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October 10, 2002

Mr. Timothy W. Simmons
Assistant U.S. Attorney
1000 S.W. Third Ave., Ste. 600
Portland, OR 97204-2902

VIA MESSENGER

Mr. David F. Shuey
U.S. Department of Justice
Environment & Natural Resources Division
General Litigation
601 Penn Avenue, NW Room 845
Washington, DC 20004

VIA U.S. MAIL

Re: Bonnichsen et. al. v. U.S.
Civil No. CV 96-1481JE
Plaintiffs' Study Plan

Dear Mr. Simmons and Mr. Shuey:

Enclosed is a copy of plaintiffs' plan for study of the Kennewick Man skeleton. I am delivering it to you rather than sending it directly to the U.S. Army Corps of Engineers since you are counsel for the federal defendants named in the pending court action. Please forward copies of the plan to the responsible decisionmakers in the Army Corps and any to other persons you deem appropriate.

The Army Corps' response to the plan and any questions it or you may have concerning the plan should be directed to me at my Portland office.

Very truly yours,

Alan L. Schneider

Alan L. Schneider

ALS/tlm
Enclosure
cc: Plaintiffs
P. Barran
R. Donaldson
C. Hawkinson

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Plaintiffs' Study Plan

Kennewick Man Skeletal Remains

U.S. Army Corps of Engineers

Burke Museum, Seattle, WA

October 10, 2002

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INTRODUCTION

A human skeleton, depending upon its completeness and state of preservation, can tell us much about an individual and the conditions he or she experienced during life. Among other things, skeletal remains can provide information about ancient population demography, health, diets, sociocultural interactions, activity patterns and lifestyles. They can also provide information about the origins of different human populations, past migrations, gene flow between regions and populations, and microevolutionary changes.

Investigation of skeletal remains often requires an analysis of the conditions that may have affected the skeleton's preservation and modification over time. Taphonomic studies of bone modification and element (or fragment) distribution patterns can inform investigators about the different physical, biological and cultural processes that operated to alter the skeleton being investigated. Such information can be critical in understanding what questions to ask of a skeleton and how those questions can be answered.

The Kennewick Man skeleton represents a truly extraordinary discovery. In the New World, there are very few well-preserved human skeletal remains older than 8,000 years that can be studied to learn more about the earliest inhabitants of this continent. The Kennewick Man skeleton is one of the most complete, and it is the only good representative from this early time period that has been found in the Pacific Northwest. It is a rare source of information, and it warrants an extraordinary level of investigation.

OBJECTIVES OF THE STUDY PLAN

Plaintiffs' Study Plan is designed to produce as much useful information about this unique fossil skeleton as can be obtained in a single, relatively short study session. The specific objectives of the Plan are fourfold. One objective is to crosscheck measurements and observations reported by prior investigators of the skeleton. Independent verification of data is a fundamental part of the scientific process, and is particularly important in the case of skeletal remains like Kennewick Man which have the potential to help resolve major issues relating to late Pleistocene human evolution, development and dispersal. A second objective is to add new data to the body of information known about the skeleton. Such data will be obtained by conducting studies and tests that were not undertaken by prior investigators or if undertaken were not as comprehensive as needed.

A third objective is to assess Kennewick Man's biological affinities to various prehistoric and modern human populations in the Americas and elsewhere in the world. Plaintiffs' study team will bring to this task new data and databases not available to prior investigators of the skeleton.

A fourth objective is to resolve, or at least bring better clarity to, some of the existing unresolved questions about the skeleton. Some of those questions are: what was Kennewick Man's biological age at time of death; what injuries did he suffer during his lifetime; was he a long-time resident of the area where his remains were discovered; what kind of projectile point

is embedded in his pelvis; was his deposition in the ground the result of a natural event or intentional human action; how has his skeleton been affected over time by natural processes.

Plaintiffs' study team will pursue these objectives through an array of studies, tests and procedures that can be grouped into the following general categories:

- inventory, reassembly and reconstruction of the skeleton
- observations and measurements of the skeleton
- sampling and testing of the skeleton and associated sedimentary materials
- imaging of the collection and study session

The following sections provide pertinent information about each study, test and procedure to be conducted by plaintiffs' study team. Most will involve the expertise of multiple on-site investigators to ensure consideration of as many different perspectives as possible. The only exception is chemical testing. To minimize the amount of bone material sampled, only one investigator will be used to remove samples for later testing. Analysis of the test results, however, will involve collaboration with other experts.

COLLECTION INVENTORY, ASSEMBLY AND RECONSTRUCTION

The Kennewick Man skeleton consists of more than 350 bones and bone fragments. These pieces will be inventoried, sorted, reassembled and reconstructed so the skeleton can be examined and studied as an integrated unit that is as complete as possible.

1. Inventory of Skeletal Elements

Description. The individual pieces of bone will be inspected and as many as possible will be identified in order to finalize the inventory of the Kennewick Man skeleton.

Responsible Scientists. The inventory will be supervised by Dr. Douglas Owsley, with assistance from Dr. David Hunt, Dr. Hugh Berryman, and Ms. Karin Bruwelheide (M.A.).

Purpose. A precise, baseline inventory is an essential step for all further examinations and investigations of the skeleton. Without such an inventory, there can be no assurance that different investigators are referring to or comparing the same bones or fragments. At present, such an inventory does not exist. Among other things, there are unresolved differences between the records compiled by Dr. Owsley in October 1998 and the records compiled during the studies conducted by the National Park Service ("NPS") in 1999. In addition, identifications of bone fragments have not been finalized. For example, the number and specific identification of all ribs (or rib fragments) recovered at the discovery site have not been determined. The inventory to be conducted during plaintiffs' study session will attempt to resolve these and other bone identification and assignment questions.

Equipment and Materials. The following equipment and materials will be used in conducing the inventory: digital calipers, sliding calipers, coordinate calipers, metric tape, osteometric board, mandibulometer, magnifying glasses, dental picks and spatulas, cameras, film and cassettes, data coding forms, coding instructions, pencils, latex gloves and laptop computers (two).

Precedents. Dr. Owsley has collected and computerized inventory information on more than 6,000 human skeletons from the United States as part of his bioarchaeological and skeletal biology research on North American populations. Inventories for 25 individuals dated to more 8,000 years ago are included, several of which came from federal lands (e.g., Gordon Creek, Colorado; Spirit Cave, Nevada; and the Grimes Burial Shelter, Nevada). A large number of museums, universities, and state and federal repositories have been visited while conducting this work. Represented are skeletal collections under the jurisdiction of the U.S. Army Corps of Engineers, the National Park Service, the Department of Defense, U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, Bureau of Reclamation, the National Museum of Health and Medicine, and the Smithsonian Institution.

2. Reassembly and Reconstruction of Skeletal Elements

Description. Subject to time availability, as many individual pieces of bone as possible will be fitted together. The cranium, mandible and selected postcranial bones will be reconstructed using Acryloid B-72. Some of the postcranial bones to be reconstructed are: both humeri, both femora, both tibiae and the right fibula. In addition, the right innominate and those ribs displaying pathological conditions will be reconstructed if doing so will aid in other investigations of the skeleton. Such reassembly and reconstruction will begin during the inventory process.

Responsible Scientists. The reassembly and reconstruction will be performed by Dr. David Hunt, Dr. Douglas Owsley and Ms. Karin Bruwelheide (M.A.).

Purpose. These procedures are essential steps toward completion of the taphonomic analysis, evaluation of skeletal and dental pathology, and recording of cranial and postcranial measurements. NPS' studies of the skeleton did not include reassembly and reconstruction of all key skeletal elements. As a result, those studies were not as comprehensive as needed for appropriate investigation of this important skeleton and may have reported erroneous measurements and observations.

Equipment and Materials. Reassembly and reconstruction of the skull and postcranial elements will involve use of the following equipment and materials: Acryloid B-72, wood splints, sand box, craniometric equipment, acetone and latex gloves. New boxes or containers will be needed for holding the skeletal elements after they have been reconstructed.

Precedents. The members of the reconstruction team have reassembled and reconstructed many skeletal remains during the past two decades. Included are several Paleoamerican crania dated 8,000 years or older (e.g., Anzick, Browns Valley, Gordon

Creek, Horn Shelter). Gordon Creek is a skeleton owned by the U.S. Forest Service. To prepare for reconstruction of the Kennewick remains, Dr. Hunt has examined and reconstructed a cast of the Kennewick cranium from separate pieces that were originally molded and cast by Dr. Jim Chatters.

OBSERVATIONS AND MEASUREMENTS

The skeleton will be examined and measured to crosscheck data reported by other investigators and to obtain data not previously collected. Some of the issues to be addressed through these investigations are: taphonomy of the skeleton; interpretation of the calcium carbonate concretions on the bones; identification of the embedded projectile point; determination of the projectile point's entry point; evaluation of Kennewick Man's injuries and lifestyle activities, his age at the time of death and his physical stature; assessment of his biological relationships to various modern and prehistoric populations.

1. Taphonomic Analysis of the Skeleton

Description. Taphonomic analysis of the skeleton will be conducted in four stages (which will be coordinated with the procedures described in "COLLECTION INVENTORY, ASSEMBLY AND RECONSTRUCTION").

Stage 1. The more than 350 bones and fragments comprising the skeleton will be laid out in anatomical order, and the taphonomic study team will examine them and record all observable conditions. Among other things, data will be gathered concerning the presence of sediments on or within bones, fracture patterns, color, presence of carbonates, evidence of biological diagensis (e.g., root etching, gnaw marks, etc.) and weathering effects (e.g., cracking, surface deterioration, bleaching, etc.). A standardized coding system will be used to document each bone or fragment. All observation procedures and descriptive terms will be defined. Taphonomic features will be photographed.

