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THIRTY-FIVE YEARS OF UPPER MISSOURI RIVER BASIN PALEOPATHOLOGY

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Wet Bones project consisted of speech/hearing evaluations performed on the Native Americans. The Dry Bones project were studies conducted on bones recovered from the region. During 35 years we examined skeletal remnants representing several cultures who existed in Dakota Territory during two millennia. The study of paleopathology was enhanced by salvage archaeology projects conducted before closure of dams across the River in the Upper Missouri River Basin (UMRB). Climatic conditions were unfavorable to mummification, limiting the study to bones. We were stimulated by a symposium on paleopathology at National Science Foundation, chaired by S. Jarcho (Yale University) (1966). There emphasis was placed on demography and epidemiology. Additional motivation by T.A. Cockburn (Detroit) (1977), who questioned whether ear disease, mastoiditis, and its complications, existed in proto United States, focused our attention on the Dry Bones study. The results of the Dry Bones project are presented here.

Key Words: Crow Creek massacre, congenital anomalies, exostoses, mastoids, reburial, scalping

El proyecto Huesos Mojados consistía en las evaluaciones de hablar/escuchar a y con los nativos de Norteamérica. El proyecto Huesos Secos consistía en estudios conducidos en los huesos recuperados de la región. Durante 35 años, examinamos los restos esqueletales que representan varias culturas diferentes que vivían en el Territorio Dakota durante 2000 años. Un factor que mejora la paleopatología en esta región eran los proyectos arqueológicos de rescate conducidos antes de cerrar las represas que cruzan el Río Missouri en Dakota del Sur. Las condiciones climáticas no eran favorables para momificación, así que el estudio fue limitado a los huesos. En 1966, participamos en y recibimos mucho estímulo del simposio de paleopatología en la Fundación Nacional de Ciencia. En 1977, T.A. Cockburn cuestionó si la mastoiditis y sus complicaciones existían en los Estados Unidos, y eso estimuló nuestro entusiasmo. Los resultados del proyecto Huesos Secos son el tema de este trabajo.

Palabras claves: *Masacre de Crow Creek, anomalías congénitas, exostosis, mastoíditis, reentierros, cuero cabelludo.*

Scope of the Investigation

Many sites in the UMRB were used in preparing this report. Prominent ones in South Dakota were Crow Creek (39BF11, A.D. 1350 ca.), Larson (39WW2, 1750-1785 A.D.), Leavenworth (39CO9, 1800-1832 A.D.), Mobridge (39WW1, 1700-1750 A.D.), Rygh (39CA4, 1600-1650 A.D.), and Sully (39SL4, 1650-1700 A.D.). Most of the findings were from salvage archeology, representing true population samples.

One hundred eighty two North and South Dakota Middle Plains Woodland (800-1100 A.D.) were from multiple scattered sites having no continuity in time or space.

The North Dakota skeletons were being curated from Minnesota, North and South Dakota. A few specimens were from Utah. Many sites were represented but classification as population statistics was not possible. The data are presented as Ear Disease, Exostoses in the ear canal, Congenital anomalies, Specific findings at Crow Creek, Disease patterns throughout the region, The Internet, the Reburial issue, and the Future of paleopathology.

Ear Disease

The project began as a voluntary effort the at University of South Dakota's WH Over Museum in 1962. Hearing and speech studies on the Indians in this state led us to believe hearing loss due to otosclerosis (fixation of the stapes in the oval window) did not exist in them. This is despite the fact that they had many ear infections (which some blamed as a cause for stapes fixation). A comparison with the past was suggested by W Hurt, Director of the Museum. To do this he offered the use of 400 skeletons. Mastoid radiographs were included on all available temporal bones (Gregg et al. 1965).

No case of otosclerosis was found in 417 temporal bones from South Dakota, so 243 temporal bones from North Dakota were accessioned. Again, the findings were negative for stapes fixation. A fixed stapes was found later in a Spaniard's temporal bone, buried in the Presidio in 18th century Tucson, by Birkby and Gregg (1975).

