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A Mummy Mystery: Analysis of a Badlands Cave

by Andy Morris

(Honors Biology 103)

The Assignment: Characterize the remains of a human as to archeological age and vital statistics, and author a paper of the research that follows a professional format.

Abstract

The identification of an archaeological find and unknown human remains requires the analysis of the various artifacts and evidence within the site. This study examined the remains of a mummified human cadaver and related artifacts excavated from a cave in Badlands National Park, South Dakota, to reconstruct the site and the unknown human cadaver found within it. Carbon-14 dating was used to date the individual samples and provide the general relationship between the human remains and the other associated artifacts. A student t-test was conducted to determine the statistical age differences between the samples. An analysis of the structure and development of the preserved human skeleton was used to determine important anatomical characteristics of the individual. Comparison of the analyses of the different samples served to provide a better understanding of the site and the mummified body found on it. The human cadaver was found to be a 30-40 year old male at time of death and was dated around 5,378 years old. Analysis of the different samples suggests that the individual probably died from an illness caused by a tapeworm parasite.

Introduction

The analysis of an archaeological find requires the joint examination and interpretation of the various artifacts uncovered within the site. A former cave discovered by paleontologists in Badlands National Park, South Dakota, was found to contain the remains of an unknown mummified human cadaver and other artifacts. The cave entrance had been sealed by a prior rockslide, which preserved the human remains and other artifacts within the cave. The research and interpretation of the human remains and other evidence is essential to the analysis of the cave site and the unknown mummified cadaver. Researchers utilize many different analytical techniques in addressing an archaeological site and analyzing the remains within it.

The analysis of human bones is also a basic tool to evaluate a site and the identity of an unknown individual. Osteology and bone analysis examines the structure and development of human bones to determine various features and traits of an unknown individual. Particular human skeletal remains can be examined for structure and growth to determine important anatomical features as height, sex, and age (Bruce 2001, Ubelaker and Scammel 1992).

The known history of the area can also aid the analysis of the cave site. Badlands National Park and the surrounding plains have been the home to various native cultures for over 11,000 years. The mummified cadaver belonged to the Early Plains Archaic Period, in which Paleo-Indian groups inhabited the northwestern plains (Fagan 1995). Around the time of the mummified individual, various native cultures descending from the ancient Clovis culture are believed to have occupied the Badlands area and lived as hunter-gatherers. They survived primarily on the hunting of bison, smaller game animals, and plant foraging (Fagan 1995). Excavations of known Clovis and other Native American sites have yielded evidence that early cultures relied heavily on the hunting of bison and other game to provide food and other necessary materials (Fagan 2001).

This study is an attempt to examine and analyze an archaeological site and an unknown human

cadaver found within the Badlands National Park. The discovered cave provided various artifacts as evidence to the identity of the site and the mummified cadaver. The results of the study provide data to determine approximate age of the uncovered materials and their relationship to each other within the context of the site. The findings help determine the basic characteristics and identity of the mummified human cadaver.

Methods

The study was conducted on various artifacts and samples acquired from a former cave in Badlands National Park, South Dakota. The samples examined included a complete human skeleton, a cyst-infested human liver, human tissue containing the remains of insects, complete skeletons of an adult wolf and seven puppies, and charcoal drawings on the walls of the cave. The remains were discovered in a cave measuring 3 m. in height, 10 m. in depth, and 4 m. in width.

The approximate age of the human remains and other associated artifacts were determined through carbon-14 dating. One sample from each wolf and insect specimen and 8 samples from the human cadaver, cysts, and charcoal drawings were subjected to the carbon-14 dating. This method of dating provided a sample mean and standard deviation for the approximate age of each sample. The statistical differences in age between the human skeletal remains and the other materials (cysts, charcoal, insects, and wolf skeletons) were calculated using a student t-test. Student t-tests and a statistical significance at $p < 0.05$ were used to analyze the statistical age difference between the samples and the probable relationship between the human remains and the other artifacts.

The height of the assembled skeleton was measured, and weight was estimated based upon obtained height (Bruce 2001). The gender, age, and other identity markers of the mummified individual were obtained by analyzing the bone characteristics. Particular areas of the bone, such as cranial sutures, were analyzed to determine the basic measurements and characteristics of the unknown human skeleton. Different areas on the human skeleton were examined as anatomical markers to identify important characteristics of the individual.

