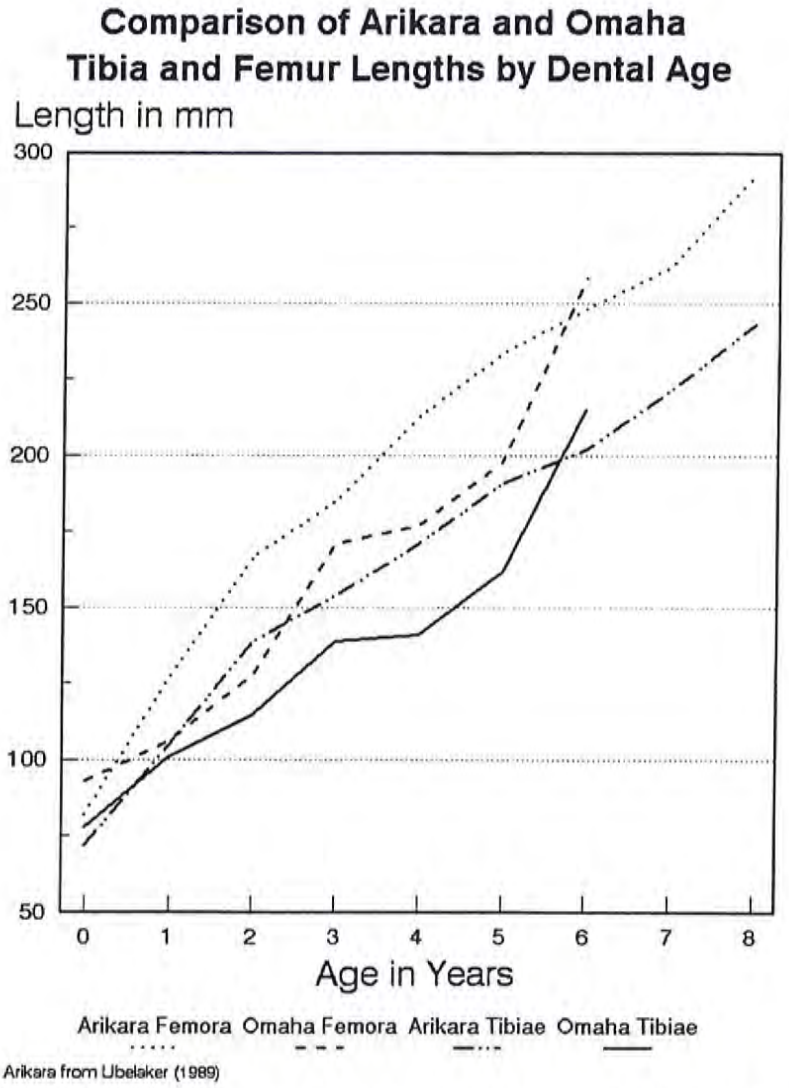

FIGURE 6: Analysis of long bone growth correlated with dental age indicates that although babies were born at the normal size, growth slowed down considerably after weaning and before 4 years of age after which time growth accelerated. Shown here are the Omaha growth data from leg bones compared to historic Arikara data. The decreased growth could be due to poor post-weaning nutrition, infectious disease, or perhaps lead poisoning.

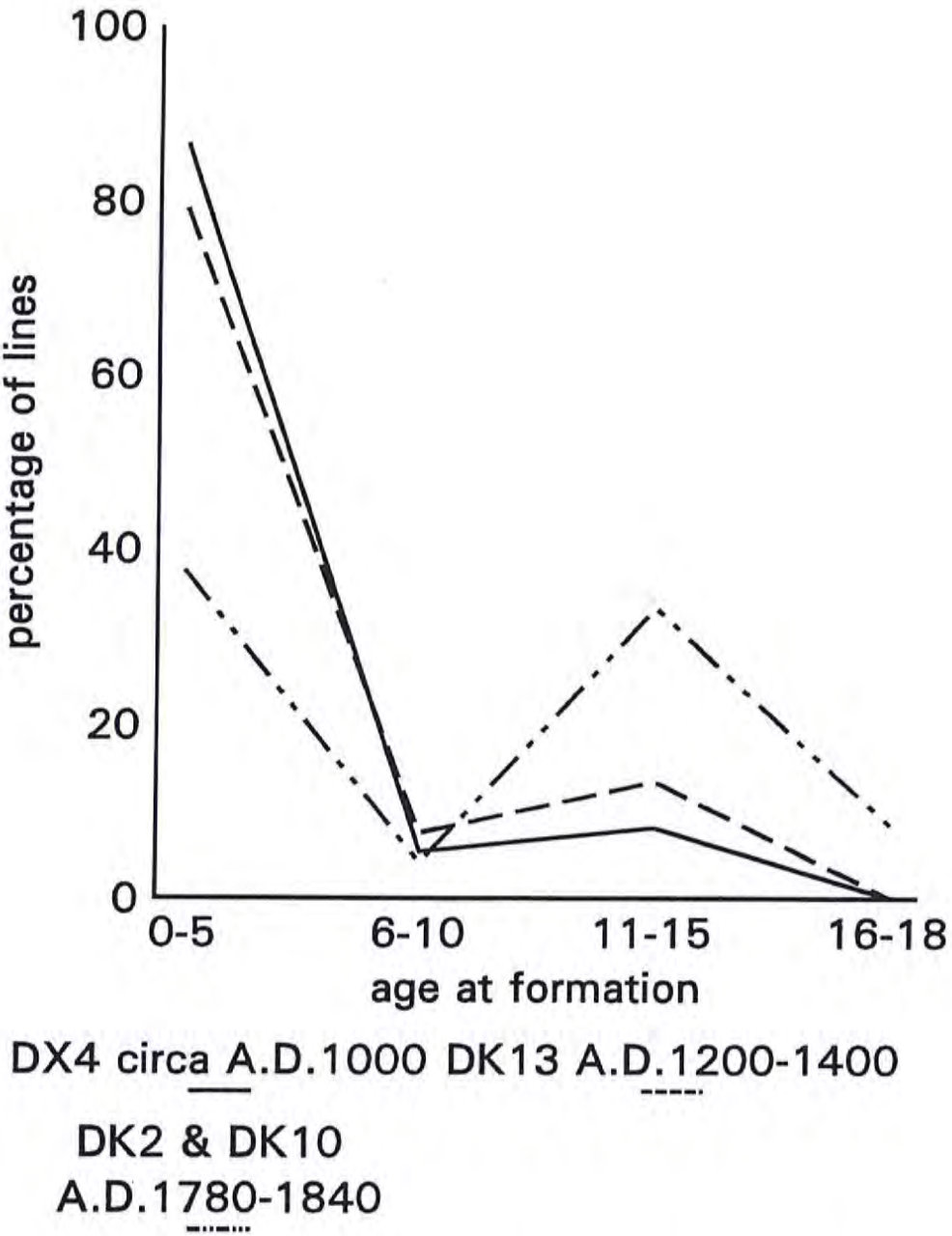

Figure 7: Harris lines form at periods of arrested growth. They provide a record of metabolic stress suffered during development. In comparison to prehistoric peoples from northeastern Nebraska, the Omaha sufferred relatively little metabolic stress. However, there occur two peak periods of stress among the Omaha, one at 0-5 years of age and one at 11-15 years of age. The latter period is evident predominantly among women. The earlier period is typical of both sexes. The 0-5 period corresponds to the time of arrested growth evident from long bone lengths of children.

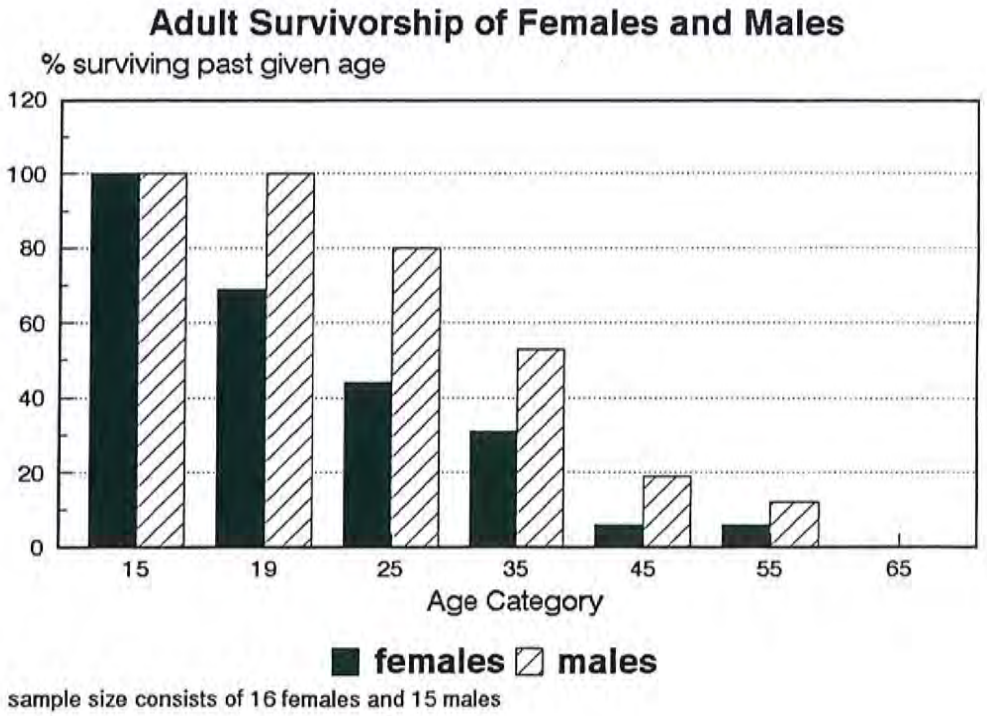

FIGURE 8: Women tended to die earlier than men among the Omaha. As can be seen, mortality increases for women in late teenage years, in part due to compliations of preganancy and trauma due to very rigorous lifestyles. Mortality is greater for women, throughout the later child-bearing years. The closer association of women with the village, and their role in caring for their families, may have resulted in a greater exposure of women to pathogens in comparison to men. It is also clear from analysis of activity patterns that women carried out especially laborous activities that may have further compramised their health.

have special significance. Many Omaha were painted before death, but the application of such a thick layer of paint is unique. Also, the paint is of pure cinnabar, not of the cinnabar-lead pigment applied to the other Omaha. This results in a duller, more lifelike coloration in comparison to the pigment applied to other Omaha. This suggests to me that the application of the pigment was more cosmetic than decorative, an attempt to reconstruct the image of life rather than to enhance that image. The thick application may have been necessary to cover up facial disfigurement. It is possible that the paint was applied to cover the lesions of smallpox, and that this multiple interment represents multiple deaths associated with that disease.