Mastoid radiographs of South Dakota skulls had provided valuable results (Table 1). They showed mastoid air cells had previously been affected by some factor, the amount and degree of alteration varying with their place in time (Figures 1, 2). The school children of today and the Indians who lived before European colonization had the highest number of normal mastoid bones and the lowest percentage of abnormalities, when compared to the VA Hospital patients and the Indians who lived after European contact. There were more changes which could be associated with middle ear disease in the Arikara Indians who lived in earthlodges at the Sully Site. The U.S. National Museum (Siouan) and the WH Over Museum skeletons (heterogeneous in culture, sex, age) temporal bones had about the same number of diseased bones (Gregg et al. 1982).

Table 1. Mastoids in Ancient/Modern Upper Missouri River Basin Populations

Ancient Populations	Time (A.D.) In history	No. of bones	No.(%)	
			Pneumatic	Altered
WH Over Museum*; mixed cultures	800-1850	417	220 (53)	197 (47)
Sully Site (39SL4) homogeneous Site; Arikara	1650-1700	255	116 (45.5)	139 (54.5)
US National Museum; heterogeneous questional provenience; Sioux	1759-1850	257	128 (50)	129 (50)
Crow Creek (39BF11); proto-Arikara massacre	1300-1350 (?)	837	516 (61)	21(39.7)

Total		1,766	980 (52.4)	786 (47.8)
Modern populations	Operational	296	210 (71)	86 (29)
Pierre Indian School (K-12); Sioux primarily				
V.A Hospital, Sioux Falls	Operational	1,590	880 (55.3)	710 (44.6)
OVERALL TOTAL		3,652	2,070 (59.6)	1,582 (40.5)

* Fifty burials (88 temporal bones) were of Middle Plains Woodland origin, dating AD 800-1000. These included four sclerotic, 33 mixed, one diploic. Adapted from: Gregg and Steele, 1982.



Figure 1. Mixed mastoid development characterized by partial pneumatization but still retaining diploic characteristics (arrow)

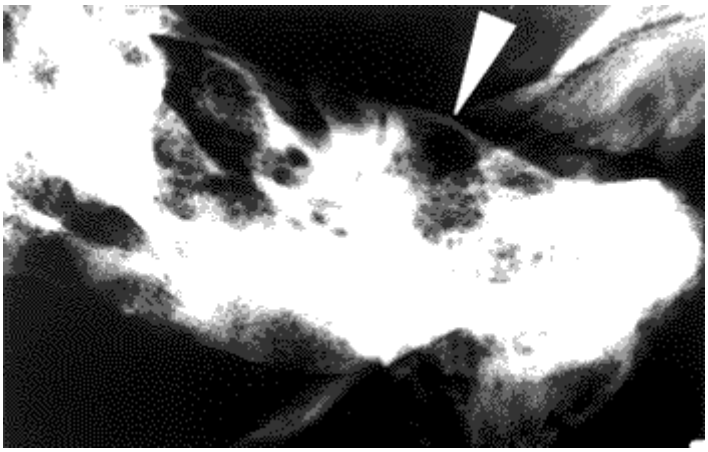


Figure 2. A cholesteatoma is seen (arrow) in the A-P radiographic view of the mastoid, near the roof of the middle ear in a Crow Creek skull. There is mixed type air cell development. This is a dangerous complication of middle ear disease most likely from inadequate "clinical material" with which to work, and around which to base a symposium.

Many communicable infectious diseases, including the "common cold", are postulated as not existing in antiquity (Black 1975; Manchester 1983; Stewart 1979; Swinton 1983; Vogel 1970). Findings at Crow Creek of residua of diseases such as otitis media, mastoiditis (and its complication), sinusitis, and their sequellae, which are recognized as having upper respiratory infections origin, does not corroborate opinions of others in regard to microbiology in antiquity.

"Although it is impossible to prove the identities of microbiological flora in the ancient UMRB, their pathogenic behavior was similar to that of infectious agents prevalent in the area in the recent past" (Gregg and Steele 1982).

If indeed, North American aborigines were isolated for thousands of years, but as Crow Creek studies indicate, were exposed to microorganisms that behaved similarly to those existing today, from whence came the microorganisms which some authorities claim did not exist? Concepts regarding microbiology in antiquity, especially virology, need review. Additionally, the possibility of pre-Columbian inter-continental commerce is a consideration.

