

CASE REPORT

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Alterations in Human Bones and Teeth as a Result of Restricted Sun Exposure and Contact with Corrosive Agents

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ABSTRACT: Skeletal remains were discovered in an unused cistern near the Omaha, Nebraska airport and were positively identified through comparison of antemortem and postmortem dental radiographs. Although nearly nine years had elapsed between death and discovery, the bones and teeth revealed evidence of the application of a corrosive substance at or about the time of death, as well as an unusual restricted response to sun exposure, that contributed to the prosecution and murder conviction of a member of Hell's Angels in the Omaha area.

KEYWORDS: physical anthropology, odontology, musculoskeletal system, human identification, corrosion

Areas of erosion and discoloration of the bone surface frequently provide useful clues for the forensic anthropologist on the history and disposition of human skeletal remains. Areas of bleaching on the bones usually offer evidence of sun exposure or some other agent causing rapid and differential loss of organic elements. This case presented evidence on an unusual pattern of sun exposure that helped explain events between death and discovery. In addition, this case was illustrative of the effects of external corrosive agents apparently applied to the skull and teeth in an effort to thwart identification.

Case Report

On 1 Dec. 1975, the Douglas County Sheriff's office, Omaha, Nebraska, received a Missing Person Report of Mary K. Harmer, a 19-year-old white female from Omaha. Investigation concluded that she may have been abducted and murdered by Hell's Angels of the Omaha area. For 8¹/₂ years, despite numerous excavations of suspected yards and fields, she remained missing until 16 April 1984 when her skeleton was found in an unused cistern in Carter Lake, Iowa near the Omaha airport. The skeleton was examined by local officials and eventually sent to Ubelaker at the Smithsonian through the FBI. Positive identification had

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been established by Dr. Robert Sorenson of Omaha through comparison with dental records. This identification was verified by Sperber when the skull and mandible were transported by the Deputy County Attorney, Sam Cooper of Omaha, to San Diego, California.

The submitted skeleton was nearly complete and displayed age, race, sex, and other features matching those of Harmer. In the course of analysis, two unusual features were noted. An irregular shaped perforation, measuring approximately 15 by 21 mm was located about 15 mm above nasion (Fig. 1). The perforation penetrated the frontal sinus, but did not penetrate the posterior wall of the sinus. The margins of the perforation were eroded and irregular (Fig. 2) and were surrounded by a large white eroded area extending over much of the face, lower frontal, and lower left side of the cranial vault. This eroded area was confined to the outer table of the skull and except in the area of the perforation did not penetrate the inner table. The eroded area did extend around the back of the skull to the right side, as far forward as about the midpoint of the squamosal portion of the right temporal. It also extended down from the maxilla across the occlusal plane of the dentition to the anterior portion of the mandible. The margins of the eroded area were very distinct, especially on the cranial vault, with a sharp contrast between the affected and unaffected areas.

Dental examination revealed an unusual appearance, inconsistent with a body lying undisturbed for nine years. The labial surfaces of the maxillary anterior dentition (Fig. 3) were a curious chalky white color, quite similar in appearance to that seen in decalcified enamel,



FIG. 1—Skull and mandible showing perforation in frontal and alterations of surrounding area.



FIG. 2—*Eroded and irregular margins of perforation in frontal.*

where patients do not maintain adequate oral hygiene, in the presence of high sugar intake and lemon eaters. The simple factor that distinguished the appearance of the victim's teeth from decalcification, seen clinically, was the tremendous scope of the affected areas. Clinical decalcification is commonly found near the gingival tissues and interproximal areas of the teeth. Many anterior teeth had lost their normal enamel sheen and polish. In addition, the labial alveolar bone was partially missing on several teeth. The occlusal surfaces of the posterior teeth also revealed amalgam restorations bearing green areas of corrosion not usually seen in an unburied dry skull and mandible. Fortunately, the corrosive substance did not appreciably distort the restorations or the teeth. Antemortem dental radiographs of Mary Harmer were compared to postmortem radiographs taken by Dr. Sorenson of Omaha at the time of the original examination (Figs. 4, 5, 6, and 7). There was absolutely no question that the films of Mary Harmer and those of the victim recovered from the cistern were of one and the same individual. The clinical written records were also consistent with respect to the antemortem and postmortem conditions. Note that the additional restorations on the postmortem radiographs obviously represent dental work completed since the antemortem ra-



FIG. 3—*Labial view of anterior dentition showing enamel destruction and loss of normal sheen.*

diographs were taken. All others are identical except for slight variations in the angle in which the radiographs were taken.

It was the opinion of both the anthropological and dental examiners that the corroded condition of the skull, mandible, and teeth was not consistent with the normal postmortem changes seen in a body. It was obvious as a result of the streaked pattern of the affected bone and enamel that an external corrosive agent had been applied.