5) One of the most surprising aspects of the study is that trade with Euroamericans exposed the Omaha to toxic lead and mercury compounds (Reinhard and Ghazi 1992). By analyzing lead isotopes in artifacts, pigment and human bone (Brown 1962, Heyl et al. 1974), it is apparent that some of the lead was absorbed before death (Figure 9). Lead could have had a pronounced impact on Omaha morbidity and mortality. This aspect of Euroamerican contact has never been documented before.

6) Analysis of degenerative disease and trauma not related to warfare indicates that the Omaha had a more rigorous lifestyle than prehistoric peoples. This analysis focussed on examination of degenerative disease of the spinal column (Figure 10), appendicular joints, and development of muscle attachments sites throughout the skeleton. Degenerative conditions in males are

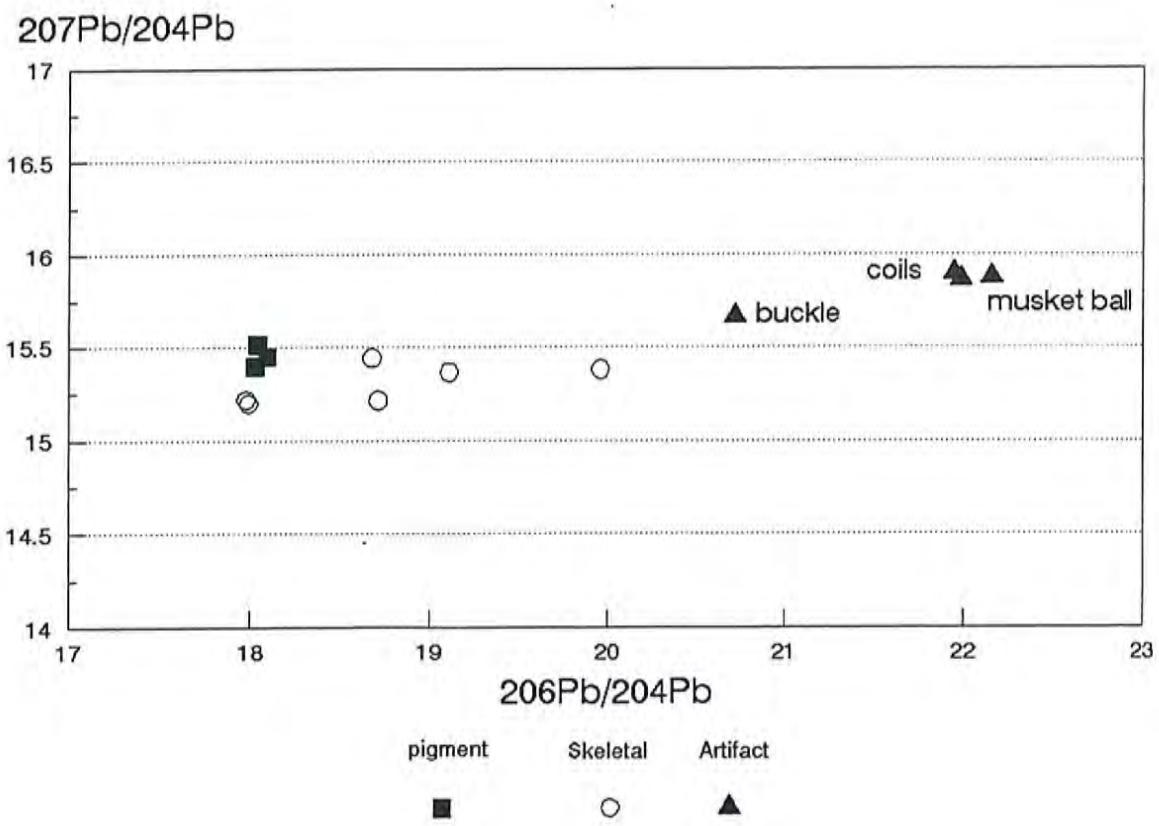

FIGURE 9: The trace elemental analysis of Omaha bones revealed the ubiquitous presence of lead in the 39 skeletons sampled. To evaluate the source of the lead, lead isotope analysis of seven skeletons, several artifacts, and pigment samples adhering to the skeletons was done. Two sources of lead are indicated by the analysis: the artifacts were made with lead from a Mississippi Valley type deposit, and lead from the pigment came from another source. As can be seen, some of the skeletons, which were not buried with lead artifacts, are intermediate between the values. This indicates that lead from both sources was ingested and became incorporated in the bone. Lead poisoning is suggested by the finds.

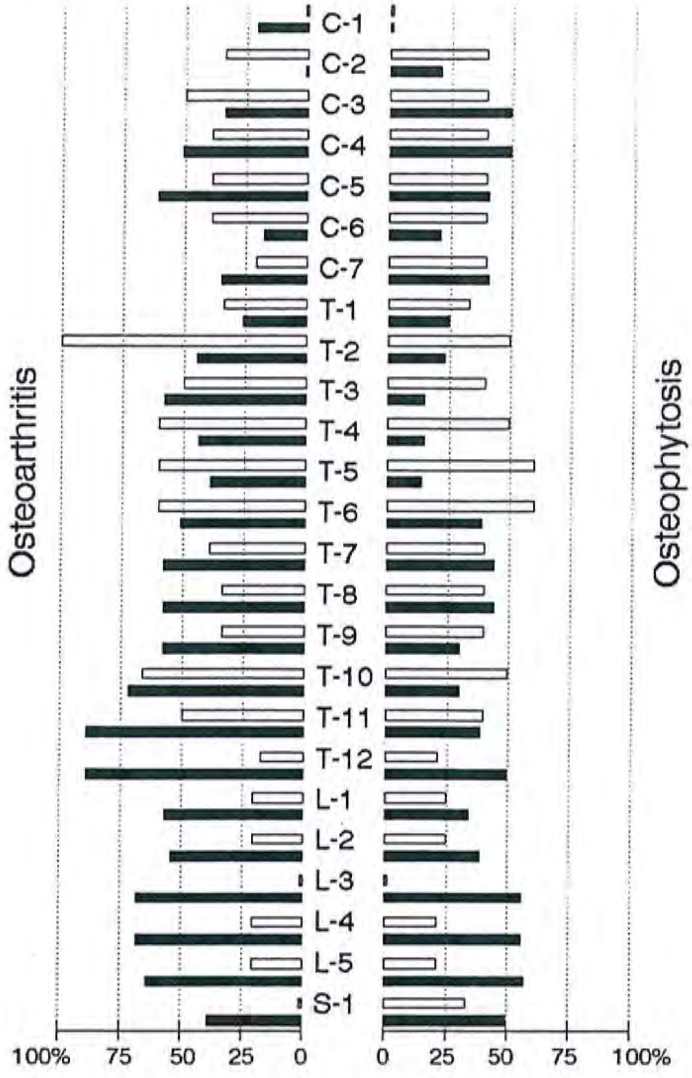

Figure 10: As one aspect of the activity pattern study, vertebral pathology was tabulated for men and women. In these graphs, the frequency of females exhibiting the specified conditions are represented by solid bars and the males are represented by open bars. Osteoarthritis was more common among women and affected the lower back and neck. This pattern is consistent with the use of chest straps for carrying heavy burdens and heavy horticultural work. Men were affected by oateoarthritis and osteophytosis primarily in the middle back, probably due to horse riding.

predominantly related to horseback riding (Miller and Reinhard 1992). Female skeletons exhibit extreme conditions related to agricultural tasks and carrying heavy loads (Reinhard et al. 1992). Strenuous life seems to have played a significant role in adult female mortality. Interestingly, a small percentage of females show signs of horseback riding which indicates that some women were incorporated into the hunts, probably to prepare the meat after the bison were killed.

7) Using artifact associations and skeletal analysis, we were able to reconstruct the individual occupations of many of the adults. For example, one individual may be related to a mention in historical documents. Edwin James (1923) who was among the Omaha in 1819 states:

> . . . an individual of this nation, who is no more, without acquiring any knowledge of white people, as far as we could learn, mended the guns and traps of his countrymen, when not too seriously injured. (James 1923:286)

Buried with one man was a mass of 106 gun parts of many types. These included flints, a complete flint lock pistol, lock plates, top jaws, jaw screws, frizzen springs, mainsprings, tumblers, sears, sear springs, bridles, ram rods, screws for lock works, side plate screws, trigger guards, side plates, ramrod thimbles, a butt plate, and wood screws. These artifacts indicate that he worked with and repaired guns. The find of this man and the mention of an Omaha gunsmith in 1819 seems to be more than coincidence. In all likelihood, this individual is the person mentioned by James and represents Nebraska's first gunsmith, an Omaha. In addition,

he was buried with a knife, bow, arrow shafts, arrow points, arrow shaft wrenches, and arrow shaft smoothers. A stone ball was found with him which I believe was a club head. These indicate that he manufactured other weapons of a more traditional nature.

A variety of other artifacts, many ornamental, were found this man. These included a shell gorget by the right of his head, a brass coil near his left ear, and the remains of what was possibly a felt top hat near his head. The brass coil was worn in the ear, and the shell gorget was a hair ornament. Copper stains on the skeleton indicate that the man wore earrings on both ears. A series of perforated thimbles and brass cones were found around his ankles and along the right lower leg. These were once attached to the man's pants and were "tinklers" such as those worn today by modern Omahas in ceremonials. A medicine bundle was also buried with the man, the remains of which consisted of a drumstick head, reed binding, a whistle mad of bird bone, and cranial parts from a crane and an ivory billed woodpecker. Other objects with the burial include bells, 6,828 beads, a perforated wooden handle from a horse whip, textile fragments, leather fragments, a tobacco pouch, a whetstone, a copper kettle, and a wooden pipestem. The grave in which he was buried was a "log and pole" type (O'Shea and Ludwickson 1992) which is the more elaborate type of grave made by the Omaha. The grave form and artifacts testify to the importance of the man to his village.

