

TRAUMA IN LATE WOODLAND CRANIA FROM ILLINOIS

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ABSTRACT: The Schild cemeteries located in Greene County, Illinois include a Late Woodland component of nine mounds. We limited our sample to crania with 55% of all elements present, resulting in a total sample of 110 individuals. Our investigation of the Late Woodland yielded twelve cases of cranial trauma. Data sheets illustrating six cranial views (anterior, posterior, superior, inferior, right lateral, and left lateral) were used. The method of recording data onto the sheets consisted of color-coding all present elements, evidence of trauma, and fractures. Preservation and differential weathering made it difficult to discern ante- and post-mortem fractures. Therefore, this investigation identified bone bruises, celt wounds, healing fractures, and excavator damage. We find the occurrence of cranial trauma in this sample at 7.34% to be indicative of the Late Woodland time period.

INTRODUCTION

In several of his reports on mortuary sites, Perino (1973a-c) has suggested that intervillage warfare was an important characteristic of Late Woodland society in the Midwest. His evidence for this claim includes burials with skull fractures, with projectile points embedded in bone, and with projectile points recovered from the area of the body cavity. His data were based on his field examination of the remains during excavation. In order to look more systematically for evidence relevant to Perino's interpretation of his data, we have examined the cleaned and reconstructed crania from the Schild Mounds, a Late Woodland site in which Perino (1973b) identified four burials with cranial injuries, for additional evidence of trauma that may have escaped his preliminary study. We have focused on cranial injuries because these are more likely than are other injuries to have resulted from interpersonal violence (Polson, 1965; Courville, 1967).

MATERIALS AND METHODS

Perino (1973b) identified 193 individual burials during his excavation of nine Late Woodland mounds at the Schild site in Greene County, Illinois. An additional 135 individuals represented by partial skeletons were recognized during laboratory analysis of the burials Perino recovered. A complete catalog of elements, including age and sex determinations reported below, is on file at the Department of Anthropology, Indiana University.

We examined all crania that were at least 55 percent complete and reconstructable. The resultant sample consisted of 110 crania. The inventory for the series includes 91 adult males, 90 adult females, and 147 juveniles and adults of indeterminate sex. Our sample of 110 crania includes 39 males, 43 females, and 28 individuals 15 years of age or less of indeterminate sex. The sample is thus representative of the population with

respect to age and sex. In addition, we examined three less complete crania that Perino (1973b) identified as injured during his excavations.

Data were recorded by plotting injuries and missing elements on forms showing anterior, posterior, superior, basilar, and left and right lateral views of the skull, supplemented with a written description of all injuries. We carefully distinguished among postmortem damage, time-of-death injuries, and healed or healing injuries. Damage occurring long after death produces fracture edges perpendicular to the surface of vault bone. Frequently, these fractures have crumbled margins, and there is less color change from soil staining than on surrounding surfaces. Fractures occurring while soft tissues are still present are typically partial and expanding, because fresh bone with soft tissues still attached is resilient, and flexes before fracturing. Such *green* or *fissured* fractures may cross sutures. Fracture edges may be darker than surrounding bone due to blood staining, although this degree of preservation is rare in most ancient remains. Injuries due to sharp implements produce depressed fractures of the outer table of the skull, or if sufficiently forceful, defects in the bone with expanding, beveled inner edges. Blunt force injury to the intact head is characterized by fractures radiating from the point of impact and by depression fractures concentric about the point of impact, producing a *spiderweb* appearance. Both kinds of instrumental fractures generally expand inward and have beveled edges oblique to the skull surface (Polson, 1965; Ortner and Putschar, 1981; Manchester, 1983; Berryman, Smith, and Symes, 1990). Healing can be detected from 7 to 20 days after fracture and is visible first as resorptive changes, followed by periosteal new bone formation (Murphy, *et al.*, 1990) and eventual union and consolidation if the victim survives his injuries.

RESULTS

Of the 110 individuals in our sample, 12 exhibited cranial trauma (Table 1). Four are male, five are female, and three are juveniles (one male and two of indeterminate sex). The age and sex distribution of these trauma cases are virtually identical to that of

Table 1. Schild Late Woodland cranial trauma by age and sex.

