CRL Report 4: Conserving the human skeleton found aboard *La Belle*

La Salle Shipwreck Project
Texas Historical Commission

Throughout each year, the Conservation Research Laboratory conserves material from a number of different archaeological projects. The purpose of these CRL reports is to showcase the conservation procedures used to treat some of the more interesting archaeological material. The conservation of the human skeleton is presented in this report. The *Belle*, one of the ships of French explorer Robert Cavelier, Sieur (Lord) de La Salle, was lost in Matagorda Bay, Texas in 1686. It was excavated by the Texas Historical Commission.

Skeletal material always creates a lot of attention and interest among the public, and the articulated remains of an individual found on a forward deck in the hold of the *Belle* was no exception. Extensive news coverage was given to this particular find.

The human skeleton from the *Belle* was discovered by archaeologists from the Texas Historical Commission (THC) on October 31, 1996. It was delivered to the Conservation Research Laboratory soon after it was removed. In the last few years, it has undergone conservation, various analyses, and we even managed to reconstruct the face.

Due to the anaerobic burial conditions, the skeleton was in excellent condition. In fact, the burial environment was so good that a large amount of tendon tissue remained on various bones and, most significantly, a large portion of the brain was preserved in the cranium. Since the cranium contained brain tissue, it had to be kept inverted to keep it from falling out of the foramen magnum. This is the reason that the conservator in the image to the right is holding the skull in an inverted position.

Drs. Donny Hamilton and Wayne Smith decided that the *Belle* skeleton would be an excellent case study to demonstrate to the lay public the technology now available that can assist archaeologists in interpreting archaeological data. The project described here is the result of a

number of specialists and technologies, all coming together to present an in-depth view of conservation and archaeological analysis. The project was undertaken with the permission of the Texas Historical Commission.

BONE CONSERVATION

In most instances, the conservation of bone is a fairly straightforward process. In the case of the *Belle* skeleton, the first problem to be confronted resulted from the fact that bone is porous - having being sumerged in sea water for over three centuries, the skeleton had absorbed soluble salts. These salts had to be removed to stabilize the bones. To do this simply meant that the bones had to be rinsed in running tap water, followed by successive baths of de-ionized water. The bones were then dried by putting them through successive baths of ethanol and acetone. The skeleton was then consolidated in polyvinyl acetate V15 in acetone under a vacuum.

As the bones were undergoing the water rinses, tissue samples were removed and placed in small vials filled with 50 percent water / 50 percent ethanol. Each vial was labeled as to location and possible type of tissue sample. Selective samples of the brain material were collected in the same manner. Some of the samples were taken to the Archaeological Preservation Laboratory for conservation treatment with silicone oils. This is to determine whether silicone treatment can be used to preserve tissue for indefinite periods without adversely affecting the DNA in the tissue samples. A final decision has not been made on how best to treat the remaining brain tissue.

The skull with the enclosed brain, as well as the mandible, are currently being stored in 50 percent water / 50 percent ethanol bath until it can be determined what tests might be run on them.

FACIAL RECONSTRUCTION TECHNOLOGY

In connection with a Paleo-Indian facial reconstruction project in 1996, the Conservation Research Laboratory staff members were contacted by representatives from CyberForm International (CFI) in Richardson, Texas, informing us of a new casting procedure called stereolithography that could produce an exact replica of the skull -- both exterior and interior features -- without making a mold. At the time, we did not have a project in mind for the proposed technology; however, when the individual was found on the *Belle*, Dr. Wayne Smith got in touch with CFI and arranged for the project. The facial reconstruction project described here required three major steps:

- a computer tomograph scan
- a stereolithography cast of the skull
- a skilled technician to model the face in clay and make the molds