The bones provide more information about the man. He was between 40 and 44 years of age and was 173.6 ± 3.8 cm high (about

6'8"). His legs were well muscled and indicate that he frequently rode horses. The legs show especially well developed adductor tubercle, linea aspera and spiral lines in the femur, soleal line on the tibia, and well developed gluteus medius attachment on the os coxae. He has arthritic lipping on all facets of the right calcaneus and cuneiform. These bone changes are consistent with an equestrian lifestyle.

There is evidence that this man suffered serious trauma. His left clavicle was fractured and healed long before he died. In addition, his right ulna and scapula were also fractured and healed. It is likely that these injuries impaired use of this left arm which may have atrophied to some degree. The deltoid tubercle is very large on the right arm but the left arm is relatively gracile with poor development of the deltoid tubercle. The two humeri differ in maximum circumference, 7.5 cm for the right and 7.0 cm for the left. Radiographs of the humeri were not taken, so the relative development of the cortical bone of the upper arms cannot be assessed. Even without the radiographs, these available observations indicate that the left arm was partially crippled.

From these observations of artifacts and bones, it is clear that the man was valued among his people, an aspect of his life that is verified by O'Shea's (1985) analysis of Omaha status. However, at the time of his death, this man probably could not have taken direct part in hunting as easily as other men and women in the tribe. This probably may have been an important part in his earlier life, but the accident that damaged his left arm

undoubtedly impaired his effectiveness. However, his role in the manufacture and repair of weapons was undoubtedly important in maintaining a successful hunt after his injury.

This is one example of many in which we can detail the lives of the Omaha and Ponca by combining bioarchaeological data with artifact analysis. Other occupations that have been identified for other individuals include farmers, burden carriers, warriors, hunters, and a possible shaman.

8) Marriage patterns are evident in the burials. Several lines of evidence indicate that the Omaha were not a genetically homogenous group and that marriage partners came from several exogamous sources: non-Native American populations, closely related tribes such as the Ponca, and more distantly related tribes.

One of the surprising finds was that of a caucasoid female adult as indicated by several aspects of the cranium. These include over-all shape of the skull, dental morphology, shape of the zygomatic arch, and morphology of the nasal aperture. She died between 20 and 25 years of age. Based on dental wear, it is probable that she lived with the Omaha for most of her life. How she came to be incorporated into the Omaha tribe is unknown.

One man was also a non-Omaha. This individual exhibits strong occipital deformation (flattening of the rear portion of the cranium). This was done in infancy through the use of a hard cradleboard. No other Omaha exhibits such pronounced deformation and ethnographic sources indicate that cradle deformation was not practiced by the Omaha. Therefore, it is very likely that this

individual was raised in a different tribe where hard cradleboards were used and cranial deformation was practiced. He then became incorporated into the Omaha tribe at some point in his life.

In the course of completing stable carbon and stable nitrogen isotopic work, further evidence of intermarriage emerged between the Ponca and Omaha. As can be seen in Figure 11, the dietary values for Tonwatonga Omaha and Ponca Fort Ponca have distinct clusters with the exception of four women, two Ponca and two Omaha, whose values fall in the opposite tribes' areas. Although this may be stretching the isotope data to the point of speculation, I think that it is very possible that the isotopic ratios of these women indicate that they were raised with one tribe and married into the other. The ethnographic data indicate that the Omaha and Ponca had a patrilocal residence system. In addition, the ethnographic data indicate that marriage between the Ponca and Omaha did occur. The variability of isotopic values among Omaha and Ponca women can be interpreted in this light.

9) Problems associated with child bearing are present among the Omaha. Three fetuses are present among the skeletons and at least one woman was found with a fetus in her abdominal cavity. This suggests that the stresses of childbearing were severe and affected maternal health and reproductive potential.

10) The dental data indicate that dental attrition was slightly more pronounced among the Omaha than prehistoric people (Figure 12). Females show more wear of the anterior teeth due to female specific activities (Figure 13). Caries (cavities produced

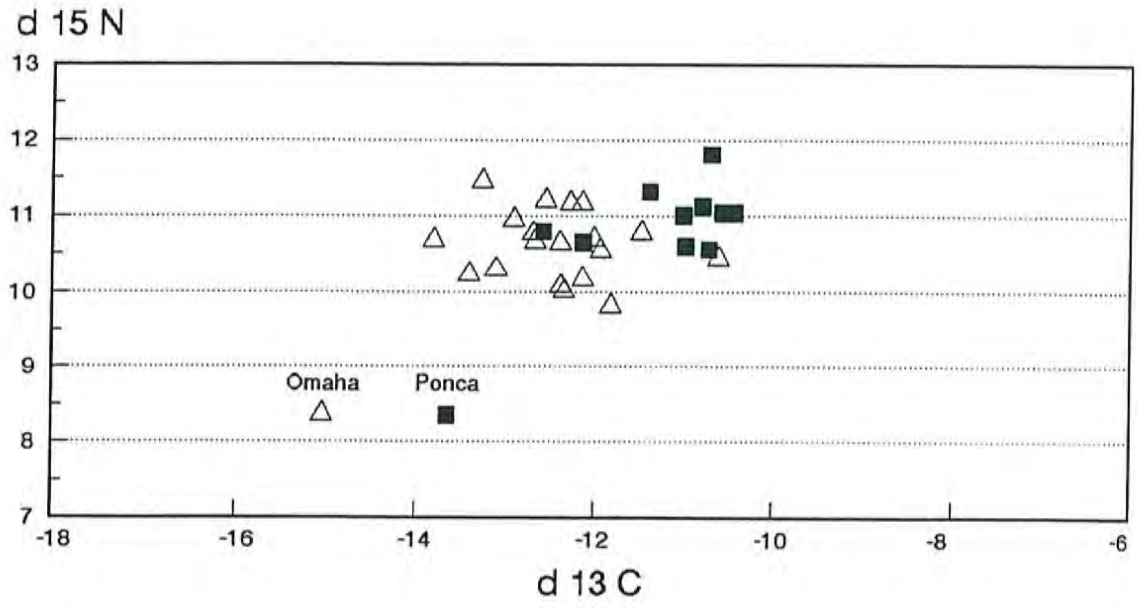

FIGURE 11: Trace element values have been obtained for adults from Ponca Fort and Tonwatonga. The two sets of data form discrete clusters except for two outlyers for each group. These points fall in the cluster of the opposite group (i.e. two Ponca values fall in the Omaha cluster and two Omaha values fall in the Ponca Cluster). All four of these values are from females. The Omaha-Ponca residence pattern was partilocal with females moving to the area of the husband's father. Dorsey (1884) notes that intermarriage between the Ponca and Omaha was a well defined custom and it is possible that the points derived from these women reflect intermarriage between the tribes.

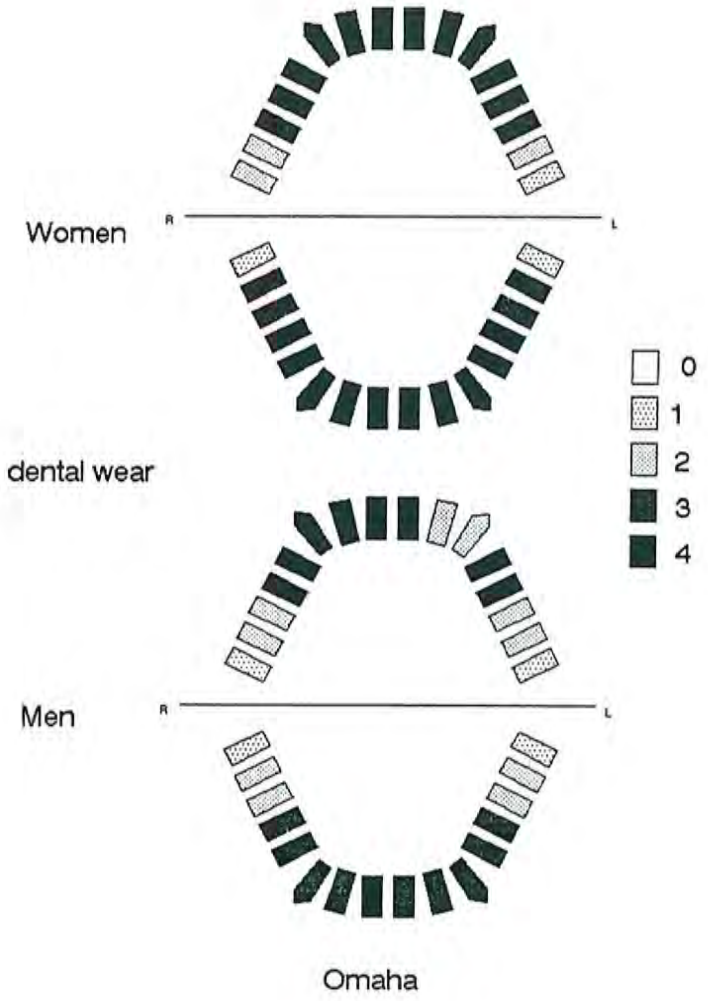

FIGURE 12: Tooth wear was scored and tabulated for all Omaha male and female skulls. A score of 0 indicates no wear, 1 is slight wear of the enamel, 2 indicates initial exposure of dentin, 3 indicates extensive wear of dentin, and 4 indicates complete dentin exposure. The data show that tooth wear was more extreme among women, and examination of the occlusion showed that female front teeth did not occlude as a result of wear. The wear is clearly due to mechanical abrasion of the teeth, perhaps from chewing hides. Fletcher and LaFlesche note that the increase of hunting for the fur trade placed extreme pressure on women who prepared the hides. The tooth wear probably resulted from the preparation of hides for trade.