The other unusual feature consisted of two circular whitened areas on the frontal and upper parietals near the midline (Fig. 8). The area on the frontal had very even margins and measured about 20 by 17 mm. The whitened area on the parietals was located about 55 mm (center to center) from the frontal spot. This latter spot was predominately on the right parietal, but a small portion of it extended across the sagittal suture to the left parietal. No evidence of the color change was apparent on the inside of the skull. Changes in both areas were confined to discoloration; no areas of erosion or abrasion were noted.

State of Nebraska v. Thomas E. Nesbitt

In February of 1986, Thomas E. Nesbitt was brought to trial for the murder of Mary K. Harmer. Testimony suggested that Harmer had been killed the morning of 1 Dec. 1975 and that an attempt had been made to disfigure the cadaver beyond recognition by pouring lye or some other highly caustic substance over the face. An important anthropological observation was that the area of erosion extended across the dentition to include areas of the mandible, in spite of the fact that when the skeleton was found the mandible was not in articulation. The mandible was found a considerable distance from the maxilla, at a lower level. The generally articulated skeleton was found resting on its back with legs extended (Fig. 9). Apparently, as decomposition proceeded, the mandible slipped out of articulation and rolled



FIG. 4—*Left side, antemortem radiograph.*



FIG. 5—*Left side, postmortem radiograph. (The occlusal restorations on the molar teeth are almost identical to that seen in Fig. 4. Minor differences are due to X-ray cone angulation.)*



FIG. 6—*Right side, antemortem radiograph.*



FIG. 7—*Right side, postmortem radiograph. (Restorations on the upper second bicuspid and lower second molar are identical to those seen in Fig. 6. All other restorations were completed following the antemortem radiograph.)*

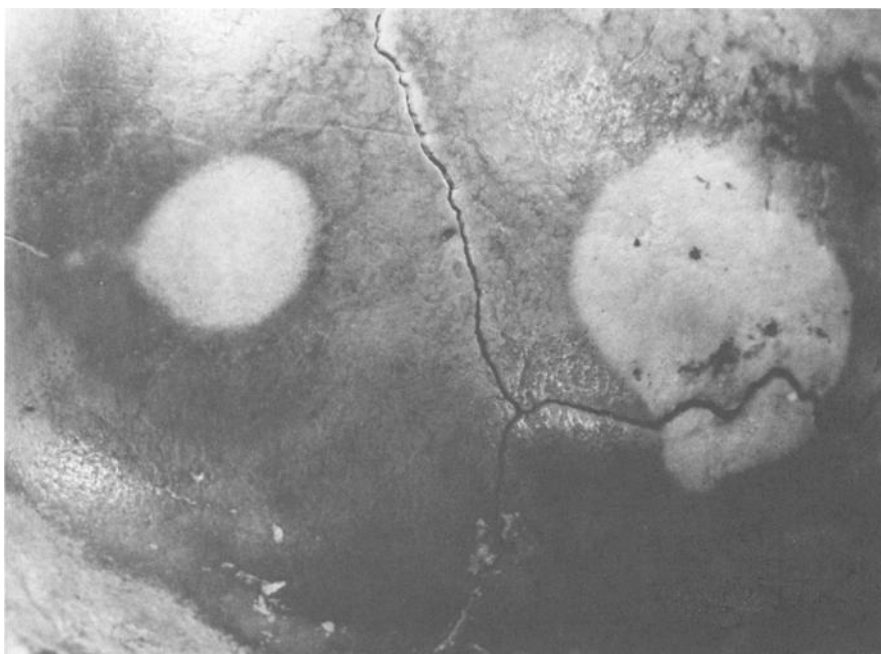


FIG. 8—Whitened areas on the frontal and parietals.

off the chest area. The fact that the erosive area was also found on the mandible indicated that the erosion had taken place while the mandible was still articulated. The clear margins separating the affected and unaffected areas also suggested that the erosion occurred while protective soft tissue was still present.

Analysis of soil residue and water within the cistern by George C. Phelps of Nebraska Testing Laboratories, Inc. of Omaha revealed properties consistent with those expected from a normal soil-water environment in that area. Ph values ranged from 7.8 to 8.3. In contrast, two other samples of semisolid or sludge-like materials collected from an area on the floor of the cistern associated with the skeleton contained a high proportion of calcium, with a ph value of 12.7. The laboratory judged these latter samples to be alien to the normal soil within the cistern and to represent a highly corrosive alkaline substance.