Stage 2. The bones and bone fragments will be reassembled into complete (or as nearly complete as possible) skeletal elements. The reassembled skeletal elements will be photographed and examined for observable taphonomic features.

Stage 3. Key bones and skeletal elements will be reconstructed to provide stable units for measurement and examination. They will be photographed and observable taphonomic features will be recorded to compare with observations made in Stages 1 and 2.

Stage 4. All available information will be analyzed to reach a final assessment. The analysis will incorporate relevant data from other procedures conducted during or following the study session and observations reported by prior investigators of the skeleton.

Responsible Scientists. The taphonomic analysis will be a multidisciplinary investigation involving the participation of a number of scientists. They will include Drs.

Hugh Berryman, Robson Bonnichsen, John Foss, David Hunt, Douglas Owsley and Thomas Stafford.

Purpose. The purpose of the taphonomic analysis is to determine how geologic, pedologic, biologic (plant and animal), and human actions affected Kennewick Man's remains from the time of his death until the time of examination. The study will seek to address key questions such as: (a) what was the cause of his death; (b) with what geological stratum (or strata) were the bones associated; (c) did sediment-loading lead to postmortem deterioration and breakage of bone; (d) can the skeleton's position in the ground be determined; (e) can carbonate deposits and mineral stains on the bone inform us about the mode of Kennewick Man's deposition at the site; (f) were the skeletal remains modified by rodent and/or carnivore activity; (g) has the skeleton been modified by wave or mechanical action following its erosion into the lake; (h) have vascular plants and algae altered bone surfaces; (i) did bone fragmentation and deterioration occur after the skeleton eroded out of the riverbank? By addressing these and other questions, the taphonomic analysis will seek to develop a better understanding of past and present environments at the discovery site and a more coherent understanding of how the skeleton has been altered through time.

Equipment and Materials. The following equipment and materials will be used: hand measuring tools; recording forms; latex gloves; Munsell Color Charts; hand magnifying lenses; laptop computer; cameras; stereomicroscope with attached digital camera.

Precedents. Taphonomic analysis is a well-established approach for understanding how faunal and human remains have been altered over time (Bonnichsen and Sorg 1989). An abbreviated form of taphonomic study was undertaken by NPS as part of its 1999 investigations of the skeleton.

2. Examination and Description of Calcium Carbonate Concretions

Description. The pedogenic calcium carbonate ("concretions" or "caliche") reported to be adhering on and within the bones of the skeleton will be visually examined, described and photographed. The size, lithologic composition, color and orientation of the concretions relative to specific anatomical bone markers will be recorded. The concretions will be located relative to proximal, distal, posterior and anterior assignments of the bone. The depositional surface of a concretion will be designated the "down" position, and each bone will be oriented relative to this Z-axis.

Responsible Scientists. The examination will be conducted by Drs. Thomas Stafford, John Foss, Robson Bonnichsen and Douglas Owsley.

Purpose. The study will attempt to determine the three dimensional orientation of each Kennewick skeletal bone relative to XYZ coordinates. Such information will be used to help determine: (a) if Kennewick Man was deposited in the ground as a result of natural causes or intentional human activity; and (b) if there was any movement of skeletal elements in the ground after burial. To determine the orientation of a rock or fossil in its enclosing sediments,

geologists use geopetal structures, which are any characteristic "Pertaining to any rock feature that indicates the relation of top to bottom at the time of formation of the rock..." (Bates and Jackson, 1980:259). The feature most useful for determining the orientation of the Kennewick Man skeleton is the calcium carbonate concretions that were deposited on the bones by soil formation processes while the skeleton was in the ground. The concretions were probably deposited under arid or semiarid conditions and were formed in the paleosol's Bk horizon. Pedogenic carbonate precipitates first on the underside of an object thereby enabling determinations of "top" and "bottom" of the object.

Materials Required. See "Microsampling of Collection" for a description of the equipment and supplies that may be used during this examination (excluding the drill and dremel). In addition, a flexible borescope with fiber optic lights and computer connection may be used to examine concretions within medullary cavities and the cranium.

Precedents. The stages of development of pedogenic structures have been long studied and are well understood (Gile, et al. 1966; Birkeland, 1974). For example, different generations of caliche on rocks have been studied to determine how many times a rock cairn was disturbed and how these disruptions related to radiocarbon dates for the human skeleton found in the cairn (Stafford et.al. 1987; 1990).

3. Investigation of Embedded Projectile Point

Description. Data will be obtained concerning the projectile point embedded in the skeleton's pelvis. Methods used will include: (a) visible examination of the ilium fragment and the exposed portion of the projectile point; and (b) assessment of relevant information provided by other procedures (e.g., CT scans, x-rays, etc.). For descriptions of those procedures see other subsections in this Study Plan. Observations and data from prior investigators of the skeleton also will be assessed.

Responsible Scientists. One investigation will be conducted by Drs. Robson Bonnichsen, Douglas Owsley, Thomas Stafford and Dennis Stanford. Other scientists will conduct separate investigations of the projectile point.

Purpose. The projectile point is the only artifact that was found with the skeleton. As a result, it is the only object that is available for relating Kennewick Man to the human cultures that existed in the Pacific Northwest 9400 calendar years ago. However, there are many unresolved questions about this artifact. Its identification as a Cascade Point is uncertain, and the type of stone from which it was made has not been confirmed. Disagreements also exist about whether the projectile point entered Kennewick Man's hip from the front or the back of his body. Plaintiff's study team will attempt to resolve these questions.

Materials Required. The investigators will use various hand measuring tools, magnifying lenses, recording forms, latex gloves, cameras and computers.

Precedents. Identification of lithic projectile points is a well established scientific practice. NPS authorized a study of the projectile point as part of its 1999 investigations of the skeleton.

4. C. Loring Brace: Measurements and Observations

Description. Up to twenty-four (24) measurements will be taken of the cranium depending upon the skeleton's condition. In addition, the cranium and postcranial skeleton will be inspected visually to obtain data concerning discrete traits and other relevant matters.

Responsible Scientist. The measurements and observations will be taken or made by C. Loring Brace, or his designated representative.

Purpose. The purposes of Dr. Brace's examination are: (a) to verify data reported by prior investigators of the skeleton; and (b) to obtain data that may not have been gathered by prior investigators. The data obtained will be used to assess Kennewick Man's biological affinities to various modern and past human populations. Such assessments will be made using Dr. Brace's database which contains measurements on more than 5,000 modern and prehistoric human skeletal remains from North America, South America, east Asia and other parts of the world.

Equipment and Materials. The following equipment and materials will be used: G.P.M (Swiss made) spreading calipers; Mitutoyo LCD readout sliding calipers; Mitutoyo LCD readout simometer; data forms; pencil; latex glove; laptop computer.

Precedents. Measurements and observations of this kind are an accepted scientific practice (Buikstra and Ubelaker 1994 at 69-94). Dr. Brace has published more than 20 articles and papers using data from his examination protocol. See, e.g., Brace et.al. (2001). Dr. Brace and his representatives have gathered similar measurements and observations on collections throughout the world. Such collections include skeletal remains curated under ARPA by or for numerous federal agencies, including Spirit Cave Man (Bureau of Land Management).

5. D. Troy Case: Examination of Hands and Feet

Description. The hand and foot bones will be examined for evidence of trauma, disease, degenerative conditions, congenital anomalies, pathological conditions, and non-metric traits. To the extent permitted by the skeleton's condition, metric and functional analyses also will be made of the hand and foot bones. Relevant radiographs will be reviewed.

Responsible Scientist. The examination will be conducted by D. Troy Case, Ph.D. student, Arizona State University.

Purpose. The purposes of the examination are: (a) to verify data reported by prior investigators of the skeleton; (b) to obtain data not gathered by other investigations. Evidence of trauma, disease and degenerative conditions can suggest cause of death, provide insights into overall health, and indicate limitations on mobility. Congenital anomalies and non-metric traits can provide evidence for assessing biological affinities. Functional analyses of hand and foot bones can provide evidence of repetitive lifetime activities.

Equipment and Materials. The following equipment and materials will be used: digital calipers, mini-osteometric board, recording forms, pencil, latex gloves, camera and film, and laptop computer.

Precedents. Collection of data concerning trauma, disease, congenital conditions and nonmetric skeletal traits is a recommended component for the documentation of skeletal remains found in archaeological contexts (Buikstra and Ubelaker 1994). Mr. Case has collected data of this kind from collections curated by a number of U.S. museums and institutions, including the Smithsonian Institution, Arizona State University and the University of Arizona. He has also collected such data at museums in Denmark and Japan.

6. James Chatters: Skeletal Measurements

Description. Measurements will be taken of the skull and selected postcranial skeletal elements following the measurement protocols set out in Howells (1973) and Buikstra and Ubelaker (1994).

Responsible Scientist. The measurements will be taken by Dr. James Chatters.

Purpose. The purposes for taking these measurements are: (a) to crosscheck data reported by other investigators of the skeleton; and (b) to complete Dr. Chatters' examination of the skeleton that he began in 1996 but was compelled to terminate prematurely. The data obtained will be used to compare Kennewick Man with other skeletons from early America, late prehistoric America and elsewhere in the world in order to assess the genetic/historical relationships among them. Obtaining accurate estimates of the individual's stature and his body and limb proportions are also objectives of the work.

Materials Required. The following equipment and materials will be used: osteometric board, spreading calipers, sliding calipers, radiometer, coordinate caliper, tape measure, data scoring sheets, pencil, latex gloves, 3-D digitizing unit and laptop computer.

Precedents. Craniometrics and osteometrics are standard components of skeletal analysis (Buikstra and Ubelaker 1994). Similar measurements have been performed by the author and other members of the study team on many federally owned skeletal collections. The anthropologists hired by NPS to study the Kennewick Man skeleton in 1999 took similar measurements as part of their work.