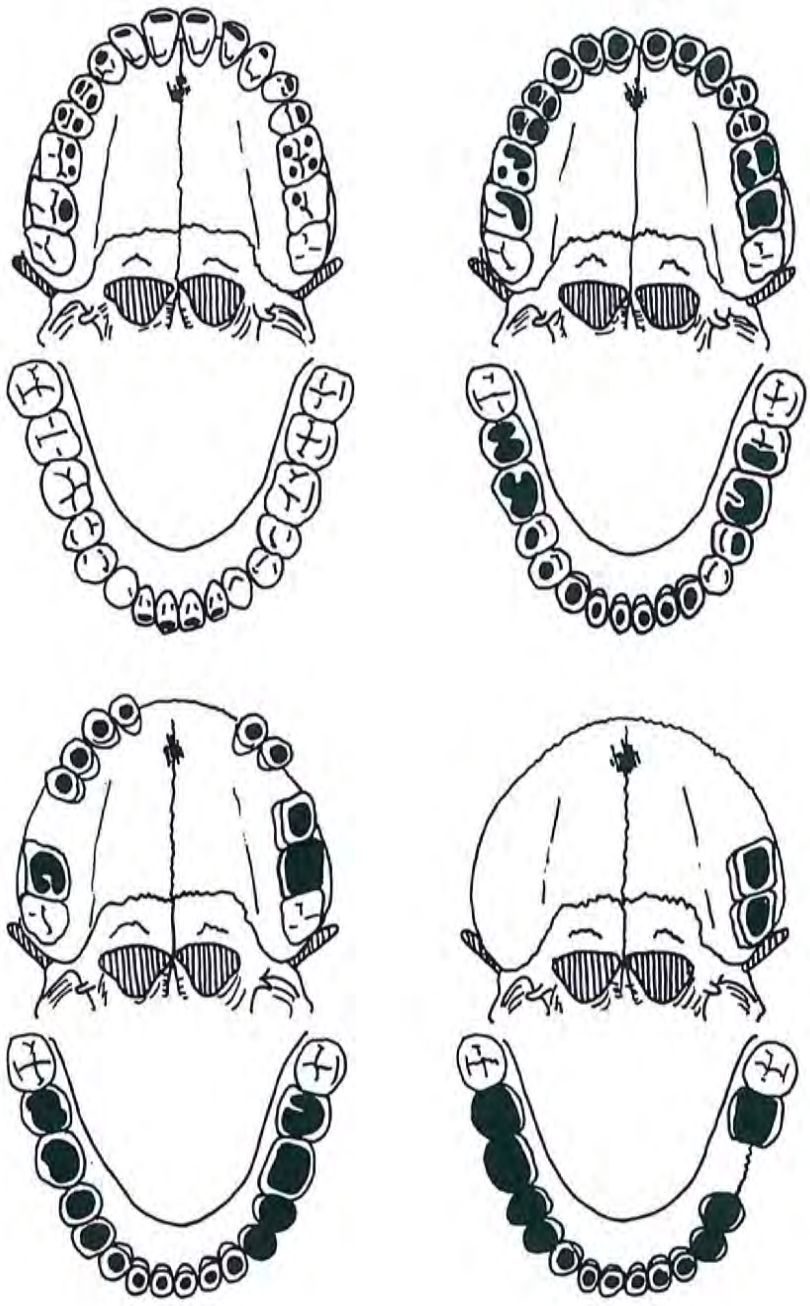

FIGURE 13: Schematic diagram based on analysis of dentition showing generalized wear patterns for Omaha women. The upper right diagram is typical for women in their late teens, the upper left for mid-20s, the lower left for mid-30s, and lower right for women in their 40s.

by bacterial agents) are more common among prehistoric people, probably due to the dietary differences previously noted.

11) Diabetes is related to genetics, diet, and activity. Although analysis of the genetic structure of skeletal populations by study of DNA in bone has recently become possible, the reburial of the skeletons in October precludes such genetic study. However, dietary and activity pattern data were collected. Strenuous lifestyle and relatively high animal protein diet with relatively low plant carbohydrate kept diabetes at a minimal level among historic Omaha. Thus, at this point it appears that the rise in diabetes may be due to decreased activity and increased carbohydrate and sugar in the diet among modern Omaha.

12) The study of cancer, like diabetes, was done at the request of members of the Omaha Tribe. Although benign tumors were present among the Omaha, no evidence of malignant cancer was found.

13) Currently, middle ear infection is the main reason for childhood hospital visits among modern Native Americans. Among the historic Omaha skeletons, one case of severe middle ear infection was found which demonstrates that the disease was not a recent introduction and may have had a role in childhood mortality.

14) Analysis of mummified tissue and preserved clothing has allowed the reconstruction of details of dress and ornamentation. For example, fragments of a leather shirt found with a child revealed aspects of beaded decoration and technique for sewing beads onto leather (Figure 14). The recovery of mummified ears allowed for the reconstruction of ear ornamentation (Figure 15).

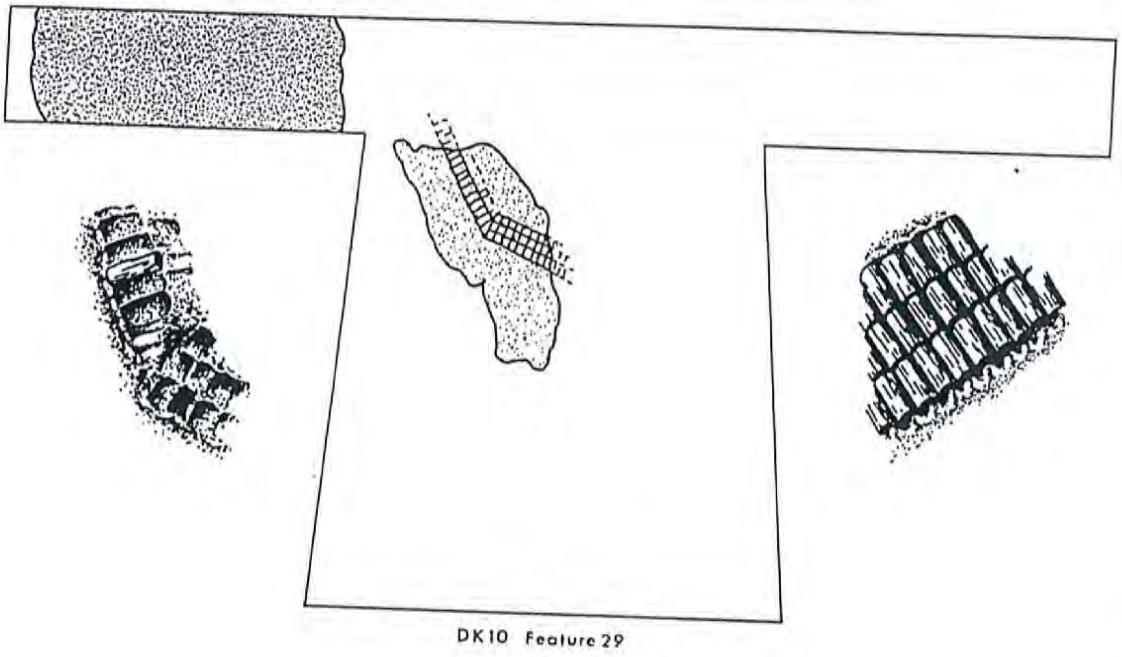

FIGURE 14: Remains of clothing found with the Omaha include felt hats, woven textile fragments, and fragments of leather clothing. In this case, a portion of the sleave and front of a hide shirt was found with a child. The orientation of the front of the shirt was determined by its association with ribs. Sewn to the shirt were beads that left their impressions in the leather (as seen on the left). The impressions of the beads were used to reconstruct the pattern of beads sewn onto the shirt (as seen on the right).

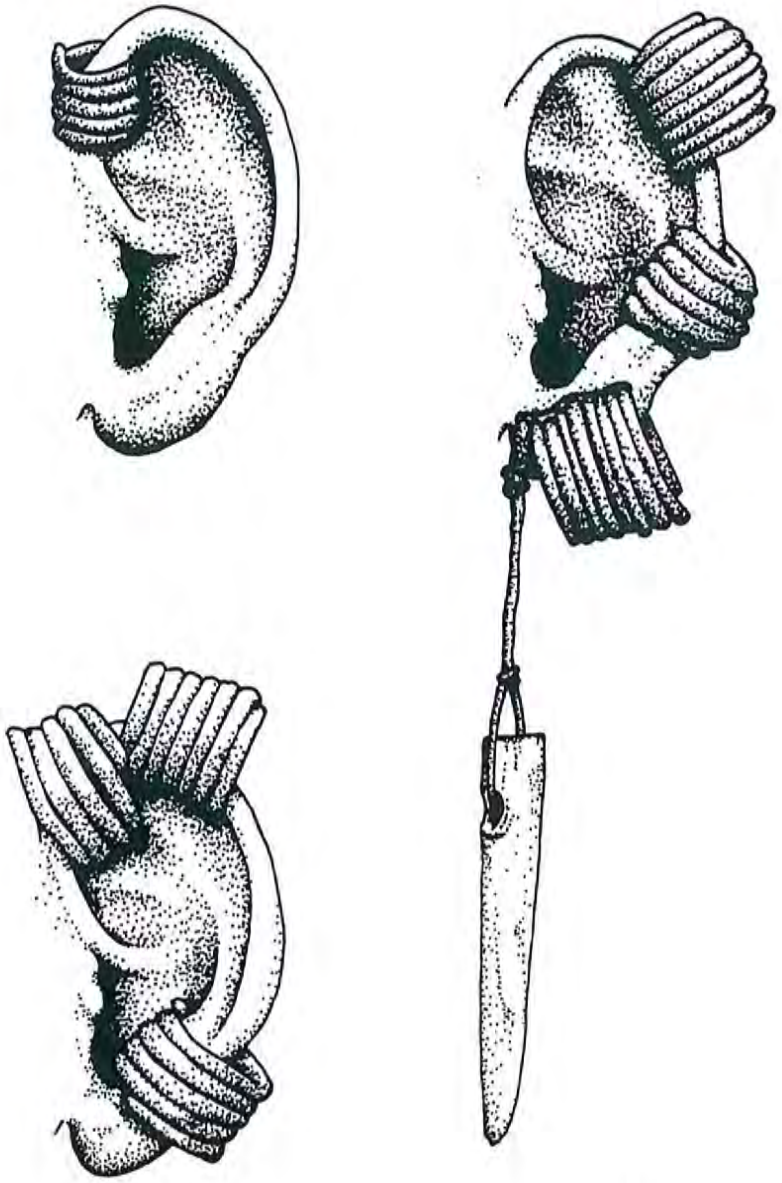

FIGURE 15: Mummified tissue was found with the Omaha and Ponca remains. In some cases this has allowed the reconstruction of ornamentation. In these cases, the pattern of ornaments worn on ears was evident from mummified remains with attached artifacts.

