

# Direct evidence of a large Northern European Roman period martial event and post-battle corpse manipulation

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New archaeological excavations at Alken Enge, Jutland, Denmark, have revealed a comprehensive assemblage of disarticulated human remains within a 75-ha wetland area. A minimum of 82 individuals have been uncovered. Based on the distribution, the total population is estimated to be greater than 380 individuals, exclusively male and predominantly adult. The chronological radiocarbon evidence of the human bones indicates that they belong to a single, large event in the early first century AD. The bones show a high frequency of unhealed trauma from sharp-edged weapons, which, together with finds of military equipment, suggests that the find is of martial character. Taphonomic traces indicate that the bones were exposed to animal gnawing for a period of between 6 mo and 1 y before being deposited in the lake. Furthermore, the find situations, including collections of bones, ossa coxae threaded onto a stick, and cuts and scraping marks, provide evidence of the systematic treatment of the human corpses after the time of exposure. The finds are interpreted as the remains of an organized and possibly ritually embedded clearing of a battlefield, including the physical manipulation of the partly skeletonized bones of the deceased fighters and subsequent deposition in the lake. The date places the finds in the context of the Germanic region at the peak of the Roman expansion northward and provides the earliest direct archaeological evidence of large-scale conflict among the Germanic populations and a demonstration of hitherto unrecognized postbattle practices.

Alken Enge | Jutland | Roman period | Iron Age warfare | postbattle ritual

The first century BC to the first century AD saw dramatic changes in Northern Europe. Internal transformations in the Roman Empire and its continuing expansion led to thoroughgoing social changes and fueled an already ongoing development in political and martial aspects of society in the areas that found themselves under Roman control and beyond the Roman domain in the Germanic regions (1–3).

The attempt to push the boundaries toward the Elbe in Northern Germany ended in catastrophic defeat in the Teutoburg Forest in AD 9, with the loss of three legions (4, 5). This historic turning point was followed by continuing Roman punitive campaigns into Germania until AD 16. In the centuries that followed, military relations between the Roman world and the Northern European areas beyond it became a central aspect of political development in Europe. The ferocity of the Germanic tribes and peoples and their extremely violent and ritualized behavior in the aftermath of warfare became a trope in the Roman accounts of their barbaric northern neighbors (6).

However, knowledge of the fighters and their fate as well as the character of their postbattle activities is largely indirect. Only a few suspected battle sites in central and western Germany have been uncovered, e.g., Harzhorn (7) and Kalkriese (8). The scarcity of well-preserved human remains at these sites has limited the opportunities for in-depth anthropological analysis, and the

period from 200 BC to AD 200 represents a lacuna before the comprehensive postbattle weapon depositions (AD 200–550) (9). The historical sources indicate early large-scale military capabilities among the Germanic populations, but the numbers are highly uncertain and they refer primarily to conflicts with the Romans (10, 11).

The period has traditionally been seen as a form of tribal society with relatively small-scale clashes, reflecting fluctuating and highly person-bound alliances and military structures (12, 13). The absence of human remains from weapon sacrifices of a later period has led to speculation that these modest casualties indicate that conflict was directed at eradicating the military leaders, or was perhaps connected with the acquisition of slaves (13).

New archaeological investigations at Alken Enge, East Jutland, Denmark (56°02'48" N, 9°51'08" E), provide an exceptionally comprehensive assemblage of human remains, with clear evidence of conflict-related trauma. The remains are interpreted as the

## Significance

Here we present direct archaeological evidence in the form of human remains of a large-scale battle in Northern Europe in the first century AD, in the wake of the northern expansion of the Roman Empire. The deposited population is estimated to 380 individuals. The relative absence of traces of healed sharp force trauma suggests that they had relatively little previous battle experience. Evidence of the systematic treatment of the human corpses, including stripping of bodies, disarticulation of bones, crushing of crania, and arrangement of body parts, points to a new form of postbattle activities, with implications for the interpretation of contemporary battlefields and later ritual traditions with regard to depositions of the spoils of war.

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Data deposition: The Alken Enge Database is available at [www.alkenenge.dk/](http://www.alkenenge.dk/) under the Open Database License (<https://opendatacommons.org/licenses/odbl/1.0/>). Any rights in individual contents of the database are licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 (<https://creativecommons.org/licenses/by-nc-sa/4.0/>).

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earliest finds of a large contingent of fighters from a defeated army from the early first century AD. The find allows us to address central questions regarding the character of the fighting groups and postbattle activities, including the possibilities of ritual aspects in the treatment of the dead.

In this paper, we present an outline of the results of the archaeological, anthropological, and geoscientific investigations of Alken Enge.