	Adult Males	Adult Females	Juveniles
Number Scored	39	43	28
Unhealed Trauma	SM 3-25*	SM 3-19 SM 2-26A* SM 3-28 SM 3-32A*	SM 1-2 SM 4-9A SM9-5
Healed Trauma	SM 1-51 SM 6-5Ca SM 9-18a	SM 3-28 SM 3-32A* SM 1-46	
Frequency Meeting Inclusion Criteria	.08	.07	.11
Frequency Adding Fragmentary Crania	.10	.11	

* Specimen too incomplete to meet inclusion criterion of 55% recovery. The specimen was described because injuries were recognized by Perino (1973b) during excavation.

the sample as a whole.

Schild Mound 1, burial 2: Sharp implement injury, unhealed. Perino (1973b: 103) pointed out in his description of this eight to nine year old child that:

The skull...has two large-lenticular-shaped holes struck into the back portion with the bit of a celt...The presence of the skull near the pelvis, instead of in its normal articulated position, indicates that the child may have been decapitated with the head and body later buried together. That the lower jaw was disarticulated might indicate the remains had thoroughly decomposed before burial.

Our examination corroborates Perino's assessment. A 50 by 24 mm opening in the squamous occipital is intersected by five radial cracks, two of which cross suture lines. Their edges expand inward and show many minute hinge or step fractures, indicating that the bone was fresh at the time the fracture occurred. There is a second opening measuring 42 by 13 mm in the posterior left parietal. A radial crack beginning in the first opening ends with inwardly displaced margins at the second opening, indicating that the second opening was produced by the second blow to the vault. Margins of the second opening bend inward, with many small, comminuted fragments still attached. Fracture edges expand inward and are soil-stained to a similar degree as the surrounding bone. Fracture lines more or less parallel to the coronal suture on the anterior portions of both parietals are similarly stained and may reflect compression of the vault resulting from the blows that produced the two openings. There is no evidence of healing. The openings conform in size and shape to the edges of Late Woodland celts from a variety of Midwestern sites in the collections of the Glenn A. Black Laboratory of Archaeology at Indiana University. Thus, the wounds are an example of a "signature fracture," in which the injury corresponds in shape to the instrument that produced it (Polson, 1965).

The skull is lacking both maxillae, the ethmoid, and the nasal bones. These elements could have become disarticulated, if the skull was separated from the remainder of the skeleton and decayed elsewhere, as Perino suggests. Only the second and third cervical vertebrae were recovered. Neither shows evidence of decapitation. The mandible was likely broken during excavation. This specimen is illustrated in Perino's report (1973b).

Schild Mound 1, burial 46: Healed superficial injury. This old adult female skull is complete except for the face and basicranium. There are four small, healed, depressed lesions near the frontal boss that may represent healed bone bruises or healed superficial crush fractures. There is rodent gnawing in the right temporal. Perino mentions no disturbance of this flexed, articulated burial, but he does note that the grave was only 16 inches deep. The rodent gnawing is stained to the same extent as the surrounding bone and cannot be recent.

Schild Mound 1, burial 51: Healed superficial injury. Two small, depressed lesions are present in the parietals of this male aged 42 to 47 years. The margins are indistinct, and the texture resembles the surrounding bone, indicating that these lesions are long-healed. The lesion in the right mid-parietal is about 22 by 10 mm in length and 2 mm in depth, while the lesion in the left parietal is about 20 mm in diameter and 3 mm deep. Both lie medial to the superior temporal lines and were covered only by the *galea aponeurotica* and scalp during life. The area between the superior temporal lines shows generalized low-grade periosteal reaction. The depressed lesions are consistent with blunt force injury to the outer table of the vault or with penetrating wounds to the scalp,

resulting in either case in localized infection.

Schild Mound 3, burial 19: Blunt force injury, unhealed. This specimen consists of a frontal, right temporal, and fragments of the occipital, maxillas, and parietals. A green partial fracture in the frontal and left parietal of this 25 to 29 year-old female suggests a time-of-death injury. The fracture is evident only on the outer table and trabeculae of the vault. It begins at the frontal boss and extends across the coronal suture. The color of the fracture edges is the same as the color of the surrounding bone, and the fracture edges are sharp. There are several other breaks in the frontal. These breaks are chalky in color, irregular in cross-section, and coarse. The breaks can be attributed to post-mortem damage. There is some periostitis of the external surface of the frontal and of the frontal process of the maxilla that can be attributed to an infectious disease.