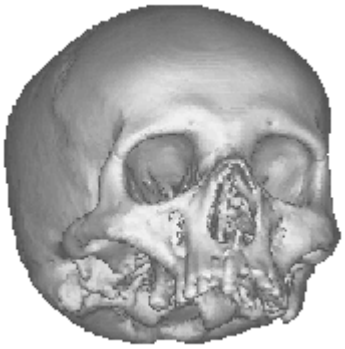
COMPUTER TOMOGRAPHY SCAN

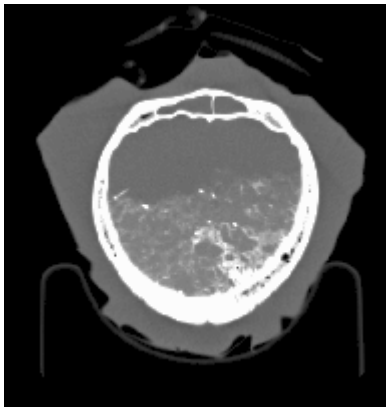
The first step in making a replica of the skull from the *Belle* was to have it scanned using a computer tomography (CT) scan. In March 1997, the Texas Scottish Rite Hospital for Children in Dallas, Texas, graciously volunteered their technicians and their newly installed Phillips Tomograph AV to do the scan. The CT imaging technicians at the hospital made very fine,

detailed 3-D digital images of the skull. Significantly, the CT scan showed the extent of the remaining brain tissue and provided us with the first volumetric indication of the amount of brain present. Despite various media accounts, no evidence of a pointed metal object was found in the skull. A small pebble was found in the cranium that probably accounts for the shadow that showed up on the CT scan.

Above left, Wayne Smith of Texas A&M University, Lois Liehman, the computer tomograph technician from the Texas Scottish Rite Hospital for Children, and Marc McAllister of CyberForm International prepare the skull for the CT with a new Phillips Computer Tomograph AV. Above right, the scanned skull.

The CT scan produced a digital 3-D image that recorded all of the diagnostic features of the skull. These data, which are stored on a computer disk, are a permanent part of the archaeological record of the skeleton. The digital image can be viewed at any time and from any perspective (see below). It can be also used to make additional casts of the skull in the future if the need arises.





The gray shadow is formed by the liquid-filled plastic bag containing the skull. The cloudy area inside the cranium is produced by the preserved brain tissue. The white area represents a cross section through the bone of the skull.

Note the bad dentition, missing teeth, and abscesses.

STEREOLITHOGRAPHY CAST

After securing the CT scan, Marc McAllister of CyberForm International took the digital data, and by a casting process called stereolithography, made two exact resin replicas of the skull (below). To the left of the two skulls is a resin cast of the brain in the cranium, which corresponds to the cloudy area in the center CT digital image above. The resin brain cast (below, left) clearly shows the volume of brain remaining in the skull.

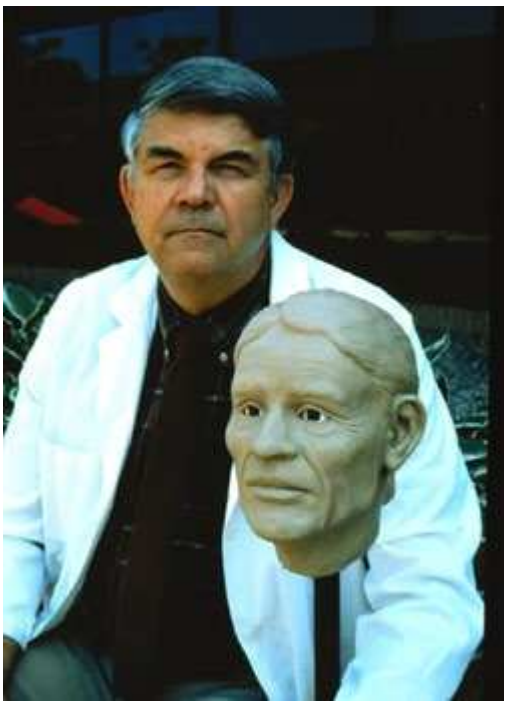
FACIAL RECONSTRUCTION - AN EXAMPLE FROM THE *BELLE*

The analysis of the skeletal remains of the individual found in the hold of the *Belle* is a very good example of the range and extent of the technologies used by archaeologists to flesh out the

