

Author: FP McManamon at NP-WASO-DCA
Date: 9/5/00 8:21 AM
Priority: Normal
TO: Jason Roberts
Subject: Report on my activities at the Burke Museum

Forward Header

Subject: Report on my activities at the Burke Museum
Author: FP McManamon at NP-WASO-DCA
Date: 8/15/00 7:47 AM

Brooke--Here is a draft from DGS of his work at the Burke in April.
Please put it into the appropriate subdirectory.

All three of us should review it for comments, but first we'll focus
on the cultural affiliation document.

Tx. FPM

Forward Header

Subject: Report on my activities at the Burke Museum
Author: David Glenn Smith <dgsmith@ucdavis.edu> at np--internet
Date: 8/14/00 1:58 PM

Frank

Please forgive my tardiness in sending my report on my activities
at the Burke last April. I hope this is what you need and that it
will be suitable for your needs. I will now crank out a report to you
on DNA of Kennewick.

David

Report to the National Park Service,
U.S. Department of the Interior

A Review of Documents and Evidence Pertaining to
the Suitability of the 8,400 year-old
Skeletal Remains from Kennewick, Washington
for DNA Studies Designed to Determine its
Closest Living Descendants

David Glenn Smith
Professor

Between the 24th and 26th of April, I participated in the study of some 350 bone fragments curated at the Burke Museum at the University of Washington. . These remains had been recovered in the summer of 1996 on the banks of the Columbia River in Columbia Park near the town of Kennewick, Washington. While at the Burke, I collaborated with four other colleagues (Drs. Irving Taylor, Phil Walker, Joe Powell and Clark Larson) to collect information pertinent to the selection of optimal samples for DNA analysis of these remain to attempt to determine their ethnic origin.

The first part of my participation was to assist Drs. Larson , Walker , and Powell in developing a coding scheme for recording descriptive information about the skeletal remains. The coding scheme developed included the I.D. number, specific bone element, location ,type and temporal context (e.g. pre-, peri- or post-mortem) of all surface breaks, coloration and surface texture and photograph of each element. Optimal samples are those lacking surface alterations such as erosion or cracking.

My second role was to participate in a detailed examination of the approximately 350 skeletal fragments and recommend specific fragments for sampling (by Dr. Irving Taylor) of the protein (e.g. collagen) and amino acid content, to serve as a proxy for an estimate of its DNA content. There is ,in fact, very little data suggesting that the presence of such organic material is closely correlated with its DNA content and the consensus of opinion of scientists attending the June,2000 (biannual) Ancient DNA Conference in Manchester ,England, was that such a correlation is ,at best, low. Nevertheless, since minimization of destructive analysis was of paramount importance, it was deemed prudent to employ as many criteria pertaining skeletal fragments most suitable for successful DNA extraction. In selecting skeletal fragments for sampling by Dr. Taylor, I gave priority to skeletal fragments without surface damage (cracks ,breaks ,erosion ,etc.) and which provided cancellous bone matrix maximally protected by a hard ,complete and undamaged cortical bone surface. I regarded the most suitable elements for DNA extraction ,based on these

criteria, to be two molar teeth that had been less exposed to X-rays than all other teeth, several metacarpals, an articulator scapular fragment, several vertebral (mostly cervical) spines, several ribs (proximal portions) and the proximal end of the right radius (later judged to be too diagnostically valuable to sacrifice for DNA testing). Most long bones and other major elements (e.g. ilia, scapular bodies, distal portions of ribs, vertebral bodies, etc.) exhibited fissuring or erosion of their cortical surfaces, making them undesirable targets for DNA extraction. Curiously, metatarsals exhibited much more cortical surface damage than did metacarpals.