7. James Chatters: Skeletal Observations

Description. The skull and postcranial skeleton will be examined and data recorded for: (a) evidence of repetitive physical activities and occupational stress; (b) traits that may be determined by simple (i.e., single locus) genetics; and (c) pathological conditions. The projectile point embedded in the skeleton's hip also will be examined through close microscopic and macroscopic inspection and by study of the x-rays, CT scans and photographs taken of this region.

Responsible Scientists. The examination will be performed by Dr. James Chatters. Dr. Nancy Ossenberg will assist with analysis of the nonmetric skeletal traits.

Purpose. The purposes of the examination are: (a) to crosscheck data reported by other investigators of the skeleton; and (b) to complete examinations of the skeleton that Dr. Chatters began in 1996 but was compelled to terminate prematurely. Examination of muscle attachments and joint surfaces of major bones can provide information about the stresses placed on Kennewick Man's body by the activities he performed in life, and such information can be used to infer his patterns of behavior. For example, his modes of transportation (such as whether or not he paddled a boat, climbed frequently under load, or ran frequently under load) and subsistence-related activities (such as pulling nets, throwing with an atlatl or making tools by various means) can be inferred to varying degrees by the patterns of stress placed on muscles and joints. Comparisons among populations on the basis of nonmetric traits are one means for establishing genetic interrelationships among populations in the New World, past and present, and between New World and Old World peoples of the past. Patterns of injury, along with musculoskeletal analysis, can provide important insight into the cultural behavior and interpersonal/intergroup relationships of ancient peoples. Differences of opinion exist about the types of injuries suffered by Kennewick Man and their significance. There is also controversy over whether the projectile point embedded in the skeleton entered from behind left or front right and whether or not it is a Cascade-style artifact. The projectile point will be examined to document, as closely as possible, the form, flaking characteristics and micro-wear patterns of this artifact. Of particular interest is whether the base of the item can be seen at left or right.

Materials Required. The following equipment and materials will be used: data scoring forms, pencils, laptop computer, pocket tape recorder, anatomical reference book, a magnifying lens, camera, film and a photo stand with suitable high-intensity lights, trinocular microscope, latex gloves, notepad, reference standards.

Precedents. Collection of such data is a well-established scientific practice (Buikstra and Ubelaker 1994; Chatters 1984; Hemphill and Larsen 1999; Kennedy 1989). Similar data were gathered as part of NPS' investigations of the skeleton, and has been collected for other skeletons held in federal collections (Chatters 1984; Hemphill and Larsen 1999).

8. Della Cook: Paleopathology Examination

Description. The skeleton will be evaluated for arthritis syndromes and for evidence of trauma.

Responsible Scientist. The examination will be conducted by Dr. Della Cook. Dr. Cook manages a collection of 6000 prehistoric skeletons, and has done research elsewhere in the United States, Canada, Brazil, Belize, Greece, and South Africa on collections containing approximately 4000 skeletons. Her interests in paleopathology include infectious diseases that affect the skeleton and developmental and degenerative conditions. She has published more than 30 papers on these and other pathological conditions.

Purpose. The purposes of the examination are: (a) to crosscheck data reported by other investigators; and (b) to make observations that may provide information not gathered by other investigators. There are several genetically mediated joint discases that are relatively common in modern American Indian groups from the Northwest (e.g., Gofton et.al. 1972), and several of these are quite variable in their distribution across human populations. These conditions must be carefully differentiated from age-related osteoarthritis and from activity-related features of the bones and joints. Trauma reported on the Kennewick skeleton requires careful description and staging, that is evaluation of the order and time intervals separating injuries. Questions of secondary infection and functional consequences of the reported injuries need attention. Other pathological changes should be described. The dentition should also be examined as a source of information about life history.

Equipment and Materials. The following equipment and materials will be used: data collections forms, measuring calipers, hand-held magnifying lens, pencil, latex gloves, camera with a macro lens, tripod, camera lights, film, dental pick, and a hand-held mirror with a light for examining the interior of the cranial vault.

Precedents. Collection of such data is a recommended component for the documentation of skeletal remains found in archaeological contexts (Buikstra and Ubelaker 1994). Some data of this kind was gathered as part of NPS' 1999 investigations of the skeleton.

9. George Gill: Measurements and Observations

Description. Depending upon the condition of the skeleton, approximately 150 measurements and observations will be recorded for the cranium and postcranial bones. For a description of some of those measurements and observations, see Dr. Gill's affidavit dated February 16, 1997 (Plaintiffs' Motion for Order Granting Access to Study).

Responsible Scientist. The measurements and observations will be taken or made by Dr. George W. Gill. He may be accompanied by an assistant.

Purpose. The purposes of Dr. Gill's examination are: (a) to verify data reported by prior investigators of the skeleton; and (b) to obtain data that may not have been gathered by prior investigators. The data obtained will be used to access Kennewick Man's biological affinities to various modern and past human populations. Such assessments will be made using Dr. Gill's database which contains measurements and observations on skeletal populations from North America (including Native Americans, Caucasians, African-Americans and Chinese), east Polynesia, West Mexico and coastal Peru.

Equipment and Materials. Some of the measurements will be taken with a special type of simometer developed by Dr. Gill. Other equipment and materials to be used are: sliding and spreading calipers, osteometric board, palometer, mandibulometer, head spanner, recording forms, pencil, latex gloves, laptop computer, camera and film.

Precedents. Measurements and observations of this kind are an accepted scientific practice (Buikstra and Ubelaker 1994). Dr. Gill has published more than 85 articles and papers using such data. Dr. Gill has gathered similar measurements and observations on numerous collections within and outside the United States. Such collections include skeletal remains curated under ARPA by and for various federal agencies, including the Bureau of Land Management, U.S. Army Corps of Engineers, Bureau of Reclamation, U.S. Fish and Wildlife Service and U.S. Forest Service. These include the 9415 year old (RC yr) Spirit Cave Man mummy (Bureau of Land Management) and the 9600 year old (RC yr) Gordon Creek skeleton (U.S. Forest Service). Some data of this kind was gathered for NPS' 1999 investigations of the Kennewick Man skeleton.

10. Richard Jantz: Cranial Coordinates, Measurements and Observations

Description. Three dimensional coordinate data of the cranium will be collected using an electronic digitizer to record the x, y and z coordinates of each point touched. These data will be supplemented with measurements taken by hand instruments for those areas of the cranium (such as the mandible) not adequately measured by the digitizer. Observations of discrete traits and other characteristics also will be recorded.

Responsible Scientists. The data collection will be performed by Dr. Richard Jantz. Assisting him as recorder will be Kate Spradley, Ph.D. student.

Purpose. Dr. Jantz and his colleague Dr. Owsley have compiled a database containing cranial measurements and observations on more than 7000 modern and prehistoric individuals. This database allows researchers to discriminate between populations in time and space. Morphological measurements and observations on the Kennewick Man skeleton will provide similar insights into population relationships for this individual. Measuring techniques are noninvasive and will not cause damage to the skeleton. These data will be used to identify the morphometric relationships of Kennewick Man to other early crania, later crania in America and other parts of the world. Questions have been raised about the accuracy of some of the cranial measurements taken by prior investigators. Those measurements are the only data available to the scientific community and are already being used by others in analyses of the

skeleton. It is essential that they be verified, and if necessary corrected. In addition, coordinate data have not been obtained from the Kennewick cranium. Coordinate data provide much finer characterization of morphology and allow explicit comparisons of shape. It is also possible to increase visual appreciation of variation by using wire frame models of skulls obtained by connecting landmarks. Coordinate data also allow computation of non-standard measurements, which may provide greater insights into variation among early American crania and between early and later American crania.

Equipment and Materials. The following equipment and materials will be used: sliding calipers, spreading calipers, coordinate calipers, radiometer, recording forms, pencil, latex gloves, digitzer, and laptop computer.

Precedents. Taking standard measurements has been an accepted scientific practice for several generations. For the past 20 years, Dr. Jantz has utilized measurements that are expanded slightly from Howells' (1973) classic and highly influential work. Although dating to the early 20th century in concept, the extensive collection of coordinate data is little more than a decade old and has been made possible by the availability of affordable and portable digitizers (see Rohlf and Marcus 1993). Dr. Jantz has used his measurement techniques on numerous collections under the jurisdiction of the Bureau of Land Management, Bureau of Reclamation, U.S. Army Corps of Engineers, and on important early American crania, including Wizards Beach, Spirit Cave (BLM), Horn Shelter, Gordon Creek (Forest Service), and Arch Lake. He has also used these techniques to evaluate recent and ancient specimens from other parts of the world. Ancient remains examined include Mladec 1 from the Eastern European Upper Paleolithic, various Mesolithic Norwegians, and a collection from the Nubian Epipaleolithic. These techniques are frequently used in forensic identification and in assisting in tribal identification for NAGPRA claims. The value of morphometric data for testing hypotheses about peopling of the New World was demonstrated in Jantz and Owsley (in press).

11. Richard Jantz: Measurements of Postcranial Skeleton

Description. Measurements will be taken and recorded of the postcranial skeleton. The measurements to be taken are similar to those described in Moore-Jansen et.al. (1994) and Buikstra and Ubelaker (1994).

Responsible Scientists. The data collection will be performed by Dr. Richard Jantz. Assisting him as recorder will be Kate Spradley, Ph.D. student.