15) A current debate regarding population decline revolves around the issue of warfare. Ludwickson and O'Shea (1992) argue that warfare, not disease, was the leading cause of Omaha population decline. This is in direct opposition to previous documentation of epidemics among the Omaha and Ponca (Trimble 1988). O'Shea and Ludwickson base their warfare conclusion on the presence of four "dismembered" skeletons, an individual who apparently died of a gunshot wound to the chest as evidenced by a musket ball inside the rib cage, and the presence of "trophy skulls" with one Omaha burial. The warfare inference was based on burial documentation without examination of the skeletons for evidence of premortem trauma or postmortem cut marks. The Omaha skeletal analysis included examination for both of these types of data. The "dismembered" skeletons showed evidence of cut marks. However, they did show evidence of copper or brass ornament stains from artifacts originally buried with them (Figure 16). No artifacts were found with the remains which suggests that the bodies were buried following normal Omaha practices, but were subsequently excavated for recovery of artifacts placed with them. Therefore, it is more likely that the bodies were disturbed by vandals with the bones being returned to burial pits. The individual that was shot in the chest shows no traumatic alteration of any bones of the thoracic cavity. Other artifacts, including a lead ornament, were found in the chest cavity. It is likely that decomposition of the chest resulted in artifacts from the surrounding soil settling into the thoracic cavity. Thus, the

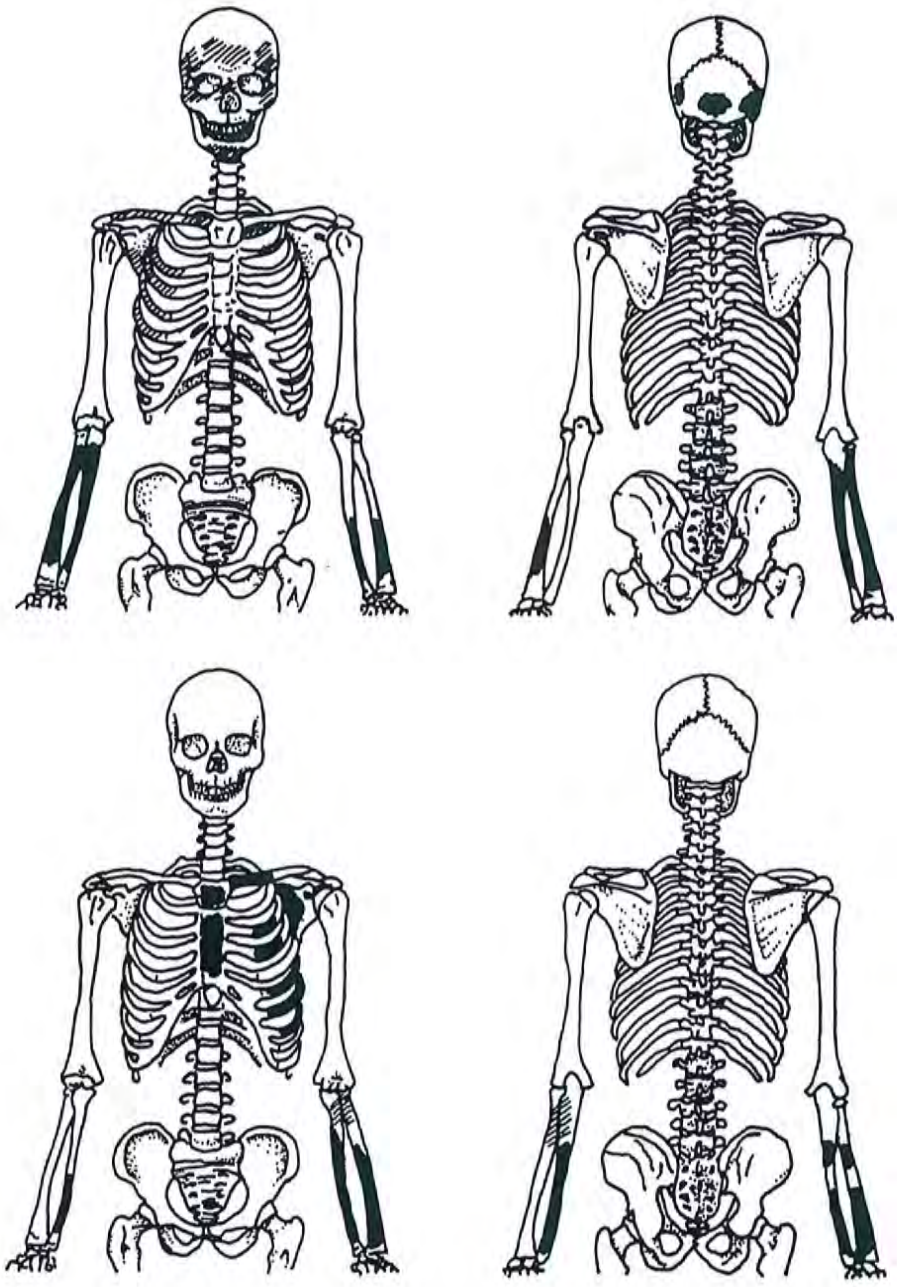

FIGURE 16: Distribution of stains on two skeletons noted by O'Shea and Ludwickson (1992) as disarticulated war dead. The black areas indicate green stain left by brass or copper artifacts. The hatched area indicates distribution of red paint. No cut marks were present on either skeleton. The distribution of green stains indicates that at one time the corpses were buried in an articulated way. The fact that they were found without artifacts and disarticulated indiates post-burial disturbance, probably by looters.

gunshot wound is probably a fortuitous association of a musket ball and skeleton. Finally, the "trophy" skulls found with one burial are craniometrically consistent with Omaha/Ponca skulls. Other burials show that skulls were sometimes placed with specific individuals. Because none of these skulls show trauma or postmortem modification, it is unlikely that their association with extended burials is due to trophy taking or other warlike activity. Therefore, based on the examination of the skeletal remains in context with artifacts and other data, none of the burials cited by O'Shea and Ludwickson (1992) can be definitely associated with warfare.

Beyond these specific examples, the Omaha analysis has provided information regarding dress, adornment, age of menarche and marriage, patterns of activity for men, women and children, dental health, status, and health impacts of euroamerican contact.

APPENDIX C

BACKGROUND TO THE COLLECTIONS

The preservation of bone and artifacts in the cemeteries was excellent. The soil matrix is composed of a fine grained, well drained, yellow loess and preservation of bone in this soil was ideal, and even mummified tissue was recovered. Unfortunately, some Omaha burials were disturbed by secondary intrusive burials, excavations by looters, and burrowing animals before archaeological excavations commenced. Often, the Omaha dug burial pits into already established Omaha graves resulting in disturbance of previous burials and mixing of bone. Single burials and multiple burials are present in the Omaha cemeteries. Single burials, with the body supine, are present, but multiple burials are more common. Up to six people of all ages shared the same burial pit. A few burials consist of a limited amount of bone, not anatomically arranged. Some of the bone from such burials exhibits breakage and tooth marks from scavenger activity. The finding of these incomplete skeletons may be explained, at least in part, by the Plains practice of placing the deceased on a scaffold above the ground for a time and then transferring the remains to a burial pit. During the period of scaffolding, decomposition takes place and scavengers have access to the remains. This leaves a partial skeleton for burial. These practices, plus animal disturbance and vandalism, resulted in the extensive mixing of skeletons which are now sorted by individual.

After their excavation in 1940, the artifacts and bones were brought to the osteology laboratory at the University of Nebraska - Lincoln for preservation. It does not appear that preservative was applied to the artifacts or skeletons. Wooden arrowshafts, whip handles, bowls, and other utensils were sufficiently preserved not to need applications of preservatives. However, acetate sheets were occasionally used to hold delicate or fragmentary cranial bones together, especially of infants, neonates and fetal individuals. Glass plates held together with acetate were used to store delicate textile and vegetal remains. Each artifact and bone was labelled and inventoried before storage. Considering that the excavations occurred in 1937-1941, it is a testimony to the archaeologists and curators of that time that the remains are in such good condition at the time of this writing.

The bones and artifacts survived several moves as the Department of Anthropology shifted location within the University since 1940. To determine whether or not artifacts and bones had been lost during the moves, the 1941 inventories of the artifacts and bones were compared to the present collections. No artifacts had been lost. No complete burials had been lost. However, a few burials now have missing elements that were present in 1941. I suspect that these were lost as the skeletons were used as instructional aids for osteology classes over the past few decades. This loss was minor and the skeletal collections are at least 95% intact.

Considering the care taken in the excavation, storage, and curation of the collections, there is remarkable information potential in the artifactual and skeletal remains. My approach to the Omaha analysis was the correlation of artifact and bioarchaeological data to gain insight into details of individual lives. One major problem was relating artifacts to burial provenience. This was eventually accomplished by examination of field photographs, maps, notes, and correlating artifact numbers with burial numbers. Once accomplished, correlating activity pattern data based on bioarchaeological analysis of skeletons with artifact distributions has allowed reconstruction of individual occupations and lifestyles within the tribe. Casts of beadwork taken in the field, and orientation of ornaments on the skeletons has allowed the reconstruction of aspects of dress and ornamentation. Present with the burials are the remains of sacred "medicine bundles" that provide insights into the nature of Omaha mythology 200 years ago in comparison to modern times. These aspects of the analysis, ornamentation and mythology, are of particular interest to the Omaha Tribe and will be explored.