Since there is evidence that radiation, to which skeletal remains are often exposed during analysis, damages DNA contained within the bone, my third role was to carefully review all available data, documents and records generated by studies of the remains to identify those unsuitable for DNA extractions because of exposure to procedures such as X-ray and CT scan technology. Some such studies were found to have been conducted as a part of Dr. James Chatters' own examination of the remains [prior to September 2, when he transferred the remains to agents of the Army Corps of Engineers (ACOE) who held jurisdiction over the Columbia Park site] while others (e.g. right ilium, several damaged ribs, both humeri, the left femur and tibia, the mandible, maxilla and entire cranium) were conducted by staff at the Burke Museum, or their agents, where the remains were transferred on October 29, 1998. Elements so exposed were found to include the cranium/skull and maxilla (with the occasional exception of two teeth that fell out of the dental arcade between July 28 (when the remains were first discovered) and September 2 (when Dr. Chatters transferred them to agents for the Walla Walla District ACOE) most of the pelvic assembly, most of both femurs, tibia and humeri, at least one clavicle (of unknown laterality) and several ribs [i.e. five middle (numbers 5-10?) ribs, which appeared "squared off as if they had been cut with an ax or some other large blade" (then subsequently rehealed)]. Dr. Chatters' field notes of July 28, 1996 imply that the two teeth cited above became dislodged after, rather than before, discovery, and some X-ray images included these two teeth while in others they appear not to have been replaced before the cranium (or mandible) was exposed to x-rays. On a separate occasion (August 7, 1996), as indicated by Dr. Chatters' field notes, Ken Lagergren, D.D.S. examined and X-rayed the teeth (presumably, both maxillary and mandibular), albeit these x-ray images were not among those I reviewed. Dr.

Chatters' notes remark that Dr. Lagergren concluded that the pulp cavities [which contain the teeth's blood supply, and, therefore, are more likely than other parts (e.g. dentin) to contain DNA] of the teeth are "calcified almost completely." Therefore, I deemed all teeth to have been exposed to X-rays and heavily calcified (therefore requiring extensive decalcification prior to DNA extraction). I still considered the desirability of using the teeth (usually deemed to be the optimal element for DNA extraction), especially the two that had apparently experienced less exposure to x-rays, as a source of DNA but this opinion was rendered moot by the subsequent decision by Dr. Francis McManamon that the diagnostic value of the teeth was too great to warrant their destruction, or potential damage, by extracting DNA from them.

Since contamination of prehistoric bone elements with modern DNA (especially that of Native Americans) seriously confounds studies of ancient DNA, my fourth role was to conduct a careful review of all records pertaining to the handling of the Kennewick skeletal remains by humans before their transfer by Dr. Chatters to the ACOE on September 2, 1996 and after their transfer to the Burke Museum on October 2, 1998. The records examined revealed that at least 13 different individuals [including two young men, Mr. Scott Turner and Mr. William Thomas, who serendipitously discovered the remains in Columbia Park, and one (or more) unidentified police officer(s), whom the young men subsequently summoned] and an unknown number of (unknown) individual members of three different groups [i.e., a geological investigative team, the Columbia Basin Dive Rescue Team and the Cultural Resource Committee (CRC) of the Confederated Tribes of the Umatilla Reservation] appear likely to have handled at least some of the 350 skeletal fragments recovered from the "Kennewick Man" site in Columbia Park before the remains were transferred by Dr. Chatters to the ACOE on September 2, 1996. Dr. Chatters himself visited the discovery site and collected skeletal remains, either alone or accompanied by at least one of the aforementioned persons, on at least nine occasions (i.e., on days 28, 29 and 31 of July and days 3, 5, 11, 19, 26 and 29 of August) between July 28 and August 29, 1996. Drs. Chatters (on July 29), Catherine Macmillan (on July 30) and Grover Krantz (on August 30) all conducted detailed anthropometric analysis of at least some (and probably most) of the skeletal remains and are the most likely sources of contamination with modern DNA prior to September 2, 1996, when the ACOE took custody of the remains. In most other cases the extent of the handling or the identification of specific

individuals who handled specific skeletal elements was not clearly specified in the records. In a few instances records indicate exactly who handled which element [e.g., Dr. Ray Tracy, archaeologist for the ACOE, handled the left first metacarpal, members of the CRC handled (at least) 3 phalanges, 4 ribs, one pubis fragment, one vertebral spinous process and 8 miscellaneous bone fragments, and numerous people (e.g. at least one unnamed X-ray-CT scan technician, Dr. Lagergren, a dentist, Claire Chatters, an artist, and Mr. Tom McClellan, who assisted Dr. Chatters in casting the Kennewick skull, all handled the cranium and or the mandible). At least some of the individuals who either certainly or probably handled the remains (e.g., Mr. Floyd Johnson, the Benton County coroner, Dr. Chatters' daughter, Claire, who rendered drawings of some of the skeletal remains, and members of the CRC) are reported to be of Native American ancestry. These constitute especially undesirable instances of potential contamination with modern DNA because such modern DNA might be mistaken for ancient Native American DNA extracted from the Kennewick remains. The identities of some of the individuals who handled some of the remains [e.g. at least one X-ray/CT scan technician at the Kennewick General Hospital who examined the right ilium to visualize an embedded projective point, and at least one police officer summoned by the two young men who first discovered the remains and who placed the skull in a bucket for transporting, are not recorded but could probably be determined by further investigation if necessary.