Schild Mound 3, burial 25: Possible unhealed cranial fracture. This specimen did not meet our sample inclusion criteria, but we describe it because it is one of a group of four clustered burials that Perino thinks may represent a single episode of violence. He describes this group as follows:

The skulls of Burials 26, 28, and 32 seemed to have been purposefully broken, for the fragments are large and not broken at the sutures. Much of the skull of Burial 32 was missing. The skull of Burial 26 was split in two pieces; Burial 25 had a small projectile point among the bones but was too badly decomposed for us to know if it had been placed there with malicious intent. It will be noted that Burials 25, 26, 28, and 32 were buried near each other, possibly at the same time. It will also be noted that, as in Mounds 1 and 2, the treatment accorded these individuals seems to have been intentional and such as is found during warfare and violent death...The evidence suggests that these individuals met death by sharp-edged clubs swung by enemies (Perino, 1973b: 119-120).

This extremely fragmentary adult male skull has a fracture line extending laterally across the mid-frontal that is patinated to the same extent as the surrounding vault surface. This may represent a time-of-death injury.

Schild Mound 3, burial 26a: Unhealed cranial fracture. This female aged 44 to 49 is represented by only the frontal and some facial fragments. Like the previous specimen, this skull did not meet our inclusion requirements. (Portions of a second skull (26b) were recovered with the burial but were not recognized as a second individual in the field.) There are four fractures radiating from the middle of the frontal and small partial fractures of both lateral margins. The radiating fractures extend posteriorly to the coronal suture; however, as the parietals are missing, we do not know whether they extended further. These fractures appear to expand anteriorly. The frontal is warped around the radiating fractures to such a degree that it cannot be reconstructed smoothly, suggesting that the fracture occurred while the bone was still green and flexible. Fractures of the left margin cross the fused *pars temporales* of the coronal suture, further supporting Perino's interpretation.

Schild Mound 3, burial 28: Unhealed cranial fracture, healed nasal fracture. This female aged 25 to 35 exhibits two distinct episodes of injury to the skull. The earliest episode consists of healed fractures of the nasals and nasal processes of both maxillae. These fractures are characteristic of a blunt force injury to the nose during life. Fracture callus is smooth and confluent with the surrounding bone, suggesting that this

injury occurred several years before death.

The second site of trauma involves both the vault and the base of the skull. The vault is represented by the majority of the frontal and right temporal, two fragments of the occipital, and one fragment of the left parietal. Perino (1973b: 118) recognized this injury during his excavation, stating that "...the skull lay upside down with its top broken off, the fragments were lying nearby." This context is reflected in marked differences in soil staining on several of the fragments. A number of the vault fragments were not recovered, but all fracture edges are stained like the adjacent surfaces, indicating that they occurred at or near the time of burial.

The skull has suffered a massive injury, with the impact centered on the occipital at lambda. One fragment of the occipital was recovered. There is a fracture perpendicular to the cruciate eminence. The thickness of the bone at this point implies that a tremendous force was required. The squamous portion of the occipital is vertically fractured near asterion. This fracture is angled anteriolaterally. The edge is hinged and torn, indicating that soft tissues were present on the bone at the time of injury. Both fracture lines can be followed anteriorly on the parietal fragments and the frontal. All of the frontal and parietal material recovered demonstrates small hinge fractures and beveled margins along the primary fracture lines. Jagged fractures lie along the squamosal and sphenofrontal sutures, producing the appearance described by Perino.

The central portion of the frontal has a conical fracture 56 by 39 mm in length with three smaller fractures radiating from it. The margins of the fracture are beveled outward, the outer margins of the fracture being larger than the inner, indicating that the force of the blow must have come from behind. The appearance is similar to that seen in exit wounds from large-caliber projectiles in modern forensic cases. The radiating fractures that center on the occipital intersect this conical fracture.

The basisphenoid is fractured diagonally, and there are small posteriorly expanding partial fractures through the right palatine and the right petrosal. All these injuries are consistent with a massive instrumental or projectile injury to the back of the skull occurring at or near the time of death.

Schild Mound 3, burial 32a: Unhealed cranial fracture, healing instrumental fracture. This very fragmentary adult female skull did not meet our inclusion criteria for statistical analysis, but we include it in our discussion, because it is the last of the group of four clustered burials Perino identified as injured. The specimen consists of portions of the mandible, temporals, occipital, maxillas, zygomatics, and sphenoid. Most of the broken edges are patinated the same color as the surrounding bone, suggesting time-of-death injuries. This supports Perino's suggestion that the skull was purposefully broken.