Purpose. The postcranial measurements will allow assessment of limb proportions, skeletal size and robusticity. These data will be compared to the existing database of measurements compiled by Drs. Jantz and Owlsey for other skeletal remains. This database includes both early and recent Americans. The comparisons will lead to interpretations of adaptation (limb proportions) and activity patterns (size and shape of long bone shaft dimensions). Postcranial dimensions also will be used as a body size control to examine variations in cranial size. At the present time, the only measurements of the Kennewick Man

postcranial skeleton available to the scientific community have not been independently corroborated. In addition, Dr. Jantz' measurement protocol differs somewhat from those used by prior investigators. Certain postcranial measurements are particularly difficult to take, and it is important that Dr. Jantz obtain Kennewick Man skeletal data that are comparable to other data in his database. It is also important that the record developed for this skeleton be as complete and accurate as possible under current techniques. Together with the image record to be made of the skeleton, the postcranial measurements will allow future scientists to study Kennewick Man's morphology. It has been demonstrated recently that traditional postcranial data are closely related to long bone shaft cross-sectional properties as seen on actual cross sections or CT scans (Wescott 2001). The information obtained during plaintiffs' study session will allow broad comparisons of Kennewick Man's functional morphology.

Equipment and Materials. This protocol will involve use of the same equipment and materials as described in the section entitled "Richard Jantz: Cranial Coordinates, Measurements and Observations."

Precedents. Postcranial measurements are an accepted and recommended scientific procedure (Moore-Jensen 1994; Buikstra and Ubelaker 1994). Dr. Jantz has collected such measurements on numerous collections held by federal agencies, including those under the jurisdiction of the Bureau of Land Management, Bureau of Reclamation and U.S. Army Corps of Engineers. He has gathered such data for a number of important early American postcrania, including Wizards Beach, Spirit Cave (BLM), Horn Shelter, Gordon Creek (Forest Service), and Arch Lake.

12. Douglas Owsley: Paleopathology and Lifestyles Examination

Description. The skeleton will be examined for evidence of skeletal and dental pathology and indicators of lifestyle activities. In addition to visual inspection of the skeleton, evaluation will also be made of x-rays and CT scan images. The dentition will be inventoried, noting the presence or absence of each tooth and alveolar socket, and the occurrence of specific pathological conditions including caries, periodontal and alveolar abscessing, antemortem tooth loss, staining and hypoplasia, task activity abrasions, calculus deposits, and alveolar bone resorption. Attention also will be given to the development of muscle attachment sites and enthesophytes (projections or irregular ridges of ossification) at muscle, tendon, and ligament attachments and insertion sites. These observations can provide evidence of handedness or of biomechanical stress resulting from repetitive activities.

Responsible Scientists. The data will be collected by Dr. Douglas Owsley with assistance from Ms. Karin Bruwelheide. Paleopathology and lifestyles data will also be collected by other members of the study team. Data will be shared by investigators.

Purpose. Dr. Owsley has been systematically collecting detailed skeletal and dental pathology and lifestyles data for nearly two decades. The standardized protocol used to score these data are described in Owsley and Jantz (1994, 1999) and Buikstra and Ubelaker (1994). An extensive, computerized database has been developed for the western half of North

America including comparable data for 24 complete and partial skeletons dated 8,000 years and older. Dental and bone pathology observations of the Kennewick Man skeleton will be interpreted in relation to this preexisting database. For comparisons involving skeletons from different archaeological sites, time periods or geographical areas, bone and joint surfaces are tabulated by sample and by age and sex categories in order to determine frequencies of specific types of pathology per individual. Because of variation in preservation and completeness, bones and joint surfaces are also tabulated relative to exact numbers of bones observed. Pathological conditions previously noted in other ancient skeletal remains include cribra orbitalia (hyperostosis of superior orbital plates of the frontal bones, a condition indicative of anemia), bone infections and inflammation, cranial and postcranial bone fractures, and joint and spinal column arthritic changes. Osteological evidence of disease or trauma can suggest cause of death, provide insights into overall health, and indicate limitations in mobility. Bones and teeth also reflect congenital defects and developmental anomalies. Carious lesions, alveolar bone pathology (e.g., dental abscessing and antemortem tooth loss), calculus deposits, dental wear, and evidence of periodontal disease can give clues as to age, diet, and food processing techniques.

Equipment and Materials. The following equipment and materials will be used: osteometric kit with digital and sliding calipers and metric tape, osteometric board, mandibulometer, magnifying glasses, data recording forms, coding instructions, dental picks and spatulas, pencil, latex gloves, camera and film, laptop computers (two) and disks.

Precedents. Dr. Owsley has collected and computerized extensive data of this kind on many collections held in museums, universities, state and federal repositories, and several European institutions and repositories. Represented are skeletal collections under the jurisdiction of the U.S. Army Corps of Engineers, the National Park Service, the Department of Defense, U.S. Fish and Wildlife, U.S. Forest Service, Bureau of Land Management, Bureau of Reclamation, the National Museum of Health and Medicine, and the Smithsonian Institution. Included are a number of federally owned skeletons that are more than 8,000 years old (e.g., Gordon Creek Woman, Colorado; Spirit Cave Man, Nevada; Grimes Burial Shelter, Nevada). Some data of this kind was collected during NPS' 1999 investigations of the Kennewick Man skeleton.

13. Steele and Wright: Study of Postcranial Elements

Description. Measurements including lengths and circumference diameters will be taken of the limb, hand and foot bones. Those bones will be examined for evidence indicating whether they experienced fractures. Evidence of degeneration of the bone surfaces and arthritis of joints also will be sought, as will evidence of subperiosteal bone deposition suggestive of infections during life. X-rays and CT scans of the bones will be examined for evidence of growth disruptions, unusual bone loss and previously healed fractures. Cross sectional CT scans of the femora, humeri and tibiae will be examined to assess geometrical properties of the bone. The data obtained will be compared with data reported by prior investigators of the skeleton and data for other populations.

Responsible Scientists. The examination will be conducted by Drs. D. Gentry Steele and Lori Wright.

Purpose. The purposes of the examination are to assess body size and sex of Kennewick Man utilizing limb, hand and foot bones, and to observe and report any disorders noted in these postcranial elements. Estimation of sex based on the long bones and tarsals will be used to corroborate assessments based on the crania and pelvis. Study of these elements will also provide additional information on the pattern of postcranial adaptation in Kennewick Man. Body size assessment will include estimates of stature and robusticity of the individual. Previous stature estimates have been based on the bones of the upper arm and the fragmentary tibiae. This study will use estimates based on additional incomplete elements of the lower limb and revised standards for the estimation of stature from fragmentary long bones as well as complete bones. Assessment of robusticity will be based upon the circumference and diameters of the shafts of the long bones and the articular ends compared to the lengths of the elements. The muscularity of Kennewick Man will be evaluated based on the extent of bone development at origins and insertions of muscles. Activity levels and bone strength will be evaluated from cross sectional geometry of the femora, humeri and tibiae obtained from CT scans. Examination of the hand bones, foot bones, and long bones also will focus upon any evidence of fractures, and will include assessment of arthritic changes to joints.

Equipment and Materials. The following equipment and materials will be used: osteometric board, spreading calipers, sliding calipers, coordinate caliper, tape measure, data scoring sheets, pencil, latex gloves, and laptop computer.

Precedents. Collection of such data is a recommended component for the documentation of skeletal remains found in archaeological contexts (Buikstra and Ubelaker 1994). Similar examinations have been performed by the members of the study team on many federally owned skeletal collections. Some data of this kind were gathered as part of NPS' 1999 investigations of the skeleton, but they are insufficient to address the issues to be assessed in the examination proposed here.

14. Christy G. Turner II: Dental Measurements and Observations

Description. This study will involve examination of the cranium to observe and record data concerning the dental morphology, oral pathologies and related supportive structural conditions of the maxillae and mandible. The procedures to be used in this study are those generally referred to as the Arizona State University Dental Anthropology System. Details of that System can be found in Turner (1991). The study also will require a brief examination of the entire skeleton since some dental anomalies and pathologies are population specific and can provide potential information about population origins and historic value. In addition, dental morphology and oral health should be assessed from the full context of overall skeletal development and health.

Responsible Scientist. The data collection will be performed by Dr. Christy G. Turner II, or his designated representative.

Purpose. The data collected will be used to identify those anatomical features of the teeth that have proven helpful in identifying population affinities (see more details below). The data will be entered into Dr. Turner's worldwide computerized human dental database that he has developed for comparative purposes. The objectives are to verify data reported by prior investigators and to determine which world population most closely resembles the Kennewick Man dental remains. These comparisons can be used to assess the fundamental question: are the Kennewick Man human remains similar to modern Native Americans or does the dental morphology show closer resemblance to non-Native Americans, such as the Ainu as has been suggested by some workers. Over the past 35 years, Dr. Turner has developed the world's largest single observer database on human dental morphology and oral pathology. The database includes approximately 25,000 individuals, and involves some 215 discrete observations per individual (depending upon completeness of remains).

Equipment and Materials. The following equipment and materials will be used in collecting the data for Dr. Turner's study: ASU DAS standard plaster reference plaques, data sheets, pencils, notebook, calipers, 15 cm ruler, 20x hand lens, gloves, two 35 mm cameras, lenses, cloth for photography, dental pick, small foam blocks to support objects for photography, bag for all the above, two 100 watt reflector lamps, clamps, 25' extension cord, and stands to hold the lamps. Dr. Turner will also need x-rays of the mandible and maxillae to determine the form and number of tooth roots in both jaws and to determine if there are unerupted supernumerary teeth.

Precedents. Dr. Turner's study protocol has been performed on skeletal remains around the world, including remains held in U.S. government collections. His database has been used in a large series of papers concerning the origins and dispersal of modern human populations, especially those of the Pacific Basin and adjoining areas. For example, Dr. Turner has published approximately 30 papers dealing with the origins and dispersal of all New World and Oceanic populations, plus a University of Cambridge book (with G.R. Scott) that deals in part with this subject. Whether or not successful assessments of the dental origins and affinities can be made for the Kennewick teeth will only be known after Dr. Turner and other scientists have been allowed to examine the remains.