Temporal bone analyses provided a reasonably accurate source of information about several types of pathology. Cautious extrapolation between temporal bone findings and those in other skeletal components made it possible to conjecture concerning epidemiological implications of infectious diseases elsewhere in the body.

Exostoses in the Outer Ear Canal

Hrdlicka (1934), estimated the frequency of outer ear canal exostoses in Dakota Indian skulls as: South Dakota all, Mobridge, Arikara, Misc. - skulls/ears 109/48, 22% with exostoses; Mobridge: skulls/ears 76/37, 24.3% with exostoses. In North Dakota skulls/ears 29/2 he found exostoses in 3.45%. Our studies had consistently showed a lower frequency (4.9%) in a larger cohort (3,623+ears). An attempt to reconcile his findings and ours was solved by reassessment of the North Dakota specimens. Because the skulls we saw in North Dakota were the same ones examined by Hrdlicka, our analysis confirmed his findings.

A comparison of his findings and ours showed that Hrdlicka was right in interpreting his results, but his archaeological methodology was faulty. Doctor TD Stewart explained that Hrdlicka's specimens were often random samples from aboriginal cemeteries, or from other sources, and as such did not present true cross sections of the pathology in a population (TD Stewart, Personal communication, 1967). The greater number of skeletons we examined came from salvage archaeology, providing more complete cross sections of populations, and a better means of assessing epidemiology.

Congenital Anomalies

Congenital anomalies are structure formation errors, or disturbed chemical function due to metabolic deficiency. They are inherited through gene transmission (genotype), or are started by some stimulus at the appropriate time in embryogenesis when developing structures are vulnerable (phenotype). The defects are visible on inspection (overt), or hidden by soft tissue (occult).

Alteration in formation or development of bone can appear during embryogenesis, or become manifested as dysplasias later during life. It is estimated that 1: 15 children born today has an inborn defect (Apgar 1965).

A symposium on congenital and developmental anomalies was scheduled for the 1979 annual Paleopathology Association (PPA) meeting, but did not occur (PPA, Newsletter 26: 3). The symposium's failure was attributed to the dearth of exemplary specimens. A symposium on this topic took place in 1983 at the PPA meeting. Despite concerted efforts to stimulate interest, only six papers were forthcoming. The unenthusiastic response again reflected the limited stimulus to research,

Paradoxically, we found occult anomalies in Indian skeletons, in numbers commensurate with those found in the general population today. This led us to believe that overt congenital anomalies were present in the past, but the skeletons did not reach the common burial area. The absence of variation fostered the opinion that manifest anomalies are found infrequently in skeletons from the past. This is only partially true.

Contrary to Morse's findings (1969) in Illinois Indians skeletons, fusion of the first cervical vertebra was quite common in Dakota Territory skeletons. Out of 2,500 skulls we found six with fused C-1. Paracondyloid process with and without atlanto-occipital fusion was in seven skulls. Bilateral parcondyloid processes, variable in size, were encountered in 93 skulls; unilateral processes were found in 54 skulls. The findings suggest a genetic difference in basicranium formation between the two skeletal populations.

Occult anomalies at Crow Creek were primarily in the lumbo-sacral spine (N=264+), but also involved one mandible, styloid processes bilaterally, 50 skull bases, and 11 teeth. Overt anomalies included two proximal radius-to-ulna fusions and one hemifacial microsomia (Figure 3). If anomalies behaved similarly in 1350 A.D. to the way they do today, the skull with the hemi-facial anomaly would have had Grade I variation deformity (Andy Gump) of the mandible. According to Caldarelli et al. (1980) he had an 86% chance of ossicular deformity (malleus/incus) and a 90% chance of external ear deformity. Here we are cautious in the interpretation of the fragmented, dismembered Crow Creek skeletons, because of intermingling of the bones, and limited time in which to work.