The excavation of the village areas provides significant information regarding the construction and nature of living quarters as well as trash deposition patterns, and food storage. These have been describe for Tonwatonga by O'Shea and Ludwickson (1992) and by Wood (1960) for Ponca Fort. Sampling of features related to these activities did not include pollen, macrofloral,

or chemical analysis procedures since these techniques were not fully developed at the time of excavation.

APPENDIX D

CURRICULUM VITAE OF RESEARCHERS

ABREVIATED CURRICULUM VITAE: Karl J. Reinhard

Assistant Professor
Department of Anthropology
126 Bessey Hall
University of Nebraska-Lincoln
Lincoln, NE 68588-0368
(402) 472-6858

EDUCATION

Ph.D., Texas A & M University. 1988. Anthropology.
M.S., Northern Arizona University. 1984. Biology.
B.A., University of Arizona. 1977. Anthropology.

EMPLOYMENT

Assistant Professor, Department of Anthropology, University of Nebraska - Lincoln, 1989-pres.

RESEARCH

Bioarchaeology
Paleoethnobotany and ethnobotany
Osseous indicators of nutritional stress.
Archaeology of historic Omaha Plains tribes

PROFESSIONAL ORGANIZATIONS

Sigma Xi
American Association of Physical Anthropologists
Society of Ethnobiology
Paleopathology Association
International Association of Wood Anatomists

5 RESEARCH PUBLICATIONS MOST RELEVANT TO PROPOSAL

Reinhard, KJ and AM Ghazi (1992) Evaluation of Lead Concentrations in Nebraska Skeletons Using ICP-MS. American Journal of Physical Anthropology 89:183-196.

Sandness, KL and KJ Reinhard (1992) Vertebral pathology in prehistoric and historic skeletons from northeast Nebraska. Plains Anthropologist (in press).

Owsley, DW, RW Mann, and KJ Reinhard (1992) Otological Infection and Tumor in Two Native American Children. In (DW Owsley, and RW Mann eds.) Skeletal Biology in the Great Plains: A Multi-disciplinary Approach. Washington, D.C.: Smithsonian Institution Press.

Reinhard, KJ (1992) The impact of diet and parasitism on anemia in the prehistoric Southwest. In (P Stuart-McAdam and S Kent eds.) Diet, Demography and Disease: Changing Perspectives of Anemia, New York: Aldine Press (in press).

Reinhard, KJ, SV Barnum, LM Beiningen, AM Ghazi, CE Miewald, E Miller KL Sandness, and LL Tieszen (1993) Fur trade and female health: evidence from northeast Nebraska. In (CS Larsen and GR Milner eds.) The Frontiers of Biocutural Adaptation. New York: Wiley-Liss (in press).

5 OTHER SIGNIFICANT PUBLICATIONS

Reinhard KJ, PR Geib, MM Callahan, and RH Hevly (1992) Discovery of colon contents in a skeletonized burial: soil sampling for dietary remains. Journal of Archaeological Research 19: (in press).

Reinhard, KJ and VM Bryant, Jr. (1992) Coprolite analysis: a biological perspective on archeology. In (MB Schiffer ed.) Advances in Archaeological Method and Theory 4. Tucson: University of Arizona Press. pp. 245-288.

Reinhard, KJ, DL Hamilton, and RH Hevly (1991) Use of pollen concentrations in paleopharmacology: coprolite evidence of medicinal plants. Journal of Ethnobiology 11:117-134.

Reinhard, KJ (1992) Parasitology as an interpretive tool in archaeology. American Antiquity 57:231-245.

Reinhard, KJ (1990) Archaeoparasitology in North America. American Journal of Physical Anthropology 82:145-162.

PROFESSIONAL PRESENTATIONS

45 papers presented at regional, national, and international meetings in the U.S. and Europe.

SYMPOSIA AND COLLOQUIA

Six presented at English, Peruvian, and U.S. institutions or professional meetings.

STEVEN R. HOLEN

HOME ADDRESS:
(b) (6)

OFFICE:
Department of Anthropology
126 Bessey Hall
University of Nebraska
Lincoln, NE 68588-0368
(402) 472-8902

EDUCATION:

High School Diploma, 1967, from Overton Public School; Regents Scholarship to the University of Nebraska.

Bachelor of Arts Degree, 1975, University of Nebraska, Major: Anthropology; Minors: History and English

Master of Arts Degree, 1983, University of Nebraska, Major: Anthropology.

Ph.D. Candidate: University of Kansas Anthropology Department, Degree expected: May 1993.

PROFESSIONAL PAPERS PRESENTED: (26 presented at Regional and National conferences).

PUBLICATIONS:

1980 Cultural Resource Survey of the New Niobrara State Park, Niobrara, Nebraska, Nebraska State Historical Society, Lincoln, Nebraska.

1985 A Chronology of Holocene Erosion and Sedimentation in the South Loup Valley, Nebraska. Geographical Perspectives No. 56 (with David May).

1989 Anthropology: The Native American Occupation of the Sandhills. In: An Atlas of the Sandhills; Resource Atlas No. 5. Edited by A. Bleed and C. Flowerday, Conservation and Survey Division, University of Nebraska-Lincoln.

1991 Bison Hunting Territories and Lithic Acquisition Among the Pawnee: An Ethnohistoric and Archaeological Study. In: (A. Montet-White and S. Holen, eds.) Raw Material Economies Among Prehistoric Hunter-Gatherers. University of Kansas, Publications in Anthropology 19. Lawrence, Kansas.

1992 (with R. Hoard, M. Glascock, H. Neff, and J.M. Elam) Neutron Activation of Stone From the Chadron Formation and a Clovis Site on the Great Plains. Journal of Archaeological Science (Final Draft Accepted for Publication).

1992 (with David May) Radiocarbon Ages of Sols and Charcoal in Late-Wisconsinian Loess in Southcentral Nebraska. Quaternary Research (Final Draft Accepted for Publication).

1992 (with William Ranney) A Cultural Resource Inventory Survey (Level III) of the Middle Bordeaux Timber Area, Nebraska National Forest, Dawes County, Nebraska. Report Submitted to the USDA Forest Service, Chadron, Nebraska.

CURRICULUM VITAE

August 1992

Shelley Dianne Burgess

Born:
(b) (6)

Social Security No.:
(b) (6)

Education:

9/86 to Present	Graduate student working towards a PhD in Anthropology (Paleopathology major). Expected completion in December 1992 Department of Anthropology, University of Chicago, Chicago, Il.

Oral Exam: Passed 1989.
Spanish Language Exam: High pass 1989
Proposal: Accepted, 1990
Admission to Candidacy for PhD: 1990.

Committee: Dr. Jane E. Buikstra, Dr. Russel H.Tuttle, Dr. Alan Kolata, Dr. Karl Reinhard

PhD Title: Chiribayan skeletal pathology on the south coast of Peru: Patterns of production and consumption.

Anticipated date of completion of dissertation is December 1992.

6/1989 MA in Anthropology
University of Chicago
Chicago, Illinois, U.S.

5/1986 HBA in Anthropology
University of Western Ontario
London, Ontario, Canada

6/1978 Nursing Diploma
Fanshawe College
London, Ontario, Canada

Awards:

1991	Department of Anthropology Stipend, University of Chicago
1990	Department of Anthropology Stipend, University of Chicago
1989	Department of Anthropology Stipend, University of Chicago
1989	Center for Latin American Studies Travel Grant
1988	Department of Anthropology Stipend, University of Chicago
1986 to 1991	Century Scholarship, University of Chicago
1986	University of Western Ontario Gold Medal in Anthropology
1986	National Science and Engineering Research Council of Canada Fellowship (Declined award in order to attend the University of Chicago).
1986	Award in Anthropology, University of Western Ontario
1985	Award in Anthropology, University of Western Ontario

1984	Award in Anthropology, University of Western Ontario
1976	Ontario Sholarship. Central Huron Secondary School
1971	General Proficiency Award. Holmesville Public School

Academic Employment:

1991/1992	Teaching Fellow in Human Morphology, Department of Organismal Biology and Human Anatomy, University of Chicago
1991	Teaching Assistant in Paleopathology, Department of Anthropology, University of Chicago
1990/1992	Research Assistant to Prof. Jane E. Buikstra, Deptartment of Anthropology, University of Chicago
1990/1991	Teaching Fellow in Human Morphology, Department of Organismal Biology and Human Anatomy, University of Chicago
1989	Lab Director, University of Chicago Archaeological Field School, Kampsville, Il.
1989	Course Assistant in Apes and Human Evolution,Department of Anthropology, University of Chicago
1989	Teaching Assistant in Osteology, Department of Anthropology, University of Chicago
1989	Teaching Assistant in Gross Anatomy, Department of Anatomy, University of Chicago
1988	Teaching Assistant in Osteology, Department of Anthropology, University of Chicago
1988/1989	Teaching Assistant in Gross Anatomy, Department of Anatomy, University of Chicago
1987	Teaching Assistant in Osteology, Department of Anthropology, University of Chicago

Lectures:

1992	The Role of Paleopathology and Paleonutritional Studies in Anthropology. April 2, 1992. Loyola University, Chicago.
1991	Cemeterio y Osteologia Humana. Aug. 9, 1991 for the "Segundo Curso de Defensa del Patrimonio Cultural Especializado Para la Policia Nacional del Peru." in Moquegua, Peru.
1991	The Microstructure of Bone, Feb. 13 1991. University of Chicago.
1989	Bone as Tissue, Nov.2, 1989. University of Chicago.
1989	The Developmental and Remodelling of Bone, July 28, 1989. University of Chicago.
1989	Bone Remodelling and Microstructure, Jan. 26, 1989. University of Chicago.
1987	Bone Growth and Development, Nov. 23, 1987. University of Chicago.

Papers Presented:

1992	Health at Algodonal: A Preliminary Report. Paper Presented at the Society for American Archaeology Annual Meeting, Pittsburgh, PA, April 1992.
1992	Patterns of Anemia in Three Late Intermediate Period Populations from the South Coast of Peru. Paper presented at the Midwest Conference on Andean and Amazonian Archaeology and Ethnohistory, Urbana-Champaign, IL, March 1992.
1991	Patterns of Anemia in Chiribaya Populations: Variation by Location. Paper presented at the American Anthropological Association Annual Meeting, Chicago, IL, November 1991.