No records/documents describing handling of the Kennewick remains were available for the nearly two-year time period between September 2, 1996, when the ACOE took custody of the remains from Dr. Chatters, and October 29, 1998, when the remains were transferred to the Burke Museum in Seattle, Washington. However, anecdotal reports (e.g. articles published by the news media) of handling of an unknown number of the approximately 350 skeletal fragments by individuals, including Native Americans (allegedly, for religious purposes), have surfaced but are not verifiable using the records available.

After October 29, 1998, when the remains were transferred to the Burke Museum, a number of scientist selected by the Department of Justice (including Drs. Joe Powell, Jerome Rose, Doug Owsley, Phil Walker and Clark Larson) examined the remains extensively but report to have used disposable rubber gloves (but not masks and lab coats) when handling the remains, minimizing their likelihood of contaminating the

remains. These examinations also included the use of X-ray and/or CT scan technology and are included in the discussion of such exposure above.

Based on the above criteria/evidence, I prepared and provided to Dr. Francis McManamon, of the National Park Service, a (wish) list of (of the approximately 350) skeletal fragments that I believe are more likely than any of the remaining elements to contain a sufficient quantity of high quality, uncontaminated DNA for analysis to attempt to identify its ethnic origin or relationships. The list of elements I recommended for sampling is as follows:

1. 3rd right mandibular molar (97.R.75a)-not micro-sampled due to diagnostic value.
2. 3rd left maxillary molar (97.R.50a)-not micro-sampled due to diagnostic value.
3. 3rd left metacarpal 97.L.16(MCa)-Sample #1, piece from the distal end.
4. Right 8th rib 97.I.12d(13)-Sample #2: vertebral end of rib fragment; Sample #3: sternal end of rib fragment
5. 2nd cervical vertebrae 97.U.4 (C2.a)-not micro-sampled due to diagnostic importance.
6. 3rd right metacarpal 97.R.16(MCa)-Sample #4: proximal end piece; Sample #5: distal end piece.
7. 2nd right metacarpal 97.R.16(MCc)-not micro-sampled due to other micro-samples already taken of neighboring bone.
8. 2nd left metacarpal 97.L.16(MCb)-Sample #7, piece from distal end.

The evidence reported above, leads me to conclude that the single element least exposed to modern contamination is that fifth metacarpal element submitted by Dr. Chatters to Dr. Taylor's lab at U.C.Riverside for radio carbon dating on August 5, 1996, prior to the time most elements were handled by either known or unknown individuals. That particular element had been recovered in a matrix of hardened clay inside the cranium of the Kennewick remains and is known to have been handled only by several individuals from whom we have obtained and studied a sample of DNA that can be compared to DNA suspected of being a modern DNA contaminant co-extracted

with the intrinsic ancient DNA. I subsequently confirmed that that particular bone fragment, which, at the request of Mr. Floyd Johnson, had been sent to me by Dr. Taylor for DNA analysis on September 5, 1996 and which I had subsequently surrendered to an agent for the U.S. Justice Department on February 2, 1999, remained as I had originally packaged it for transfer and storage with the other Kennewick remains housed at the Burke Museum. I then accepted returned custody of these remains from Dr. Michael (Sonny) Trimble, Director of the St. Louis District ACOE Mandatory Center of Expertise for the Curation and Management of Archaeological Collections (MCX-CMAC), to complete the DNA analysis initiated in my lab by Dr. Frederika Kaestle (then my graduate student) on October 1, 1996. Upon my return, I divided the specimen into two approximately equal (0.45 gram) fragments and gave one to each of my two senior graduate students, Mr. Ripan S. Malhi and Mr. Jason A. Eshleman, directing them to complete the analysis begun by Dr. Kaestle.