Several healing injuries point to an earlier episode of trauma, which the individual survived by several weeks. There is a crush fracture of the left zygomatic. The edge of the fracture is hinged inward at least 4 mm. The profile of the wound is consistent with a narrow-edged instrument, such as a celt. A crush fracture of the left margin of the basioccipital shows remodeling of the fracture edges. The base of the left zygomatic process of the temporal is fractured, and there is fracture callus on the superior margin of the break. These injuries are consistent with a powerful blow to the left side of the head some weeks before death.

Schild Mound 4, burial 9a: Sharp implement injury, possible short-term survival. This seventy percent complete six year-old skull has two antemortem injuries on the frontal and right parietal. The first wound is an oblong opening in the frontal and

right parietal situated on the bregmatic portion of the coronal suture. Only three-fourths of the opening is present, the midline portion of the parietal not having been recovered; however, the wound is 22 mm at its widest point. The anterior edge of the opening is beveled outward, the outer margins of the fracture being larger than the inner, and there are small crush fractures along the edge that displace fragments inward, indicating that this wound was produced by a glancing blow from an edged implement. The color of the fracture margins resembles the adjacent external surface. There is a white discoloration on the endocranial surface surrounding the opening, which indicates that the individual may have survived the injury for a few days, long enough to allow some resorption of necrotic bone. The shape of the opening closely resembles the celt wounds in Schild Mound 1, burial 2.

The left frontal exhibits a similar injury. This fracture is not as extensive, the injury being limited to the outer table. There are two radiating partial fractures extending anteriorly from the left margin, indicating an impact wound in life. The fracture may continue posteriorly; however, the deteriorated condition of the anterior margin of the left parietal complicated interpretation. Small crush fractures on the posterior left parietal may indicate a third blow.

Schild Mound 6, burial 5Ca: Healed facial fractures. This eighty percent complete adult male older than 47 has multiple healed fractures of the left zygomatic. Portions of the fractured zygomatic and the bones of the right side of the face are missing, likely because of damage during excavation. There are irregular nodules of well-consolidated fracture callus on the frontal process of the zygomatic. This degree of remodeling indicates that the fracture occurred several years prior to death. There is porous and highly vascular elevated bone on the inferior orbital margin contiguous with the fracture callus. The porosity points to a persistent local inflammation or infection. The lesion is confined to the facial surface of the bone, and the eye does not appear to have been directly affected. The left zygomatic process of the temporal also exhibits a fracture that has healed with little distortion. Both fractures are consistent with blunt force trauma to the face.

Schild Mound 9, burial 5: Unhealed sharp implement injuries. Five separate injuries on this fifteen year-old skull indicate time-of-death wounds. The skull was shattered, and many small fragments were not recovered. A blow to the posterior right parietal produced an ovoid opening with six green, radiating fractures. Although two small pieces of the margin of the opening are missing, the wound measures approximately 36 by 19 mm and closely resembles the lenticular wounds on SM 1-2 and SM 4-9a. The superior margin of the orbit is crushed inward and hinged on the endocranial surface. Together with the green fractures, this is evidence for a massive blow to the right side of the head.

A second series of green fractures radiates from the missing right zygomatic process of the frontal across the right parietal. This blow could have been produced by the same instrument. The left margin of the frontal has been shattered, detaching eight fragments. Green fractures and partial fractures radiating from just superior to the frontal boss indicate the point of impact. Two of the fractures had sufficient force to travel across the coronal suture and onto the anterior left parietal. Substantial hinging on the endocranial surface along the whole of the anterior margin suggests a blow of enormous force.

The fourth site of trauma is the squamous portion of the left temporal. A 38 by 15 mm opening is present, but the resultant fragments were not recovered. Partial fractures cross the suture to the parietal. At the inferior margin of the opening, there is a small,

deep crush fracture, 12 by 5 mm, on the superior margin of the zygomatic process. Three partial fractures radiate from this injury, and the inner table at this thick point on the temporal bone is displaced inward at least 3 mm. This may represent the point of impact for the larger injury, perhaps the edge or corner of the instrument, or it may represent a separate injury from a pointed implement.