Figure 3. Left hemifacial dysostosis, including hypoplasia of the ascending ramus, malformed head, and asymmetry in a Crow Creek skull

Evidence of the Massacre at Crown Creek (39BF11)

Crow Creek was a walled, moated village, indicating hostility, aggression, and warfare in the region preceding the massacre (Kivett and Jensen 1976; Zimmerman et al. 1980). Scalping of both living and dead individuals amputation (Figure 4) of hands and feet, decapitation, and other corporeal dismemberment, found during examination of the bones, showed these to be cultural practices at the time. Findings in the massacre remnants dating to A.D. 1350±, sixteen hundred miles from the U.S. East Coast, dispel forever popular misconceptions that scalping came to America from Europe (Axtell and Sturtevant 1980; Bruesh 1974; N.A. 1981 -Don't blame the Indians for scalping; Haugh 1982; Hume 1982; Livingstone 1986). Their mortal remains went into a mass grave that remained untouched until the site was uncovered accidentally in 1978 A.D.

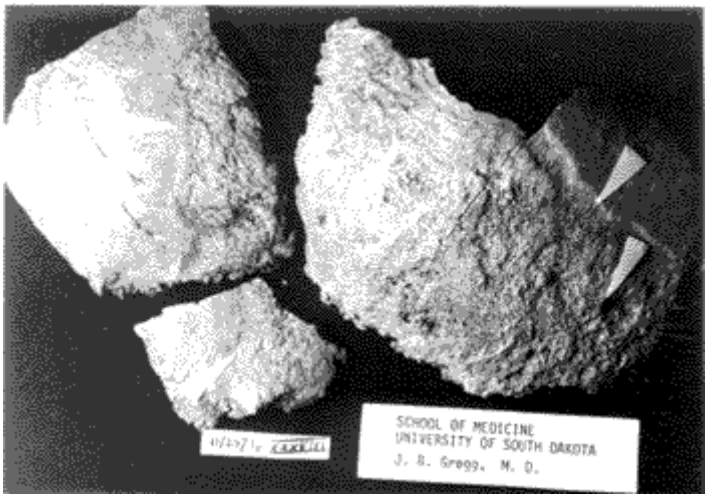


Figure 4. Skull external surface scalped of almost entire soft tissue, leaving pattern of osteomyelitis clearly visible. Victim survived this fate, only to perish in the Crow Creek massacre

Similar findings were made in 1970 at the Larson Site (39WW@), where the villagers were found brutally murdered, still in their earthlodges (Owsley et al. 1977). Two examples of antemortem scalping were in these specimens.

The health and diseases of pre-White contact aborigines in the Americas have long been conjectural. Some believe that before A.D. 1492 American natives were relatively disease free (Vogel 1970), that many health problems, specially infections came from Europe. Our studies changed this concept.

Specific Findings in the Crow Creek (39BF11) Skeletons

1. Skeletons were dismembered, precluding evaluation as individuals. The temporal bone count (Rt=486, Lft=477) was the best indicator of the number of skeletons present.

2. Para and post-mortem damage to skeletons included scalping, decapitation, hand and foot amputation, and other mutilation. Much of this was attributed to trophy taking, but some came from carnivore molestation (wolf, coyote).

3. Scalp evulsion had taken place several months ante-mortem on 2/392 skulls, indicating the practice was not confined to dead bodies, and that scalping antedated the coming of the White man.

4. Residua of old fractures with long term survival included one subtrochanteric hip fracture, two old skull fractures. A piece of flint was embedded in the innominate bone.

5. Bones of the victims showed that they had undergone previous nutritional stress, and were actively affected by it at death (Gregg and Zimmerman 1986; Symes 1983; Figures 5, 6). The findings were those of malnutrition and scurvy.



Figure 5. Residua of recent resorbing subperiostial hematomata were on many Crow Creek bones. Here it appears as a "scab" on the bone surface