## Results

**Setting.** The Alken Enge wetlands (*enge* means meadows in Danish) cover 75 ha and are situated in the east/west-oriented Illerup River valley, 8 km long and 0.5 km wide, in the center of the Jutland peninsula in Denmark. The Illerup River valley and Lake Mossø occupy a Weichselian subglacial meltwater valley, surrounded by high moraine plateaus with a marked dead-ice topography. The valley is a well-known archaeological location with a number of ritual depositions. The largest of these comprise lake depositions of weapons from defeated armies (third to fifth centuries AD).

Situated at the terminal end of the Illerup River valley, the Alken Enge basin formed the eastern end of the larger Lake Mossø basin until its isolation by a coastal spit during the late Holocene. According to optically stimulated luminescence dating of the lowermost sandy spit deposit, this spit bar extended northward and reached the main deposition area by  $2.51 \pm 0.15$  ka BP.

Pollen records from eastern Jutland suggest that the prevailing landscape type was rough pasture with scattered deciduous woodlands and groves (14, 15). Although open, this landscape would still have supported wolves (*Canis lupus*), whereas brown bears (*Ursus arctos*) had probably become extinct as a result of hunting (16).

**Archaeological Investigations.** The human remains are dispersed in peat and lake sediments over a large part of the 75-ha meadows (Fig. 1). From 1957 to 1960, excavations conducted in two locations

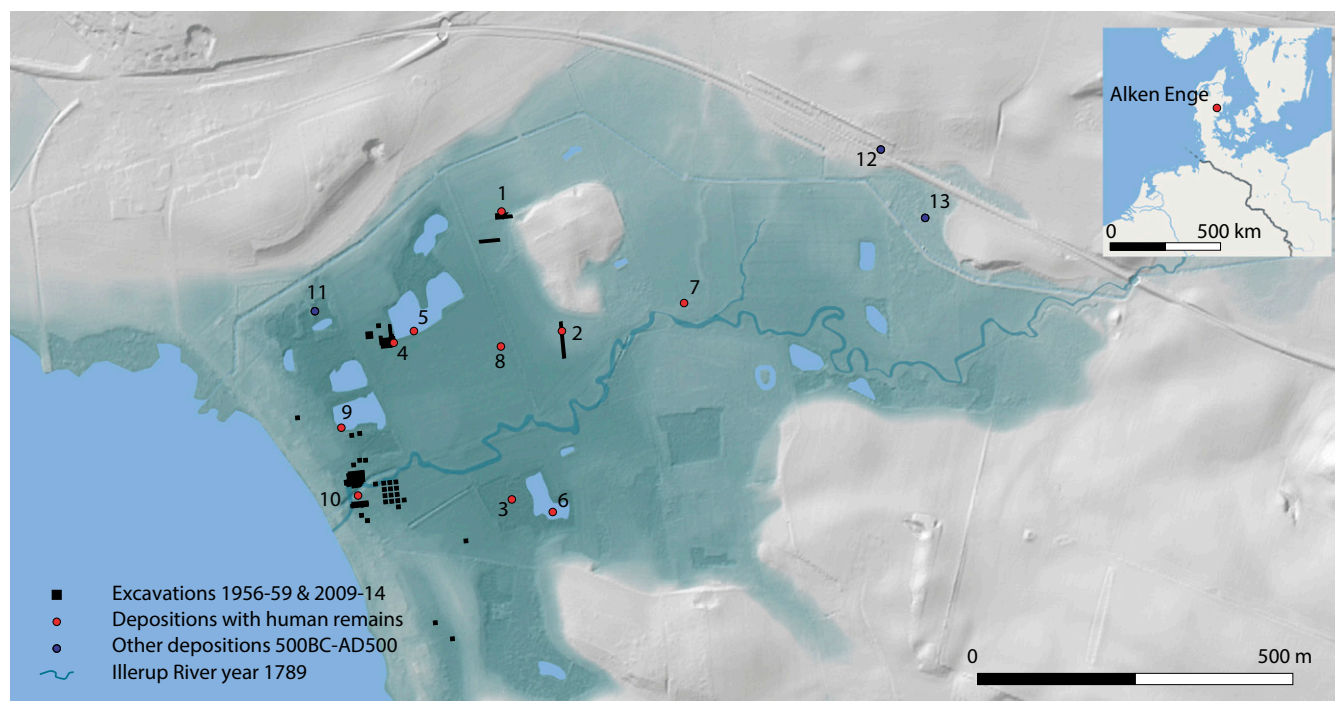
revealed dense concentrations of disarticulated human remains and dispersed artifacts. Except for an analysis of the human remains (17), the finds were published only in short, popular accounts (18, 19).