SAMPLING AND TESTING

Bone microsamples will be tested for amino acid composition, CHN content and stable isotopes. These tests will provide data for: (a) assessing preservation variability throughout the skeleton; (b) determining if any parts of the skeleton are suitable for radiocarbon dating and DNA testing; (c) assessing the accuracy of prior isotope analyses on the skeleton; and (d) making dietary reconstructions and radiocarbon age corrections. Tests also will be made of the calcium carbonate concretions adhering to the skeleton to obtain data for taphonomic analyses and for radiocarbon determinations.

1. Microsampling of Collection

Description. Microsamples will be removed from up to 20 bones or bone fragments to determine their amino acid and CHN content. One to two microsamples (each 10 to 50 mg in weight) will be taken from each selected bone by using a hand-held power drill with a 1/16" diameter (or smaller) stainless steel bit. The resulting microsample holes will be so small they will not affect the appearance or structural integrity of the sampled bone, and will not interfere with future measurement or testing of the skeleton. Figure 1 is a photograph illustrating the size of the drill that will be used and a sample of bone powder weighing 10 mg. If sufficient bone collagen is preserved in the microsamples, stable carbon and nitrogen isotopes will be measured and analyzed on the microsamples. See further discussion under "Stable Isotope Analyses."

Responsible Scientist. The microsamples will be removed by Dr. Thomas Stafford. He will also perform the amino acid and CHN analyses.

Purpose. Quantative amino acid analyses will provide crucial information for: (a) assessing the accuracy of past radiocarbon and stable isotope tests on the skeleton; (b) determining whether or not any of the tested bones are suitable candidates for radiocarbon and DNA tests; and (c) assessing the variability of protein preservation throughout the skeleton. Only one of the laboratories (UC Riverside) that performed prior tests on the skeleton has released any data on the amino acid composition of the bones tested. The data released by UC Riverside does not indicate if secondary amino acids (proline and hydroxyproline) were measured. These secondary amino acids are fundamental components of bone collagen, and their relative abundances are critical for assessing the amount and type of bone protein present in specimens as old as the Kennewick Man skeleton. CHN data are a measure of the weight percent of carbon, hydrogen and nitrogen present in the bone. These percentages provide an indication of protein content, which together with quantative amino acid data, can be used to select bones suitable for radiocarbon and DNA testing. Such data can also provide insights into why so much variability was encountered during prior testing of the skeleton.

Equipment and Materials. The following instruments and supplies will be used for removing the microsamples: stainless steel 1/16" and 1/32" diameter drill bits, dremel tool with a flexible connection, binocular microscope, microsurgery magnification eyeglasses, 10x and 15x hand lenses, small and large borosilicate vials with plastic tops (approximately 2 dram and 10 ml in size), fiber optic lights, latex gloves, pencil, stainless steel tools (such as dental picks, spatulae, etc.), camel's hair brushes, laptop computer and disks, video camera and connections to the computer, digital 35mm camera and assorted lenses and tripod, Munsell Color Charts, digital calipers, analytic balance for measuring samples, and multiple outlet power strip/surge suppressor.

Precedents. Microsampling of bones to determine their amino acid and CHN content is an accepted scientific practice. Published works discussing this procedure or using the resulting data include Stafford, et al. (1991) and Stafford (1998). Dr. Stafford has performed this procedure on the Arlington Springs skeletal remains (National Park Service), which have

FIGURE 1.

1/16" DIAMETER DRILL BIT AND 10 MG OF BONE POWDER

EACH 1 DIVISION = 1 MM

been dated to 10,950 RC yr. B.P. He has also microsampled bone for law enforcement purposes including prosecutions under ARPA.

2. Microsampling of Archived Test Remnants

Description. Microsamples will be taken from the bone remnants and/or bone powder returned by the three laboratories that conducted radiocarbon dating tests on the skeleton in 1999. These microsamples will be tested for stable isotopes, amino acids and CHN content. Up to three microsamples (each approximately 10 to 100 mg in weight) may be taken from the bone materials returned by each of the 1999 testing laboratories.

Responsible Scientists. The microsamples will be removed by Dr. Thomas Stafford. He will also perform the stable isotope, amino acid and CHN tests. Dr. Peggy Ostrom, Michigan State University, and Dr. Libby Stern, University of Texas-Austin, will assist with interpretation of the test results.

Purpose. Microsampling and testing of the archived 1999 test remnants is needed for: (a) assessing the variability of protein preservation throughout the skeleton; and (b) determining the reasons for the wide variations in data reported by prior investigators. Previous radiocarbon measurements made of the skeleton ranged from 5730 ± 100 to 8410 ± 40 RC yr., and stable isotope results varied from -10.3‰ to -21.9‰. See Table 1 on next page. Descriptions of the quantity and quality of the bone protein preserved in the samples tested by prior investigators ranged from "collagenous" and "plenty of carbon" to "non-collagenous" and "below protein yield acceptable for accurate dating." The best way to determine why the prior test results varied so widely is to analyze remnants from the samples used in those tests. No CHN or $\partial^{15}N$ were reported for the prior tests, and the amino acid data were ambiguous. See discussion in "Microsampling of Collection."

Equipment and Materials. The instruments or supplies to be used for this procedure are described in "Microsampling of Collection."

Precedents. Microsampling of bones to determine their amino acid and CHN content is an accepted scientific practice. Published materials discussing this procedure and analysis of the data include Stafford, et al. (1991) and Stafford (1998). Dr. Stafford has performed this procedure on the Arlington Springs skeleton (National Park Service), which has been dated to 10,950 RC yr. B.P. He has also microsampled bone for law enforcement purposes including prosecutions under ARPA.

TABLE 1

AMS ^{14}C measurements and data reported for the Kennewick, Washington human skeleton

Sample and ID No.	Age, RC yr. BP	Apparent ^{14}C Age and Fm	Lab Number	Fraction Dated	$\partial^{13}C$ ‰ PDB	Comments
5th metacarpal						
APS-CPS-01	8410±60		UCR-3476	Total amino acids	-15.4	Collagenous, well preserved bone; 68.8% of modern protein content
1st right metatarsal						
CENWW.97.R.24 (Mta) DOI-1a	8410±40		Beta-133993	Alkali-washed collagen	-12.6	"Plenty of Carbon"
CENWW.97.R.24 (Mta) DOI-1a	—	"8130±40" Fm = 0.3633±0.0014	UCR-3807	Total amino acids	-10.8	Non-collagenous protein content; 14% of modern
Left tibia, cnemial crest						
CENWW.97.L.20b DOI2a	—	"5750±100" Fm = 0.4889±0.0066	AA-34818	Gelatin	-21.9	Below protein yield acceptable for accurate dating
CENWW.97.L.20b DOI2b	—	"6940±30 Fm = 0.4216±0.0015	UCR-3806	Total amino acids	-10.3	Non-collagen protein composition; 2.3% of modern

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3. Stable Isotope Analyses

Description. If sufficient bone collagen is present, the microsamples obtained from the skeleton and the archived test remanents will be analyzed for stable istopes ($\partial^{13}C$ and $\partial^{15}N$). These analyses will not increase the amount of bone material microsampled (i.e., 10 to 50 mg per microsample).

Responsible Scientists. Dr. Stafford will perform the chemical tests to obtain the needed stable isotope data. The results will be reviewed with outside scientists before a final interpretation is reported.

Purpose. Stable carbon isotope data are used to correct for dietary, diagenetic, and laboratory induced isotope fractionations that affect radiocarbon age calculations. The $\partial^{15}N$ data are used to assess the degree of collagen degradation, and importantly, diet reconstruction. Whether or not marine foods were a dietary component of an individual (such as Kennewick Man) determines the magnitude of the marine reservoir correction that is applied to the radiocarbon measurement. No nitrogen isotope measurements have been reported for the Kennewick Man skeleton, even though it is the $\partial^{15}N$ value that establishes conclusively if the person had a true marine diet or a terrestrial C_4 diet whose carbon isotope signature resembles a marine one. The published $\partial^{13}C$ values for the Kennewick Man skeleton vary from –10.3‰ to –21.9‰. Such a range is too extreme to determine what the appropriate marine reservoir correction should be (or if a marine correction is even warranted).

Equipment and Materials. The instruments or supplies to be used are described in "Microsampling of Collection."

Precedents. Stable isotope analyses are an accepted scientific practice. Published materials discussing this procedure or using the resulting data include Stafford, et al. (1988) and Hare, et al. (1991). Dr. Stafford has performed this procedure on the Arlington Springs skeletal remains (National Park Service), which have been dated to 10,950 RC yr. BP. He has also microsampled bone for law enforcement purposes including prosecutions under ARPA.

4. Radiocarbon Measurement of Calcium Carbonate Concretions

Description. The secondary pedogenic calcium carbonate ("concretions" or "caliche") reported to be adhering to many pieces of the skeleton will be sampled for radiocarbon AMS ^{14}C measurement. The samples will weigh approximately 20 to 100 milligrams each, and will be removed by either a dremel tool or low-speed drill. Up to 20 samples may be taken.

Responsible Scientists. The samples will be removed by Drs. Thomas Stafford and John Foss. Radiocarbon measurements of the samples will be performed by Dr. Stafford.

Purpose. The purpose of this procedure is to determine the ^{14}C /^{12}C value of the concretions. Such concretions were most likely developed by soil forming processes that occurred after the Kennewick Man skeleton was deposited in the ground. Measuring the radiocarbon content of these concretions will help in reconstructing the taphonomic history of the skeleton and in determining appropriate strategies for radiocarbon dating of bone or teeth from the skeleton.

Equipment and Materials. The instruments or supplies to be used for this procedure are described in "Microsampling of Collection."