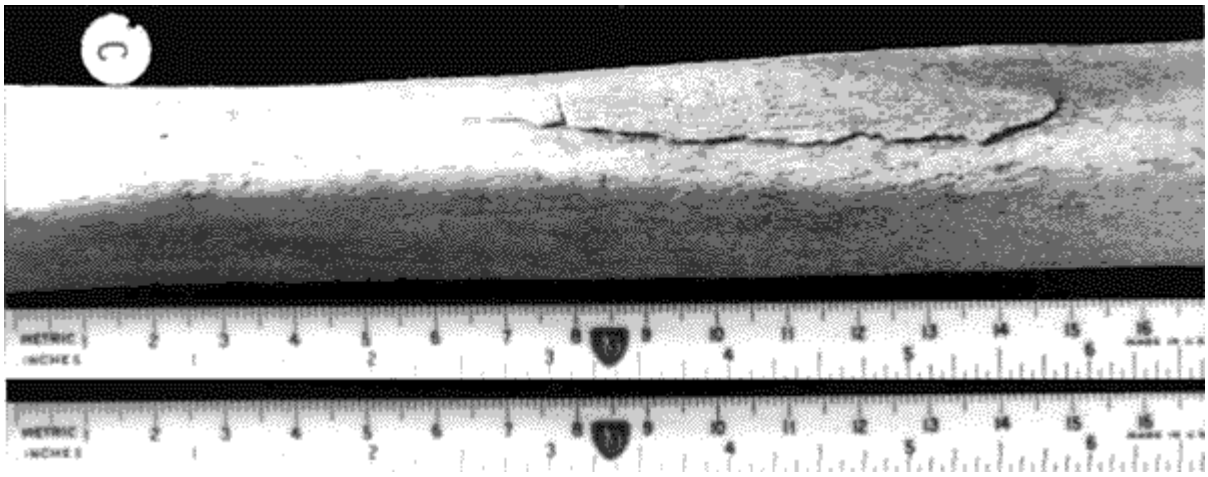


Figure 6. Residua of recent resorbing subperiostial hematomata were on many Crow Creek bones. Here it appears as a "scab" on the bone surface

They were probably factors in their demise.

Disease Patterns Throughout the Region

According to the European Bills of Mortality cited by Catlin (A.D.1870), disease patterns were similar for afflictions encountered before and after A.D. 1350, to those in Europe. The major difference was the absence of evidence of the herd type diseases, which came from Europe.

During the 35 year study interval the following residua of diseases were identified:

A. Dislocation hip, shoulder and ankle.

B. Fracture various bones that included skull, face, clavicle, all larger arm bones, vertebrae, ribs, pelvis, femora, tibiae and fibulae.

C. Fused knee, hip, malleus to tympanic ring.

D. Inflammatory diseases such as putative actinomycosis involving the face, cryptococcosis in the skull, histiocytosis X in the skull, monostotic and polyostotic fibrous dysplasia.

E. Various cysts and cystlike lesions.

F. Osteomyelitis involving several bones.

G. Metastatic cancer (probably breast), and putative nasopharynx.

H. Benign tumors such as osteochondroma, non-odontogenic tumors.

I. Dental anomalies and abnormalities.

J. Degenerative arthritis involving the majority of bones, Marie Strumple arthritis.

K. Trephinations.

L. Burned bones.

M. Various manifestations of nutritional deficiency.

N. Vertebrae that were absent, fused, assimilated up or down, parts missing, anomalous, infected by tuberculosis and other agents.

Nasal and sinus findings in one Crow Creek skull were suspected to be the result of allergic rhinitis (Figure 7) Allergy is a process which hasn't received attention from investigations in paleopathology. Allergies affect soft tissue primarily, but prolonged allergy can cause nasal and sinus bone changes. It is difficult to diagnose in old skeleton and soft tissue or mummified bodies. Other post A.D. 1492 regional skulls had similar changes. They must be interpreted from the anatomical findings, unless mummified nasal polyps are found.