The fifth injury centers on the right mastoid process. The right temporal is represented only by fragments, but there are both concentric and radiating fractures on the adjacent occipital and parietal. There is a fracture through the auditory canal. Finally, a diagonal fracture through the basioccipital could be related to either temporal fracture.

The fracture edges are similar in color and texture to the surrounding bone. Two detached fragments of the right parietal are stained darker than the adjacent vault, as are the facial bones. These fragments must have been separated from the vault as the body decomposed. Perino comments that part of the skull is missing. In his published photograph (Perino, 1973b: 128), one can see that the vault is separated from the face.

Schild Mound 9, burial 18a: Healing blunt force injury. This old adult male skull is missing the face and basicranium. There is a shallow, depressed lesion on the right frontal 18 by 15 mm in length. The central area is quite porous, while the surrounding margins are smooth and confluent with the adjacent bone. The right margin is slightly raised. This lesion was in the later stages of healing at the time of death. It represents a blunt force injury.

DISCUSSION

Quantitative statements about these cases present some difficulties. We have rather arbitrarily decided to include specimens in our statistical analysis, if they are 55 percent complete. Deciding that trauma was not present, when less than 55 percent of the skull was recovered, seems suspect. On the other hand, using a higher inclusion criterion would make the sample very small, even in this extremely well-preserved series. A question arises as to how to treat the skulls with massive trauma. If skulls are incomplete **because** they have been injured, we lose interesting information by excluding them, and the exclusion is in some sense artificial. We have elected to summarize our data both ways (Table 1). If the more fragmentary examples are included, 11 percent of the Schild Late Woodland crania show injuries, and in 7 percent, these injuries are likely to have been the cause of death. The corresponding figures, if our inclusion criterion is applied rigorously, are 8 percent and 5 percent, respectively.

All these injuries are likely to have been the result of interpersonal violence (Courville, 1967; Manchester, 1983). A number are instrumental, or signature, wounds in which the shape of the implement can be inferred. It is interesting that all fatal celt wounds are in juveniles. These high frequencies support Perino's inference that warfare, rather than sporadic interpersonal violence, is the most probable cause. The logical step between interpersonal violence and warfare is necessarily inferential when dealing with the past. However, the high frequency of injuries, the high frequency of fatal injuries, their instrumental character, and the contextual evidence for dismemberment presented by Perino argue that the injuries were the result of warfare rather than other sorts of conflict. It is difficult to imagine a scenario in which this pattern would result from

familial or community violence or other causes, and warfare may be the most parsimonious explanation. Similar patterns are reported in other studies of Late Woodland populations in the Midwest (e.g., Cook, 1984; Paine and Anderson, 1990). The temporal associations of such patterns with independent evidence for warfare, for example, trophy taking or scavenging of exposed corpses by carnivores (Paine and Anderson, 1990), limitations in access to resources (Cook, 1984), or fortification of sites, can support such inferences.

The frequency of cranial injuries is remarkably equal across age and sex categories, and unhealed injuries are more common in females than males. This may surprise us, if we assume that most injuries and deaths from interpersonal conflict will be found among males. This assumption appears in the ethnographic literature on warfare in simple farming societies (e.g., Divale and Harris, 1976), but it is probably not correct. Vayda (1976) has reported the indiscriminate killing of women and children as a common phase in New Guinea warfare.

Interpreters of patterns of injury in prehistoric eastern North America are largely consistent in inferring warfare from results similar to ours. Females and juveniles predominate at the Crow Creek massacre site, where warfare is abundantly clear from context (Zimmerman, Gregg, and Gregg, 1981). Paine and Anderson (1990) report significantly more interpersonal injuries in females than in males in their prehistoric Oneota sample and argue for warfare, because many skeletons show evidence of scalping, decapitation, or postmortem exposure. However, van Wagenen and Wilkinson (1990) stop short of this inference and refer to intentional interpersonal violence in a Michigan Late Woodland sample in which 80 percent of the cranial injuries are found in females. Lovejoy and Heiple (1981) infer from the low frequency of cranial injuries and the absence of a male predominance in postcranial fractures in the Libben Late Woodland cemetery in Ohio that warfare was not an important contributor to fracture patterns. In conclusion, Perino appears to have been right in his interpretation of the field context of these burials, and the remains themselves testify to the extent and impact of Late Woodland warfare.

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