Precedents. Measuring ^{14}C abundance in inorganic samples, especially caliche, is a standard practice when geochemists need to quantify the amount of modern ^{14}C that enters a geological system (Birkeland, 1974:115-122). For example, the technique was used to determine if recent groundwater was entering bedrock at the Yucca Mountain Nuclear Waste Repository. Archaeologically, Dr. Stafford measured ^{14}C in caliche associated with the Yuha, California human skeleton in order to distinguish ancient caliche from more recent deposits that formed on the rock cairn since the individual's internment (Stafford, et.al. 1987:33-35; Stafford, et, al 1990).

5. Sediment Sampling and Analysis

Description. Small amounts of sediment within the Kennewick Man cranial vault, adhering on bones, and within medulary cavities will be removed for sedimentological examination and geochemical characterization. The samples will weigh approximately 20 to 100 milligrams each, and will be removed by either a dermel tool or hand tools (e.g., brushes, dental picks, etc.). Samples may be taken from up to 30 bones.

Responsible Scientists. Drs. John Foss and Thomas Stafford will remove and analyze the sediment samples.

Purpose. The purposes of this investigation are: (a) to determine if the skeleton-associated sediments are from one stratum or numerous strata; and (b) to provide an independent test of the sediment analyses conducted during NPS' studies of the skeleton in 1999. Sediments removed from the skeleton will be compared with sediments collected by Drs. Chatters and Stafford during the December 1997 survey of the Kennewick Man discovery site. Such comparisons will include analyses of major and trace elements. Some of the questions to be addressed by the investigation include the following: (1) does the cranial vault contain sediments that are younger or older than those adhering to other bones; (2) are there any pedogenic carbonates inside the cranial vault, and if so, are they informative for when the skeleton was deposited at the site; (3) are there visual (non-CT observable) litholologic differences that indicate the skeleton's orientation while it was in the ground; and (4) is it feasible to radiocarbon date any of the sediments filling the cranium. Physical observation and sampling of the adhering and enclosed sediments are essential supplements to CT scans and X-ray images for determining skeletal orientation, deposition stratum, and time of deposition.

Equipment and Materials. The instruments and supplies to be used for this procedure are described in "Microsampling of Collection."

Precedents. Analyses of sediments from the Kennewick Man skeleton were conducted by investigators for NPS.

COLLECTION AND STUDY SESSION IMAGING

The skeleton and the procedures used for its examination will be thoroughly photographed (in both black and white and in color), and x-rays and CT scans will taken of the skull and other key elements. In addition, selected parts of the skeleton will be analyzed by scanning electron microscopy. High quality, scientific grade images can provide information crucial to many of the investigations to be conducted by plaintiffs' study team, and are needed to establish a documentary record that can be consulted by future investigators.

1. Scientific Photography

Description. High quality photographs will be taken of the Kennewick Man skull, dentition, postcranial skeleton and pathological conditions. Images taken will include photographs of various views of the skull (i.e., frontal, left and right laterals, posterior, superior, and inferior views) in standard anatomical position (i.e., in the Frankfort Horizontal). The image record will include 35 mm slides, 4 x 5 inch negatives, and B&W photography. Documentary photographs of the scientists examining the skeleton will be taken periodically. The objective is to create a series of images that comprehensively document the Kennewick Man skeleton and its examination and analysis by the scientific study team. The image record will include digital photographs of the skull by Mr. Carl Hansen. These digital photographs consist of a specially positioned series of images that can be integrated by computer to create high resolution, three dimensional computer models. The resulting 3D files permit observations to be made that are not possible with other imaging systems.

Responsible Experts. The photographic image record will be created by two professional scientific photographers: Mr. Roy Clark (Studio and Scientific Photographer for the National Museum of Natural History, Smithsonian Institution); and Mr. Carl Hansen (Branch Chief of Photographic Services, Natural History Museum Branch, Smithsonian Institution). Other photographs may be taken by individual scientists.

Purpose. The existing Kennewick Man photographic record does not provide sufficient detail to adequately document texture, condition, and morphological features of the bones depicted. The skull is the single most important element of this skeleton, and it should be thoroughly documented. Such documentation is needed so other observers can assess whether the skull was correctly reassembled when it was measured and whether the resulting measurements are reliable. The existing photographic record also does not clearly document the occlusal (chewing) surfaces of the dentition. The pictures of the teeth that do exist suggest a pronounced gradient of anterior to posterior (front to back) differential wear. They also suggest the presence of lingual (tongue side) wear on the mandibular incisors.

Equipment and Materials. Photography of the skeleton will involve the use of studio flash and lighting equipment, support equipment and materials, and cameras and lenses. A list of the specific items will be provided on request. The area to be used as a photographic studio will need to meet the following requirements: (a) a working space at least eight feet wide, eight feet high, and twelve feet deep; (b) a blank wall to which a seamless paper background can be temporarily taped; (c) a sturdy work table at least six feet wide and three feet deep; (d) a chair, preferably on rollers and height adjustable; and (e) access to electrical power.

Photographic Procedures. A table top photographic studio will be set up within the primary study room. This photographic studio should be located in a darkened space, i.e., an area where overhead lighting and ambient room lighting is very low (or completely absent), with normal air circulation to dissipate the heat from the 250 watt halogen modeling lamp. In addition, after the skeleton has been reassembled, Mr. Clark will photograph it in its entirety. This will involve laying the skeleton out on a table covered with photographic background paper, and photographing the skeleton from above using a tall tripod. Set up of the skeleton will require assistance from Drs. Owsley and Hunt and Ms. Bruwelheide. Documenting the reconstruction and study activities will involve relocating the flash equipment to the areas where the individual scientists are working. Such photographs will be taken only as requested by the different scientists.

Precedents. Photographic documentation of human skeletal remains is an accepted and recommended scientific practice (Bruwelheide 2001; Buikstra and Ubelaker 1994). Mr. Clark has accompanied Dr. Owsley on more than 70 visits to federal agencies, museums, universities, and state collections for the purpose of photographing human skeletal materials and their associated artifacts. Mr. Hansen's 360 degree multi-dimensional photographic images can be used to derive unrecorded or new measurements from the cranium. For example, photographs of the Buhl Paleoamerican skull were used to reconstruct 3-dimensional coordinates and measurements that were not originally recorded.

2. X-Ray of Maxillae and Mandible

Description. Prior to reconstruction, the maxillae and the mandible will be x-rayed in order to obtain clear images of the tooth roots and alveolar sockets. Because the left and right maxillary bones are articulated, they will be x-rayed together in left and right oblique-lateral orientations. The mandible fragments will be x-rayed by laying them directly on the cassette.

Responsible Scientist. The x-ray procedure will be supervised by Dr. Owsley or his designated assistant.

Purpose. Clear, properly oriented x-rays of the maxillae and mandible are important for a number of reasons. Among other things, images of the anatomical structure of the teeth can provide data for assessing the biological affinities of prehistoric individuals (see Turner protocol). In addition, the x-ray images are needed to check for pathological conditions and to determine whether the tooth root pulp chambers are open or have been infilled by secondary

dentine (or by sediments). The existing x-rays of the skeleton are not adequate for such observations.

Equipment and Materials. Plaintiffs will arrange to have the x-rays taken at a facility to be named later in Seattle, Washington. All equipment and materials needed for the x-ray procedure will be provided by the imaging facility or plaintiffs.

Precedents. X-rays of archaeological dentition is an accepted and recommended scientific procedure (Bruwelheide et.al. 2001; Buikstra and Ubelaker 1994).

3. X-Ray of Skull

Description. After it has been reconstructed, the skull will be x-rayed in posterior-anterior, lateral and superior-inferior views. The x-ray views will be taken in the Frankfort Horizontal plane where appropriate.

Responsible Scientists. The x-ray procedure will be supervised by Dr. Douglas Owsley or his designated representative.

Purpose. The need for standardized data collection for human skeletal remains has been acknowledged in numerous publications (Buikstra and Ubelaker 1994; Ortner and Putschar 1985: 29-54; Ortner and Aufderheide 1991: 1-2). The documentary record for the Kennewick Man skeleton will not be complete without clear, properly oriented x-rays of the cranium. Such x-rays are needed to assess the sediments filling the inside of the cranium, to evaluate the maxillary and frontal sinuses and to check for pathological conditions. The existing radiographs of the cranium are not adequate for such purposes.

Equipment and Materials. Plaintiffs will arrange to have the x-rays taken at a facility to be named later in Seattle, Washington. All equipment and materials needed for the x-ray procedure will be provided by the imaging facility or plaintiffs.

Precedents. X-ray of prehistoric crania is an accepted and recommended scientific procedure (Bruwelheide et.al. 2001; Buikstra and Ubelaker 1994). X-rays of crania and other bones are an integral part of the documentation process used by the Smithsonian Institution for human skeletal remains that may be subject to repatriation under the National Museum of the American Indian Act and Public Law. To date, more than 15,000 radiographs have been taken. Kennewick Man's cranium was x-rayed as part of NPS' investigations of the skeleton in 1999.

4. X-Ray of Long Bones and Pathological Bones

Description. The long bones (humeri, ulnae, radii, femora and tibiae) and those bones showing possible pathological conditions (e.g., arthritic changes, trauma or infection) will be x-rayed.

Responsible Scientists. The x-ray procedure will be supervised by Dr. Douglas Owsley or his designated representative.

Purpose. X-rays of the skeleton's long bones and pathological bones are an important part of the documentary record that should be compiled for this fossil specimen. The evaluation of pathological conditions in human remains from archaeological contexts relies heavily on radiographic analysis. In addition, the x-rays will be used to determine the presence of sediments within bone cavities and to determine the presence of transverse lines of arrested growth. The existing x-rays of the skeleton do not adequately document all needed information. For bones displaying pathological conditions, the orientation of the element is determined by the lesion and the type of information desired by the reviewer. While standard positioning may sometimes provide the desired views of a condition, in many cases it is most useful to position the bone so the lesion is in closest contact with the film plane and is not obscured by other features of the bone. Multiple views of bones displaying a pathological condition are often necessary.