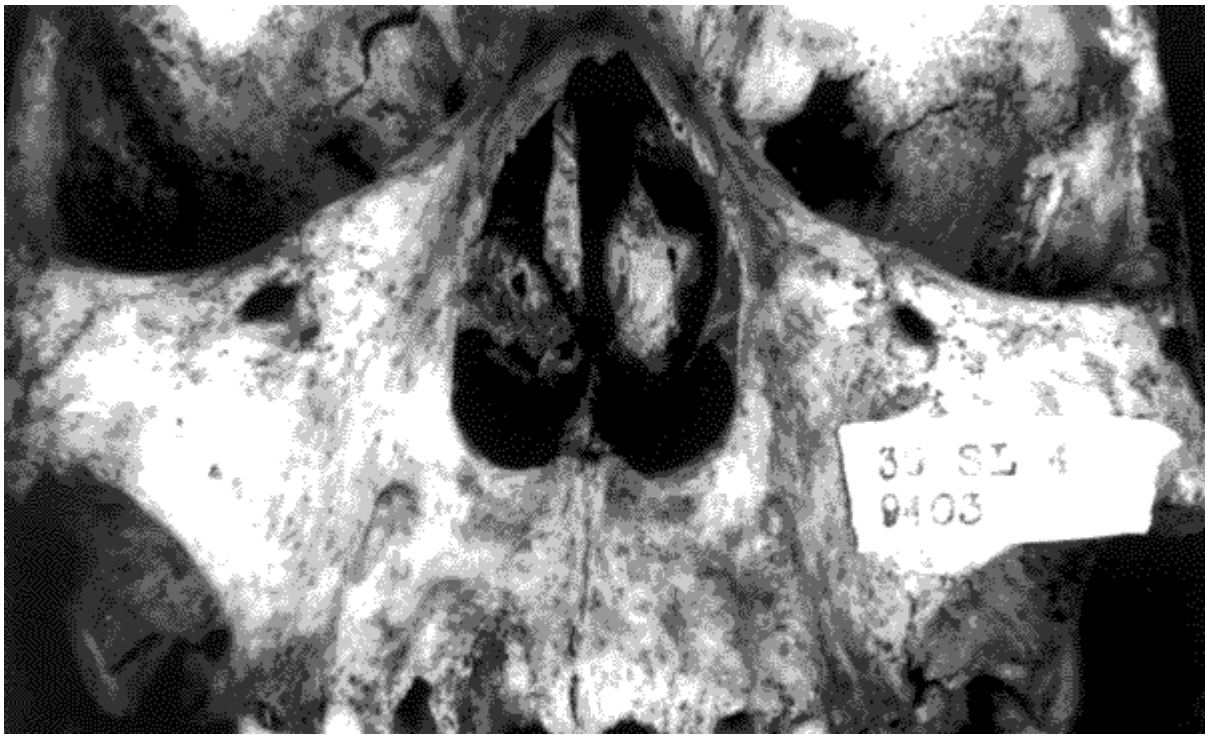


Figure 7. Allergic rhinitis (allergy) is suspect because of wide nasal aperture, enormous middle turbinates, thickening and warping of the nasal septum, compromising the nasal airway and producing symptoms of hay fever

The Internet

There now exists a means to disseminate the findings that are available to help paleopathologists communicate with others. It is *Internet*, a service that is on line to the world. Pages having to do with paleopathology on the *Internet* presently are available, and many more are sure to appear in the next few years.

At the present time a page can be found at: http://www.uiowa.edu~anthro/paleopathology. All are invited to come on line and see what exists.

Reburial Issue and the Future of Paleopathology

While the Crow Creek massacre was being investigated, a major effort was made by militants for Reburial in the United States, to repatriate all Indian artifacts, and to prevent archaeological projects in the future. To date the skeletal material in the W H Over Collection, the North Dakota Historical Society Collection, the Crow Creek skeletons, material at the Smithsonian Institution representing Siouan people, have all come to repatriation. This issue is still pending. Until it is decided exactly how human

remnants are to be handled, and assigned their place by law, things will remain nebulous.

This paper is a brief recitation of pathology that occurred during two millennia. It was found in a limited portion of the world over a thirty five year interval. Many unusual cases have been documented, but many were omitted here, to promote brevity. Our object was to present much of what of was learned, and how this information has been gathered.

The future of paleopathology depends largely on the people of the World. Reburialists have had their say, and at the present time their views predominate. However, it is debatable that those who speak loudly and longest, truly speak for the majority of people. They have given insufficient time to serious soul searching, and efforts to see the benefits of what the study of ancient pathology hopes to achieve. Their reliance on emotional and spiritual inspiration for their efforts has been strong. If they can be influenced by more moderate members of their group to rethink their beliefs, then perhaps reconciliation is possible.

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