New excavations at Alken Enge were initiated in 2009 and continued in 2012–2014 (*SI Appendix, Supplementary Information 1*). Borings, geophysical prospection, and light detection and ranging (LiDAR) digital elevation models were used to reconstruct the hydrological situation at the time of deposition of the human remains. The excavation efforts were concentrated in an area with high find densities centered on a channel bisecting the spit bars that separate the Alken Enge basin from the main basin of Lake Mossø. Additional trenches were laid out in various parts of the wetlands to clarify the character of the dispersed finds and the geological development of the lake.

The excavations uncovered a dense distribution of predominantly disarticulated human remains. The stratigraphy indicates that the human remains were deposited in relatively calm water shortly after the sand spit progressed to this specific spot and thus formed a protection from the high-energy waves of Lake Mossø (*SI Appendix, Supplementary Information 8 and 9*). Altogether, 2,095 new human bones and human bone fragments were found. All of the finds appear to have been deposited under water, in the lowest parts probably as much as 2 m in depth.

**Additional Finds.** Relatively few artifacts were unearthed apart from human bones. The finds included weapons (concentrated in the same find horizon as the human remains), pottery and animal bones (found in a broader horizon that also extends above the human bones), and parts of wagons (found in the horizon immediately above the human remains).

The weapons (*SI Appendix, Supplementary Information 13*) comprised seven spearheads, an axe, and fragments of swords and shields, including a complete shield found during the 1957–1960 excavation. An axe with a complete shaft of ash and a large wooden club may have been used as a weapon or as a tools in activities at the site. The horizon with the human remains also



**Fig. 1.** LiDAR elevation model of Alken Enge showing excavation areas, previously uncovered finds ([www.kulturarv.dk/fundogfortidsminder/](http://www.kulturarv.dk/fundogfortidsminder/)), and sand spits (42). (Upper Right) Maximum extent of the Roman interest zone during the Augustinian campaigns ca. AD 4–9. Numbered finds are listed in *SI Appendix, Supplementary Information 14*. Graphics assistance courtesy of Casper S. Andersen (Aarhus University, Højbjerg, Denmark).

contained five iron knives and small fragments of fine wickerwork, probably from baskets. There is a complete absence of standard personal equipment such as belt fittings and dress pins, and most of the uncovered weapons are broken or damaged. Typologically, the metal artifacts are Germanic, and generally belong within the second to first centuries BC, with a few finds potentially extending into the first century AD. Metallurgical analyses indicate a local Jutish provenance (20). Two spearheads are dated to the sixth century AD, and may belong to a different event.

The find comprised approximately 25–40 ceramic pots, dominated by regular, everyday ceramics. Chronologically, the ceramics extend from the Late Bronze Age to the early Iron Age, with a concentration around the first century BC/first to second centuries AD.

A total of 674 animal bones and bone fragments were discovered, deriving from domestic species such as dogs (*Canis lupus familiaris*), cattle (*Bos taurus*), caprines (Caprinae) and pigs (*Sus domesticus*). Butchery marks are recognizable on several of the animal bones, but they show no sign of weathering or gnaw marks.

**Chronology.** A  $^{14}\text{C}$  dating program was conducted to examine the chronological depth of the finds, targeting animal remains from supposed ritually deposited husbandry and wooden artifacts, and both old and newly recovered human remains from the excavations (SI Appendix, Supplementary Informations 10–12). The majority of the dates on the human remains were obtained from collagen from the lower jaws (mandibulae).

The ages are dispersed over more than two millennia, with a distinct concentration around the turn of the millennium. Including two outliers originating from peripheral parts of the Alken Enge basin, the human remains show a more significant chronological concentration than the wooden artifacts, animal remains, and ceramics (SI Appendix, Supplementary Information 10). The broader chronological (and topographical) dispersion of ceramics, wooden artifacts, and animal remains can be seen as part of a long-term use of this landscape, something also commonly seen in other Danish wetland depositional traditions (21, 22).