archaeological data and, in this case, literally put a face on history. Reconstructing the faces of various historic figures has been in vogue for some years, but the process is not well understood by the public or even professional archaeologists. *Making Faces: Using Forensic and Archaeological Evidence,* by John Prag and Richard Neave, Anthropology Series, Number 1, Texas A&M University Press, 1997, is an excellent publication that describes the procedures in detail. A number of case studies, including King Philip II of Macedon, are presented.

All facial reconstructions start with a cast of the skull, for the face is modeled in clay directly onto the cast. This process requires a trained specialist, for it involves a thorough knowledge of the musculature of the face and the hands and eyes of a sculptor. Professor Denis Lee, a medical and biological illustrator in the School of Medicine at the University of Michigan, volunteered his services for the *Belle* project.

Before any facial reconstruction can begin, everything possible must be known about the individual. From a preliminary skeletal analysis, Dr. Gentry Steele of the Department of Anthropology at Texas A&M University determined that the sailor from the *Belle* was definitely a male of European stock, was at a minimum 5'3" and a maximum of 5'7" height, was approximately 35-45 years of age at death, suffered a break on the left side of his nose well before his death, and suffered from low-back pain. He had lost a number of teeth prior to this death, and at the time of his death had a number of bad caries and abscesses that had eaten through the bone just above the upper left teeth. All of these data were taken into consideration by Dr. Lee.



Professor Denis Lee puts the final touches onto the clay face molded directly onto the stereolithography cast. The next step is to make a flexible mold of the clay model so that a more permanent plaster-of-Paris cast can be made.

An unpainted version of the plaster cast

A cast that Professor Lee painted for a more life-like appearance

It should be remembered that there is no way to determine the color of the eyes or hair or the exact shape of the ears. Also, most men of this era wore beards. Considering the fact that this individual was stranded in the wilds of coastal Texas in 1686, he probably had a rather unkempt beard and hair. These facial hair features were left off to show the features of the face. In addition, he probably was more emaciated and weather-worn at the time of his death because of the endured hardships. This facial reconstruction shows him more as he might have looked on leaving France in 1685 and is a face that his mother and close acquaintances would probably recognize.

DNA ANALYSIS

Still pending is a DNA analysis of the samples of tissue and brain from the *Belle* sailor. The DNA profile will be compared against the gene profile of Western Europeans, and it may provide researchers with a means to associate him with modern relatives. One area of interest to be investigated is the possible identification of this individual to the name 'C. Barange,' found engraved on a pewter porringer located near the skeleton. Recent inquiries have found that there are Barange families living today in La Rochelle, France. Is the individual found on the *Belle* a Barange and might he be related to the Barange families living in the same port city from which the *Belle* set sail some 314 years ago? DNA studies should be able to answer these and other questions. More will be reported here and on the Texas Historical Commission web pages as more data on this fascinating study gets underway.

Citation Information:

Donny L. Hamilton
1997, Conservation of the Skeleton from the *Belle*, Conservation Research Laboratory Research Report #4, World Wide Web, URL, http://nautarch.tamu.edu/CRL/Report4/skeletal.htm, Nautical Archaeology Program, Texas A&M University; La Salle Shipwreck Project, Texas Historical Commission, Austin, Texas.

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1997, Conservation of the Skeleton from the *Belle*, Conservation Research Laboratory Research Report #4, World Wide Web, URL, http://nautarch.tamu.edu/CRL/Report4/skeleton-2.htm, Nautical Archaeology Program, Texas A&M University; La Salle Shipwreck Project, Texas Historical Commission, Austin, Texas.

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