Results

The carbon-14 dating provided an estimated age for the human remains and other associated artifacts (Table 1). The statistical differences between the human remains and the other samples varied. As expected, the student t-tests concluded that the human skeletal remains could not be shown to be statistically different in age from the cyst-infested liver ($t = .760$; $p = .460$; $df = 14$) or the insect material found throughout the body ($t = 1.049$; $p = .312$; $df = 14$). The charcoal samples proved to be significantly older than the human remains ($t = 13.005$; $p < .001$; $df = 14$), while the wolf remains appeared much younger ($t = 160.710$; $p < .001$; $df = 14$).

Examination of the individual samples provided information of the identity of the human cadaver. Measurements of the human skeleton determined the individual's height to be close to 1.58 m and have an approximate weight of 61.4 kg. The analysis of the skeleton's pelvic bone structure distinguished the individual as male. The skeleton's smaller pubic arch (less than 90°) and less open, heart shaped pelvic inlet identify the remains as male (Van DeGraaff 1998). Examination of the skeletal structure also determined the individual to be between 30 and 40 years of age. The full emergence of the individual's teeth, ossification of the sutures, and the almost complete closure of the cranial sutures suggest that this is a mature skeleton and probably over 30 years old (Bruce 2001, Van DeGraaff 1998). The lack of bony outgrowths on the vertebrae, lack of eroded teeth, and the clearly visible sutures on the skull suggest that the individual was not very old at the time of death (Ubelaker and Scammel 1992). The cysts within the liver were found to be hydatid cysts, which would have resulted from the tapeworm parasite, *Echinococcus granulosus*. The male was the intermediate host for parasite's larval form.

The insect specimens found within the mummified human tissue provided details on the death of the human cadaver. The human remains contained individuals from *Dermestes maculatus*, *Creophilus*

maxillosus, *Silpha lapponica*, and *Cynomyopsis dadaverina*. The first three species are scavenger beetles and the latter a calliphorid fly, which reside in and feed on carrion (Elzinga 2000, Borrer and White 1998). Each of these beetles infests dead material in a specific order and at a particular period of decomposition (Gullan and Cranton 1994).

Discussion

The earlier date of the charcoal drawings shows that the mummified individual could not have created the images of the bison and deer and must have inhabited the cave at a much later time. The 600-year difference does indicate relative long-term use of the cave by humans. Likewise, the significant age difference between the human skeletal and wolf remains determines that they also could not have occupied the site at the same period of time. Animals other than humans evidently also utilized the cave. The adult wolf may have been a parent of the pups, but this and the possible causes of the wolf deaths were not explored.

The presence of the tapeworm-infested liver may provide a reasonable explanation for the death and health at time of death of the individual. The tapeworm, *Echinococcus granulosus*, is a widely common parasite which causes hydatid cysts within human livers and other areas of the body. The larval form of the tapeworm infests the liver, causing hydatid disease in humans. Hydatid disease may lead to the emergence of serious health problems, as ruptured cysts may cause anaphylactic shock, fever, and harm other organs (Anwar et al. 1991). The parasites are transmitted from the intermediate host of grazing animals to humans by ingestion of the eggs by hand-to-mouth transmission (Anwar et al. 1991). The individual is likely to have ingested the tapeworm eggs, as Paleo-Indians relied primarily on hunting game animals and foraging for plants for food (Fagan 2001). The individual would have picked up parasitic eggs as he handled unsanitary plant or animals material containing feces matter. The hydatid disease infection would have weakened the individual and may also have led to his death.

The evidence of carrion and scavenger insects within the human tissues and mummification further supports this. The diseased individual would have used the cave as a shelter to rest and would not have been properly buried if he suddenly died from the hydatid cysts. The exposure to the environment would have allowed scavenger insects to feed on the decaying material and also would have promoted the natural mummification of the cadaver. The small amount of insects found in the body probably meant that the cadaver had limited decay and was mummified not long after death. The individual probably died in winter, in which the cold, dry temperatures would have limited decay time and increased the mummification process. Winter would also have reduced the number of available insects to infect the cadaver. The cave environment may have exposed the cadaver to a relatively dry, cold, and windy environment, which would naturally mummify the individual's body (Zivanovic 1982).

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Table 1. Summary (\bar{x} + SD years; all n=8) of carbon-14 data of tissues from the human cadaver and also associated artifacts found in a cave in Badlands National Park, South Dakota.

Item	Mean \pm standard deviation
Human skeletal remains	5379 \pm 79
Insects in human remains	5342 \pm 59
Hydatid cysts in the liver	5352 \pm 56
Charcoal drawings	5974 \pm 103
Wolf remains	403 \pm 38