Equipment and Materials. Plaintiffs will arrange to have the x-rays taken at a facility to be named later in Seattle, Washington. All equipment and materials needed for the x-ray procedure will be provided by the imaging facility or plaintiffs.

Precedents. X-ray imaging of human long bones and pathological bones found in archaeological contexts is an accepted and recommended scientific procedure (Bruwelheide et.al. 2001; Buikstra and Ubelaker 1994; Ortner and Putschar 1981; Otner and Aufderheide 1991; Owsley 1985; Owsley 1991).

5. CT Imaging of Skull and Other Bones

Description. High resolution CT scans will be taken of the skull, humeri, femora, tibiae, right innominate, and ribs. Both the left and right long bones will be imaged, because there may be differential preservation or differences in sediment deposition within the medullary cavities and cancellous bone. Bilateral imaging is appropriate for other reasons. For example, originally the left tibia was broken and damaged but was essentially complete. This bone was extensively sampled by NPS during its studies of the skeleton. Although the right tibia is not as complete, images of this bone may help to reconstruct the original dimensions and features of the proximal left tibia before it was sampled.

Responsible Scientists. The CT imaging procedure will be supervised by Dr. Douglas Owsley or his designated representative. He may be assisted by other scientists, including Dr. David Hunt and Ms. Karin Bruwelheide (M.A.).

Purpose. Comprehensive, high resolution CT scans of key skeletal elements are a critical component of the documentary record that should be compiled for the Kennewick Man skeleton. The CT scan images will be used for interpreting pathology observations, for investigation of the embedded projectile point, and for assessing cross-sectional morphology and properties of the long bones. They will also provide important information for the

taphonomic analysis of the skeleton. In addition, they are needed to help assess the accuracy of prior reconstructions of the skull. Those reconstructions may have been affected by postmortem distortion of the cranium and by mispositioning of some of the midfacial bones. If such effects occurred, prior measurements of the skull may be inaccurate. In addition, the existing CT scan images of the skull show that the cranium once contained layers or laminations of sediment. Determining whether any of this sediment is still present will provide information on the postmortem positioning of the cranium in the ground and the processes that affected the cranium after death. Although CT scan images were previously taken of some of the skeleton, the accuracy of those images has never been confirmed. Independent verification of data is a critical part of the scientific process. In addition, most of both femora were missing when the prior CT scans were taken.

Equipment and Materials. Plaintiffs will arrange to have the CT scans taken at a facility to be named later in Seattle, Washington. All equipment and materials needed for the CT scans will be provided by the CT facility or plaintiffs.

Precedents. CT scan imaging of prehistoric human skeletal remains is an accepted scientific practice. CT scans were taken of selected parts of the Kennewick Man skeleton in 1999 as part of NPS' investigations of the skeleton.

6. Laser Scan of Skull and Other Elements

Description. A portable, handheld, laser scanner will be used to obtain digital measurements of the skull, the right innominate and other bones with unique features (e.g., fractured ribs). The scanner projects a fan of laser light on an object while cameras on the wand view the laser light from different angles and use the reflected light to record the three-dimensional surfaces of the object. This scanning system produces external surface data that are accurate within 0.025 mm. Images of the scanned object are visualized as 3D models in real time on a computer monitor, thus permitting the images to be viewed before the data are saved to disk.

Responsible Expert. Mr. Robert Francis of Pacific Survey Supply, Medford, Oregon, will conduct the scanning and data recording process. Mr. Francis has 20 years of experience involved with high precision laser scanning, implementation of various surfacing and modeling softwares, and production of models by stereo lithography.

Purpose. The purpose of the laser scan is to obtain and record accurate 3D models of the shapes of the skull and other scanned bones. Such models can be used in a variety of ways including the following: (a) to verify measurements and other data obtained by other investigators; (b) to provide data for adjusting measurements of the skull or other bones to compensate for any postmortem deformation or damage; (c) to visually compare the skull with skulls of other prehistoric (and modern) individuals; (d) to produce casts of the skull and other scanned bones. The data obtained will be recorded in a coordinate based STL file that can be archived in industry-standard formats for access by future investigators.

Equipment and Materials. The scanning process will be conducted at the Burke Museum. It will involve the use of lighting equipment, cameras, and a computer. A list of the specific items will be provided on request.

Precedents. The U.S. Fish and Wildlife Service National Forensic Laboratory in Ashland, Oregon, has retained Mr. Francis and Pacific Survey Supply to install a system for scanning skeletal remains for forensic investigation and analysis. Pacific Survey Supply is also working with archaeologists and forensic scientists on the CSS H.L. Hunley Confederate Civil War submarine project, a project administered by the U.S. Navy and the Friends of the Hunley Organization. Analogous technology (i.e., stereo lithography) was used to produce a cast of the skull of the Spirit Cave Mummy (Bureau of Land Management).

7. SEM Bone Analysis

Description. Selected bones, bone fragments and/or teeth will be analyzed by scanning electron microscopy ("SEM") to determine if the structure or composition of the bone has been affected by natural or other processes. Such analysis will be conducted in the following stages:

Stage 1. Samples for examination will be selected on the basis of gross surface morphology and other characteristics.

Stage 2. The samples will be examined by SEM, and possibly by environmental microscopy for those images requiring greater cross-sectional depth of field. Documentation will be obtained concerning modification of bone microstructure features such as osteon structure, Haversian canals, and hydroxyapatite crystals in which collagen fibrils are embedded, and for other characteristics such as surface cracks, pits, and mineral replacement. Wavelength dispersive spectroscopy (WDS) will be used for quantitative material analysis and will focus on the examination and documentation of bone or tooth degradation and mineral replacement.

Stage 3. The SEM and environmental microscopy images will be analyzed to reach a final assessment. The assessment will incorporate relevant data from other procedures and observations by the members of the taphonomy study team.

Responsible Scientists. Dr. Wayne Smith will supervise the sample selection and the image taking procedures. He will help interpret the images. Other experts including various members of the study team may assist in preparation of the final assessment.

Purpose. Many factors can affect the structure, composition and strength of bones and teeth. Such factors include fungal agents, bacterial agents, ground water fluctuations, sediment loading, freeze-thaw cycling, etc. Determining how such factors have affected the Kennewick Man skeleton will help to reconstruct its taphonomic history and to assess preservation variability throughout the skeleton.

Facilities. The SEM (and environmental microscopy images if needed) will be made at a facility to be named later in Seattle, Washington.

Precedents. During the last two decades taphonomists have made increasing use of scanning electron microscopy to examine the micromorphology of bone structure and the characteristics of specific bone features. References to studies of this nature include: Bonnichsen 1979; Johnson 1985; Johnson and Shipman 1986; Shipman and Rose 1983; and Shipman et. al. 1984.

8. Dental Peels of Occlusal Surfaces

Description. Nondestructive molds of the occlusal surfaces of the maxillary and mandibular anterior dentition and molars will be prepared so that high resolution casts can be made. Casts from the molds will be prepared at Johns Hopkins University and examined by SEM. Prior to making the molds, the dentition will be gently cleaned with acetone and alcohol using cotton swabs and then air-dried. President Plus Jet regular body will then be placed on and around the maxillary and mandibular arches covering the crowns and cemento-enamel junctions of the teeth in order to create a mold (negative) of the dentition. The President Plus Jet regular body will be removed after the material is fully cured. It is a noncorrosive substance and will not damage the skeleton.

Responsible Scientists. The molds will be made by Dr. Mark Teaford and/or Ms. Kate Spradley. SEM examinations of the casts will be performed at Johns Hopkins University. Anterior dentition images will be interpreted by Dr. Peter Ungar at the University of Arkansas. Posterior dentition images will be evaluated by Dr. Teaford. Both scientists have extensive experience and large data bases for comparison with the Kennewick Man skeleton, including North American population data.

Purpose. The purpose of the study is to observe and record microscopic wear patterns on the dentition. Analysis of dental wear patterns can provide data for reconstructing dietary habits and different aspects of ancient lifestyles. For example, certain patterns of wear are indicative of reliance upon stone-ground plant foods. Other patterns may reflect repetitive work activities, such as the use of teeth to separate plant fibers. Micro-wear patterns have also been used to evaluate homogeneity of jaw movements during mastication.

Equipment and Materials. The following equipment and materials will be used: cotton swabs; acetone; alcohol; paper towels; plastic ziplock bags; tooth picks; dental vibrator; latex gloves; pencil; Sharpie marker; recording forms, disposable beakers; plastic spoons; Coltene President Plus Jet regular body (surface activated); Coltene President putty soft base and catalyst. If a stereozoom microscope is available at the Burke Museum, permission will be requested to use it for this examination.

Precedents. Collection of data concerning dental wear is a recommended component for the documentation of skeletal remains found in archaeological context (Buikstra and Ubelaker 1994). See also Harmon and Rose (1998) and Powell and Steele (1994).

STUDY SCHEDULE

Subject to the assumptions and requirements described elsewhere in this Plan, plaintiffs estimate that their examination and study of the skeleton can be completed in approximately twelve (12) working days. The first seven days will be devoted principally to reassembly of the skeleton, imaging, sample collection and taphonomic investigations. The final five days will be devoted to other measurements and observations. Figure 2 provides an overview of how the various studies and other procedures will be scheduled.

Some components of the study plan will need special scheduling arrangements. They include the following:

Initial X-Rays

Plaintiffs plan to take x-rays of the mandible, maxillae, right innominate and selected other bones (e.g., both femora, humeri, and tibiae) before those skeletal elements have been reassembled. It is anticipated that these x-rays will be taken on the afternoon of the second day to avoid delaying the reassembly of the skeleton. Since the Burke Museum does not have x-ray facilities, plaintiffs will arrange to have the necessary images taken at a facility to be named later in Seattle, Washington. Defendants will need to provide security and transportation to and from the x-ray facility.