Publications:

1992	"La salud en los Andes precolombinos." Suplemento Especial de Cobre No. 1, pp. 15-17.
in press	Patterns of Anemia and Dental Caries in Chiribaya Populations: Variation by Location. Osmore Mortuary Studies, edited by Jane Buikstra and Sloan Williams.

Employment:

1978 to 1988	Registered Nurse in Neonatal Intensive Care Unit. Duties included being a Staff nurse, Charge Nurse, Team Leader, Admission Nurse and Special Prodedures Nurse.

Field Experience:

1992	Dickson Mounds Recordation Project with the Illinois State Museum in Lewistown, IL., analysis of paleopathology , June 17, 1992 to July 17, 1992.
1991	Proyecto Chiribaya, June 25, 1991 to Sept. 18, 1991, Ilo, Peru.
1990	Proyecto Chiribaya, Jan. 16, 1990 to April 23, 1990, Ilo, Peru.
1990	Proyecto Chiribaya, June 21, 1990 to Sept. 23, 1990, Ilo, Peru.
1989	University of Chicago Archaeological Field School; the Bullseye site in Illinois.
1988	University of Chicago Archaeological Field School; the Bullseye site in Illinois.
1984	Field Course, University of Western Ontario, the Lawson site in London, Ontario.

Positions Held:

1985 to 1986	President of the University of Western Ontario's Student Anthropology Association
1984 to 1985	Council Member, University of Western Ontario's Student Anthropology Association
1976 to 1978	Treasurer, Class of 78, Fanshawe College

Membership in Professional Societies:

1991 to present	American Anthropological Association
1986 to Present	Paleopathology Association
1986 to Present	American Association of Physical Anthropologists

Areas of Primary Interest:

Paleopathology, Skeletal Biology, Andean Prehistory, Paleonutrition, Hominid Ev olution, North American Prehistory, Human Gross Anatomy

ELIZABETH ANN MILLER

Home Address:
(b) (6)

Office Address:
Dept. of Anthropology
Arizona State University
Tempe, AZ 85287-2402
(602)965-6213

EDUCATION:

Ph.D. student, Department of Anthropology, Arizona State University, under Dr. C. Merbs. Tentative graduation date 1993. GPR 4.0

M.A. Anthropology, under Dr. D. Gentry Steele, Department of Anthropology. 1989. Texas A&M University, College Station, Texas. GPR 3.92 Thesis: Effect of European Contact on the Health of Indigenous Populations of Texas.

B.S. Geology, minors in Biology and Anthropology. May 1985. Texas A&M University, College Station, Texas. GPR 2.9.

DISSERTATION:

European Contact and Health: A Paleopathological Approach to Contact Studies in North America.

CURRENT PROJECTS:

The effect of European contact on the health of indigenous peoples of Nebraska, and a comparison with similar studies in Texas, Georgia, Florida, and California.

The effect of horseback riding on the human skeleton, with special reference to the Omaha and Ponca.

Description of rheumatoid arthritis and avascular necrosis in dry bone, using macerated hospital specimens.

PUBLICATIONS:

Miller E. Ragsdale BD and Ortner DJ (1992) Can specific diseases be diagnosed from dry bones? A comment on current paleopathological goals (in preparation).

Miller E. Stout K and Turner, CG II (1992) Antemortem tooth loss and dental chipping among prehistoric Aleuts and Kodiak Islanders, Alaska. In Richard Knecht (ed.): Festschrift fur Williams S. Laughlin (in preparation).

Miller E (1992) The effect of European contact on the health of indigenous populations in Texas, and a comparison across Southern North America. In L. Kealhofer and B. Baker (eds.): Disease and Demographic Collapse in the Spanish Borderlands (in press).

Miller E (1989) Appendix I, 41HL66 Skeletal Analysis. In "Archaeological Investigations at the Kent Creek Site (41HL66): Evidence of Mogollon Influence on the Southern Plains" Jimmy Brett Cruse. Masters Thesis, on file at Texas A&M University.

PAPERS PRESENTED AT PROFESSIONAL MEETINGS: (13 presented at Regional, National and International meetings.)

RESUME

Dennis Hastings

(b) (6)

BIOGRAPHICAL DATA:

(b) (6)

Tribal Affiliation: Enrolled member of the Omaha Tribe
Marital Status: Single Parent with Two Children
Military Service: Honorable Discharge - U.S. Marine Corp

EDUCATION:

* Master's Candidate, Applied Anthropology, Western Institute for Social Research, Berkeley, CA.

* B.A., Applied Anthropology - 1975, University Without Walls, Berkeley, CA.

* High School Diploma - 1968, Flandreau Indian School, Flandreau, SD.

* Grade School - 1964, Wapheton Indian School, Wapheton, ND.

PROFESSIONAL EMPLOYMENT RECORD:

* Director, Department of Interior "638 Contracts", Aid To Tribal Governments, Omaha Tribe, 1980-88.

* Social Services Investigator, San Francisco Indian Center, 1977-80.

* Program Director, Social Services, San Francisco Indian Center, 1976-77.

* Coordinator of Native American Program, Core Faculty, University Without Walls, Berkeley, CA, 1975.

PROFESSIONALLY RELATED ACTIVITIES:

* Founder and Project Director, Omaha Tribal Historical Project, Inc., 1974-Present.

* Trustee, Nebraska State Historical Society Foundation, 1989-91.

* Member, Board of Education, Public School District #16, Macy, NE, 1986-90.

* Researcher, Susan Picotte Center, Walthill, NE, 1986-Present.

* Member, Northeastern Nebraska Tourist Assn, 1986-Present.

* Governor's Appointee, "Blood Run Advisory Committee", 1987-Present.

* Member, Nebraska State Historical Society, 1986-87.

* Member, Board of Directors, Native American Human Services, Inc., Omaha, NE, 1991-Present.

* Member, Omaha Tribal Economic Development Authority, 1982-84.

* Member, Common Ground, Thurston County, 1986-Present.

* Member, Board of Directors, Butte County Indian Assn, Chico, CA, 1977-80.

* Member, Native American Church, Macy, NE, 1981-88.

* Member, Omaha Tribal Hethushka Society, 1984-87.

PROFESSIONAL AWARDS:

* Certificate of Award, presented by the Pawnee Tribe of Oklahoma, in recognition of assistance and support leading to the enactment of the Nebraska Unmarked Burial Sites and Skeletal Remains Protection Act (LB 340), 1989.

* Statement of Commendation for work on behalf of Omaha tribal research, presented by the Omaha Tribal Historical Project, Inc., Board of Directors, 1989.

APPENDIX E

LETTER OF INTEREST FROM UNIVERSITY OF NEBRASKA PRESS

University of Nebraska
Lincoln

University of Nebraska Press
327 Nebraska Hall
901 North 17th Street
Lincoln, NE 68588-0520
Telephone: (402) 472-3581
FAX: (402) 472-6214

September 18, 1992

Professor Karl J. Reinhard
Department of Anthropology
126 Bessey Hall
City Campus
University of Nebraska
Lincoln, NE 68588-0368

Dear Professor Reinhard:

I have read with great satisfaction your proposals for four volumes on the culture and history of the Omaha and Ponca tribes in the context of Euroamerican contact. The proposal is already rich. I'm confident the finished volumes will be invaluable.

Permit me to compliment you for two points in particular, both of which intensify my interest in publishing the forthcoming works. First, I commend the collaboration achieved between you and the descendants of the two tribes. They will be as interested in your work as any anthropologist and will be at least as eager to see the work done well. Your work is being built on a foundation of trust and candor that exemplifies the highest ideals of the academic community.

Second, I applaud your decision to direct your research to both professional and lay audiences by preparing different books targeted to different needs and expectations. By addressing both audiences yourself you reduce the risk of having your work misunderstood by amateurs and popularizers. More important, you will accelerate the transmission of the research to the broader group of historians, ethnologists, geographers, and intelligent citizens eager to know more about these remarkable tribes. As you know well, interest in your subject increases every year.

You will find the University of Nebraska Press pleased to welcome your manuscripts.

Respectfully,

Willis G. Regier
Director
UNIVERITY OF NEBRASKA PRESS

INTERPRETIVE STUDY OF PONCA AND

OMAHA HISTORIC ARCAHELOGY: 1775-1820

BUDGET

Salary

Reinhard, summer salary for 1993	(b) (6)
Reinhard, summer salary for 1994	
Hastings, summer salary for 1993	
Hastings, summer salary for 1994	
Burgess, salary for January 1993 through May of 1994	
Holen, 1/2 time salary for Jan 1993 - May 1994	
Miller, salary for summer of 1993	
Miller, salary for fall of 1993	
Secretarial support, Jan 1993-May 1993, 1/8 time	1,090.00
Secretarial support, May 1993-May 1994, 1/4 time	5,232.00
Student illustrator from Jan 1993-Jan 1994, 1/2 time	10,000.00
Student assistant from Jan 1993-Jan 1994, 1/2 time	10,000.00
Total Salaries	141,138.00
Benefits at 23.5%	33,167.00
Total Salaries and Benefits	174,305.00

Equipment

Quadra 950, computer	6,375.00
keyboard	151.00
monitor	1,108.00
Laser Writer IIG printer	3,187.00
Connectors	60.00

One Scanner	900.00
Total	11,781.00
Expenses	
Xeroxing	500.00
Telephone expenses	1,200.00
Travel for consultation with Hastings	400.00
Total	2,100.00
Total Salaries, benefits, equipment and expenses	188,186.00
Indirect costs 40.5% of total minus equipment	76,215.00
Grand total	264,401.00
Matching	
Reinhard, two course release time for spring 1993	$16,451.00
Reinhard, two course release time for 1994-1995	18,096.00
total matching salary	34,547.00
benefits (23.5%)	8,119.00
indirect (40.5% of total)	17,280.00
total matching	59,946.00

OMB No. 3136-0129
Expires 11/30/93

National Endowment for the Humanities

BUDGET FORM

Project Director	If this is a revised budget, indicate the NEH application/grant number:
Karl J. Reinhard	
Applicant Organization Department of Anthropology University of Nebraska-Lincoln	Requested Grant Period From 1/1/93 (mo/yr) to 12/31/94 (mo/yr)

The three-column budget has been developed for the convenience of those applicants who wish to identify the project costs that will be charged to NEH funds and those that will be cost shared. FOR NEH PURPOSES, THE ONLY COLUMN THAT NEEDS TO BE COMPLETED IS COLUMN C. The method of cost computation should clearly indicate how the total charge for each budget item was determined. If more space is needed for any budget category, please follow the budget format on a separate sheet of paper.