Testimony also suggested that soon after Harmer's death, the cadaver was transported to the unused cistern near the Omaha airport, where it apparently remained undisturbed until discovery in April 1984. The cistern was circular, about 55 in. (140 cm) in diameter and 70 in. (178 cm) deep and was covered with a thick metal "manhole cover" measuring about 24.5 in. (62 cm) in diameter. The cover had 24 perforations arranged symmetrically around its circumference. Minimal diameters of the perforations ranged from nearly 0 to $\frac{7}{8}$ of an inch (0 to 2.2 cm). When the skeleton was found, the skull was resting on its base almost directly below the cover. Thus, it seems likely that the whitened spots observed on top of the skull were produced gradually by small beams of sunlight streaming through the perforations. Because of the thickness of the cover, the light was diffused except for a brief period around midday when the sun was overhead. Over the years, this brief, but daily, sun exposure apparently produced the circular whitened areas described above. Variation in shape between the two areas may represent a slight shift of position in the skull as a result of soft tissue decomposition. Such a shift of position of the skull would affect the angle of exposure and could produce the more elongated pattern seen on the parietals.

In March 1986, Thomas E. Nesbitt was convicted of first degree murder.

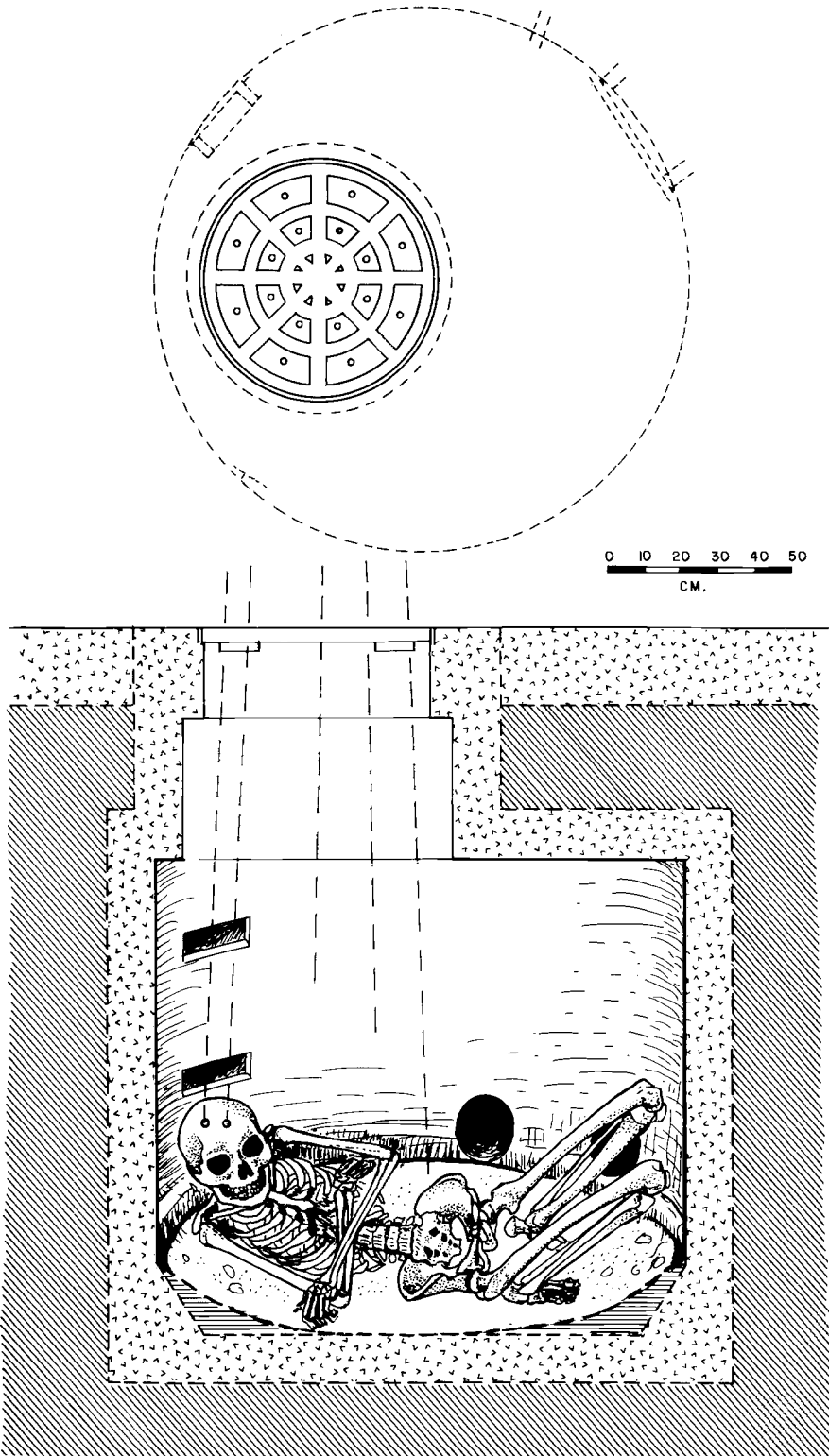


FIG. 9—Artist's conceptual drawing of skeleton resting in cistern (below) and manhole cover (above). Dashed lines represent light striking skeleton.

Acknowledgments

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