SEM Examination

A scanning electron microscope ("SEM") examination will be made of the visible portion of the projectile point lodged in the skeleton's hip and of other selected elements and fragments. It is anticipated that this examination will be made on the second work day of the study session either concurrently with or after the x-rays. Since the Burke Museum lacks the necessary facilities, plaintiffs will arrange to have the examination performed at a facility to be named later in Seattle, Washington. Defendants will need to provide security and transportation to and from the SEM facility.

CT Scans and Additional X-Rays

CT scans and x-rays will be taken of the skull and selected long bones after they have been reassembled. It is anticipated that this procedure will be performed on the seventh work day of the study session. Since the Burke Museum lacks the necessary facilities, plaintiffs will arrange to have the CT scans and x-rays taken at facilities to be named later in Seattle, Washington. Defendants will need to provide security and transportation to and from the CT scan and x-ray facilities.

Figure 2
Proposed Study Schedule
Note: photography will be conducted throughout the study session.

Work Day 1 Layout of Skeleton Start Reassembly Projectile Point Inspection Taphonomic Observations Microsampling of Test Remnants	Work Day 2 Reassembly Taphonomic Observations Dental Peels PM: Initial X-Rays SEM Examination
Work Day 3 Reassembly Reconstruction Taphonomic Observations Sediment Sampling	Work Day 4 Taphonomic Observations Bone Microsampling
Work Day 5 Photography of Laid Out Skeleton Laserscan	Work Day 6 360° Photography of Skull Laserscan
Off Day No work at the Burke Museum	Work Day 7 Measuring and Observations AM: CT Scans and X-Rays
Work Day 8 Measuring and Observations	Work Day 9 Measuring and Observations
Work Day 10 Measuring and Observations	Work Day 11 Measuring and Observations
Work Day 12 Measuring and Observations	

ASSUMPTIONS AND REQUIREMENTS

Successful completion of the studies and procedures described in this Plan and adherence to the projected work schedule are dependent upon the following assumptions and work requirements.

Minimum Advance Notice

It is assumed that at least 90 days will be allowed for scheduling of the study session after plaintiffs have received defendants' approval of the Study Plan. Such advance notice is essential to enable plaintiffs and the other study team members to arrange their teaching duties, speaking engagements and other commitments to accommodate the dates selected for the study session. 90 days is the minimum notice needed for such purposes.

Available Facilities

This Study Plan is based upon the assumption that plaintiffs and the other study team members will have the use of three rooms at the Burke Museum during the study session. Use of multiple rooms is necessary so that different studies and examinations can be conducted simultaneously. Without such concurrent scheduling of activities, it will be impossible to complete all needed studies and procedures within the work period projected in the Plan. Such an arrangement will also reduce congestion in the study areas and will help to create a productive work environment that is free of unnecessary noise and other distractions. In addition, it will help to maintain more stable temperatures and RH levels in the work areas.

The rooms will be used for the following purposes and should be equipped as noted below:

Room 1. It is assumed that one of the rooms will be the same L-shaped room used by NPS for its studies of the skeleton in 1999. This room will be used for photography, sample collection, and reassembly and study of the postcranial skeleton. It should be equipped with three work tables (six feet long), ten chairs, two small tables (approximately three feet square) for holding equipment, and at least four power outlets.

Room 2. This room will be used for reconstruction and examination of the cranium. It should be at least eight by ten feet in dimensions, and should be equipped with one work table (six feet long), four chairs and at least two power outlets.

Room 3. This room will be used for meetings and communications, and as a work station where scientists can review their study data before concluding their examinations of the skeleton. It should be at least eight by ten feet in dimensions, and should be equipped with one work table (six feet long), eight chairs, at least four power outlets, a telephone and an internet connection. Use of the room during the study session should be limited to plaintiffs' study team.

Photocopies. Plaintiffs and the other study team members will need access to a photocopy machine at a location convenient to the study area so that they can make copies of examination notes, report forms and other documents. The photocopier should be equipped with a feature that permits charges to be debited to a designated account (up to a prepaid limit).

Security and Transportation

The Study Plan assumes that the Army Corps will provide security and transportation for the off-site x-ray, CT scan and SEM sessions. The Army Corps is the most appropriate party to provide the necessary arrangements given its past experience with these matters for prior studies of the skeleton.

Collection Sorting and Layout

The Study Plan assumes that all bones and fragments that have been sorted or laid-out in anatomical order by the study team will remain sorted or laid out until the study session is finished. Such a set-up procedure is important for a number of reasons. First, it will reduce unnecessary handling of the collection, thereby minimizing any possible risks of inadvertent damage. Second, productive taphonomic analysis of the skeleton requires that the investigators be able to view the entire collection as an integrated unit so that each bone and fragment can be assessed in relation to all of the others. Third, the study session cannot be completed within the proposed time period if key parts of the skeleton must be reassembled at the beginning of each work day. The time lost meeting such a requirement would extend the study session by an unknown number of weeks.

This set-up procure is an accepted scientific practice. For example, Dr. Owsley and his examination team have used this procedure for numerous skeletal remains held in federal collections.

Stabilization of Reconstructed Elements

The Study Plan assumes that reconstruction of key elements of the skeleton (e.g., skull, long bones, selected ribs) will involve the use of a reversible glue so these elements will remain stable throughout the study session. Such stabilization is essential to ensure the accuracy of measurements and to eliminate the potential for interobserver differences in measurements due to variations in how the skeleton has been reconstructed. It will also avoid the need for repeated refitting of the affected skeletal elements, thereby reducing possible risks of inadvertent damage. The glue that will be used is Acryloid B-72 (or an equivalent). Consultation with conservators has identified Acryloid B-72 as a safe, predictable, stable and reversible adhesive that is appropriate for use in the circumstances involved here (Koob 1996).

This procedure is an accepted scientific practice. Dr. Owsley and his examination team have used it on many occasions when studying skeletal remains held in federal collections.

Coordination Visit

Approximately 30 days prior to the study session, a delegation of study team members will visit the Burke Museum to inspect the collection and the facilities to be used for examination of the skeleton. Discussions also will be initiated with Army Corps representatives concerning arrangements for the study session. It is hoped that such advance coordination and consultation will help to ensure a productive and harmonious study session.

Unforeseen Delays

The time period projected in this Plan for the study session assumes that the investigators will not encounter any significant delays due to work conditions or other causes beyond their control. None of the study team members has seen the skeleton or any of the facilities available for its study other than Mr. Clark and Drs. Chatters and Owsley. Their opportunity to observe relevant conditions were limited, and in the case of Dr. Chatters occurred long before its present curation arrangements took effect. As a result, many parts of this Study Plan have been prepared in reliance upon secondhand information and/or assumptions which may not reflect accurately all of the conditions that might impact study of the skeleton. If any delays are encountered due to unanticipated conditions, it may be necessary to extend the study session or reschedule some of the procedures to be performed.

OTHER CONSIDERATIONS

Avoiding Unnecessary Congestion

In order to complete the study session within the projected work period, it will be necessary on occasion to have as many as seven study team members in room 1 and five in room 2. To avoid overcrowding, plaintiffs request that the Army Corps assign no more than three persons (including conservators and Burke Museum personnel) to duty at any one time in room 1 and no more than one person to room 2. Too many people in a small confined space is distracting and will elevate room temperatures and RH levels.

Observers

For past studies of the skeleton, it was the practice of NPS to allow outside observers into the study room so they could watch the activities being conducted. Such a practice is inappropriate because it contributes to overcrowding and increases the amount of traffic into and out of the study areas. If observers are invited to view plaintiffs' study session, they should be provided with a separate room where they can view the session via closed circuit television.

Substitutes

Plaintiffs reserve the right to appoint a substitute for any study plan scientist who is unable to attend the study session because of illness, family emergencies or other unavoidable circumstances. Plaintiffs will promptly notify the Army Corps of any such substitutions and the identities of the substitutes appointed.

Other Tests

No request is being made in this Study Plan for samples to be used for radiocarbon dating or DNA testing because the chemical characteristics of different parts of the skeleton are presently unknown. If microsampling of the skeleton indicates that some of the bones are suitable candidates for dating, DNA testing, or both, this Plan may be amended to request samples to be used for such purposes. It may also be amended to request samples for other tests or procedures found to be needed or warranted after the results of this initial study session have been analyzed.

Other Investigators

Depending upon time availability, other specialists may be invited to participate in plaintiffs' investigation of the skeleton. If any are invited, their names and proposed studies will be provided to the Army Corps prior to commencement of their examination of the skeleton.

Sequencing of Events

During the study session, plaintiffs' study team may encounter circumstances not anticipated when this Study Plan was prepared. Accordingly, plaintiffs reserve the right to alter the sequence in which the various studies, tests and procedures will be conducted. If any such changes become necessary, plaintiffs will give the Army Corps as much advance notice as possible under the circumstances.

Sharing of Data

The data obtained by plaintiffs' study team will be made available to other researchers interested in these matters. Plaintiffs will provide to the Army Corps, without charge, a copy of the final reports issued by plaintiffs' study team. If requested, plaintiffs will also provide to the Army Corps, at cost, copies of the photographs taken by Mr. Clark and Mr. Hansen, and copies of the x-rays and CT scans taken during the study session.

Attribution of Views

The descriptions contained in this Study Plan of the different studies, tests and procedures to be conducted by plaintiffs' study team reflect the views and research interests of the persons who drafted those descriptions. Their statements should not be interpreted as reflecting the perspectives of all study team members as a group, some of whom may have differing views on particular issues.

LIST OF SCIENTISTS AND EXPERTS

Unless a substitute is otherwise designated, the scientists and experts who will participate in the study session at the Burke Museum are as follows. Biographical information will be provided on request.

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