When the requested grant period is eighteen months or longer, separate budgets for each twelve-month period of the project must be developed on duplicated copies of the budget form.

SECTION A — budget detail for the period from 1/1/93 (mo/yr) to 12/31/94 (mo/yr)

1. Salaries and Wages

Provide the names and titles of principal project personnel. For support staff, include the title of each position and indicate in brackets the number of persons who will be employed in that capacity. For persons employed on an academic year basis, list separately any salary charge for work done outside the academic year.

name/title of position	no.	method of cost computation (see sample)	NEH Funds (a)	Cost Sharing (b)	Total (c)
Reinhard, Director	[ ]		$ (b) (6)	$ 34,547	$ (b) (6)
Holen, Archaeologist	[ ]				
Burgess, Osteologist	[ ]				
Miller, Res. Assist.	[ ]				
Student, Illustrator	[ ]		10,000		
Student, Res. Asst.	[ ]		10,000		
Secretarial Support	[ ]		6,322		
	[ ]				
		SUBTOTAL	$ 120,138	$ 34,547	$ (b) (6)

2. Fringe Benefits

If more than one rate is used, list each rate and salary base.

rate			salary base	(a)	(b)	(c)
23.5	%	of	$ 154,685	$ 28,232	$ 8,119	$ 36,351
	%	of	$			
			SUBTOTAL	$ 28,232	$ 8,119	$ 36,351

3. Consultant Fees

Include payments for professional and technical consultants and honoraria.

name or type of consultant	no. of days on project	daily rate of compensation	(a)	(b)	(c)
Hastings, Cul. Consult.	(b) (6)	$ (b) (6)	$ 21,900	$	$
		$			
		$			
		$			
		$			
		SUBTOTAL	$ 21,900	$	$

4. Travel

For each trip, indicate the number of persons traveling, the total days they will be in travel status, and the total subsistence and transportation costs for that trip. When a project will involve the travel of a number of people to a conference, institute, etc., these costs may be summarized on one line by indicating the point of origin as "various." All foreign travel must be listed separately.

from/to	no. of persons	total travel days	subsistence costs	+ transportation costs	= NEH Funds (a)	Cost Sharing (b)	Total (c)
Lincoln/Macy	2	24	$256	$144	$400.00	$	$
				SUBTOTAL	$400.00	$	$

5. Supplies and Materials

Include consumable supplies, materials to be used in the project, and items of expendable equipment; i.e., equipment items costing less than $500 or with an estimated useful life of less than two years.

item	basis/method of cost computation	(a)	(b)	(c)
		$	$	$
	SUBTOTAL	$	$	$

6. Services

Include the cost of duplication and printing, long distance telephone, equipment rental, postage, and other services related to project objectives that are not included under other budget categories or in the indirect cost pool. For subcontracts over $10,000, provide an itemization of subcontract costs on this form or on an attachment.

item	basis/method of cost computation	(a)	(b)	(c)
telephone long dist.	400 toll calls @ $3.00	$1,200	$	$
xeroxing	10,000 pages @ .05	500		
	SUBTOTAL	$1,700	$	$

NEH Budget Form

7. Other Costs

Include participant stipends and room and board, equipment purchases, and other items not previously listed. Please note that "miscellaneous" and "contingency" are not acceptable budget categories. Refer to the budget instructions for the restriction on the purchase of permanent equipment.

item	basis/method of cost computation	NEH Funds (a)	Cost Sharing (b)	Total (c)
Quadra 950, computer		$ 6375	$	$
keyboard		151		
monitor		1108		
Laser Writer IIG printer		3187		
Connectors		60		
One Scanner		900		
	SUBTOTAL	$ 11781	$	$

8. Total Direct Costs (add subtotals of items 1 through 7) $ 184,151 $ 42,666 $ 226,817

9. Indirect Costs [This budget item applies only to institutional applicants.]

If indirect costs are to be charged to this project, check the appropriate box below and provide the information requested. Refer to the budget instructions for explanations of these options.

☒ Current indirect cost rate(s) has/have been negotiated with a federal agency. (Complete items A and B.)

☐ Indirect cost proposal has been submitted to a federal agency but not yet negotiated. (Indicate the name of the agency in item A and show proposed rate(s) and base(s), and the amount(s) of indirect costs in item B.)

☐ Indirect cost proposal will be sent to NEH if application is funded. (Provide an estimate in item B of the rate that will be used and indicate the base against which it will be charged and the amount of indirect costs.)

☐ Applicant chooses to use a rate not to exceed 10% of direct costs, less distorting items, up to a maximum charge of $5,000. (Under item B, enter the proposed rate, the base against which the rate will be charged, and the computation of indirect costs or $5,000, whichever sum is less.)

A. _____ (name of federal agency) _____ (date of agreement)

B.

rate(s)		base(s)	NEH Funds (a)	Cost Sharing (b)	Total (c)
40.5 %	of	$ 226,817	$ 69,809	$ 17,280	$ 87,089
%	of	$			
		TOTAL INDIRECT COSTS	$ 69,809	$ 17,280	$

10. Total Project Costs (direct and indirect) for Budget Period $ 253,960 $ 59,946 $ 313,906

SECTION B — Summary Budget and Project Funding

SUMMARY BUDGET

Transfer from section A the total costs (column c) for each category of project expense. When the proposed grant period is eighteen months or longer, project expenses for each twelve-month period are to be listed separately and totaled in the last column of the summary budget. For projects that will run less than eighteen months, only the last column of the summary budget should be completed.

Budget Categories	First Year/ from: to:	Second Year/ from: to:	Third Year/ from: to:	TOTAL COSTS FOR ENTIRE GRANT PERIOD
1. Salaries and Wages	$103,172	$16,966	$	= $120,138
2. Fringe Benefits	24,245	3,987		= 28,232
3. Consultant Fees	10,950	10,950		= 21,900
4. Travel	400			= 400
5. Supplies and Materials				=
6. Services	1,700			= 1,700
7. Other Costs	11,781			= 11,781
8. **Total Direct Costs (items 1-7)**	$152,248	$31,903	$	= $184,151
9. Indirect Costs	$57,216	$12,593	$	= $69,809
10. **Total Project Costs (Direct & Indirect)**	$209,464	$44,496	$	= $253,960

PROJECT FUNDING FOR ENTIRE GRANT PERIOD

Requested from NEH:[1]		Cost Sharing:[2]	
Outright	$ 253,960	Cash Contributions	$
Federal Matching	$	In-Kind Contributions	$ 59,946
		Project Income	$
TOTAL NEH FUNDING	$253,960	TOTAL COST SHARING	$ 59,946

Total Project Funding (NEH Funds + Cost Sharing)[3] = $ 313,906

[1] Indicate the amount of outright and/or federal matching funds that is requested from the Endowment.

[2] Indicate the amount of cash contributions that will be made by the applicant or third parties to support project expenses that appear in the budget. Include in this amount third-party cash gifts that will be raised to release federal matching funds. (Consult the program guidelines for information on cost-sharing requirements.)

Occasionally, in-kind (noncash) contributions from third parties are included in a project budget as cost sharing; e.g., the value of services or equipment that is donated to the project free of charge. If this is the case, the total value of in-kind contributions should be indicated.

When a project will generate income that will be used during the grant period to support expenses listed in the budget, indicate the amount of income that will be expended on budgeted project activities.

[3] Total Project Funding should equal Total Project Costs.

Institutional Grant Administrator

Complete the information requested below when a revised budget is submitted. Block 11 of the application cover sheet instructions contains a description of the functions of the institutional grant administrator. The signature of this person indicates approval of the budget submission and the agreement of the organization to cost share project expenses at the level indicated under "Project Funding."

Sharon K. Davis, Director, Office of Sponsored Prog. Telephone (402) 472-3171
(area code)

Name and Title (please type or print)

Sharon K Davis

Signature

Date 10/13/92

NEH Application/Grant Number: _____

BUDGET
Salary

Reinhard, summer salary for 1993	$ (b) (6)
Reinhard, summer salary for 1994	$
Holen, one-half time Jan 1993--May 1994	$
Burgess, January 1993 -- May 1994	$
Miller, Summer 1993	$
Miller, Fall 1993	$
Secretarial support, Jan 1993-May 1993 1/8 time	$ 1,090.00
Secretarial support, May 1993-May 1994 1/4 time	$ 5,232.00
Student illustrator 1993 1/2 time	$ 10,000.00
Student Research Assistant 1993 1/2 time	$ 10,000.00
Fringe Benefits	$ 28,232.00
Consultant (b) (6) days @(b) (6)	$ 21,900.00
Travel:	
transportation 24 trips @ $6.00	$ 144.00
subsistence 24 days @ $10.666	$ 256.00
Services:	
long distance phone calls 400 @ $3.00	$ 1,200.00
xeroxing 10,000 pages @ .05	$ 500.00
Equipment:	
Quadra 950 computer	$ 6,375.00
Keyboard	$ 151.00
Monitor	$ 1,108.00
Laser Writer IIG printer	$ 3,187.00
Connectors	$ 60.00
Scanner	$ 900.00
TOTAL DIRECT COSTS	$184,151.00
INDIRECT COST CHARGE 40.5%	$ 69,809.00
TOTAL PROJECT COST	$ 253,960.00

MATCHING

Reinhard, two-course release time Spring 1993	$ 16,451.00
Reinhard, two-course release time 94-95	$ 18,096.00
Fringe benefits	$ 8,119.00
TOTAL MATCH COST	$ 42,666.00
INDIRECT COST CHARGE 40.5%	$ 17,280.00
TOTAL PROJECT MATCH	$ 59,446.00