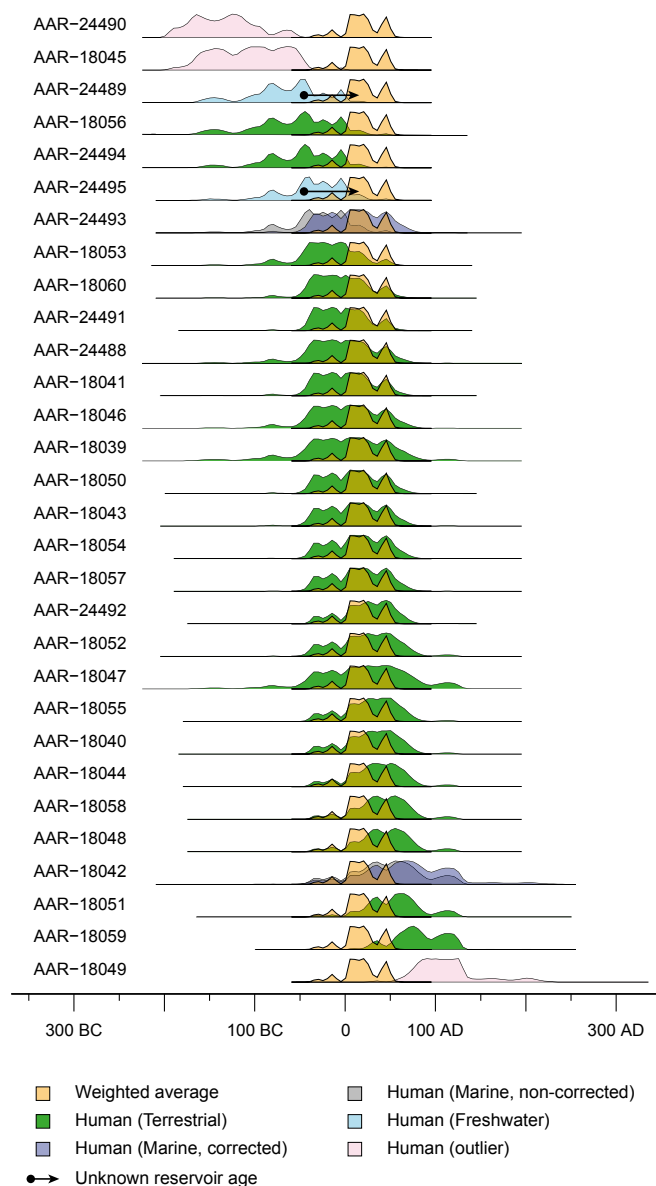
The newly excavated finds show a consistent picture, with all dates falling within a narrow time span, with the median at the beginning of the first century AD (Fig. 2). The narrow distribution indicates that all human remains are contemporary. In each case, the dates provide a combined date ranging from 2 BC to AD 54.

**Find Situation.** The human remains are found dispersed over the entire excavation area, with a concentration in the deepest part of the channel between the sand spits (Fig. 3). The majority of the bones from the northern trench were found in gyttja or gyttja/sand-mixed sediments, and traces of water-rolling wear and abrasions were very limited (23). Nasal bones and teeth were still preserved in situ on the crania, and fragile artifacts such as wickerwork and shield parts were preserved. This indicates relatively calm and protected waters.

Moving upward toward the present soil surface, the preservation of the bones deteriorates significantly, and, in the plow-layer, virtually no archaeologically relevant organic material is preserved (24, 25). Test pits and previous finds of human remains demonstrate that the find concentration extended further to the north on the eastern side of the sand spits, but modern settlement complicates an investigation of this area.

**Structured Depositions.** Although most of the human bones were spread out on the past lakebed in no anatomical order, structured depositions were uncovered in the northern trench (Fig. 4).

Situation A consists of an assembly of four ossa coxae from four male individuals, two left sides and two right sides. The ossa coxae were arranged on an alder branch (*Alnus*) through the holes of the obturator foramen in an interlocking sequence of



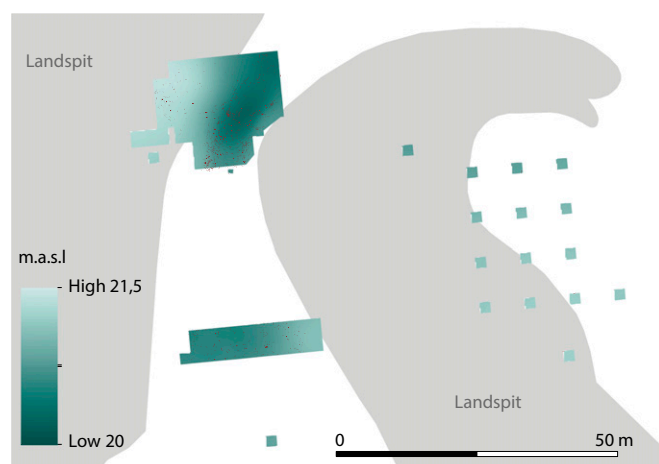
**Fig. 2.** Calibrated age probability distributions of all human individuals from Alken Enge.

left/right/left/right. The arrangement of the bones on the branch must have occurred after skeletonization.

Situation B consists of several articulated parts of at least two individuals, including the lower limbs of one individual, and some of the bones of the foot. The other individual is represented by fibula, tibia, and some of the bones of the foot. Altogether, the two individuals are represented by 27 and 15 bones, respectively. In addition, numerous disarticulated remains of upper and lower bodies were found in the same area. The remains were situated in the deepest part of the channel, and the articulated conditions indicate that the bones were held together by ligaments when they ended up in the lake.

Situation C consists of an assemblage of a femur, fibula, tibia, and two white stones. The bones were found on the slopes of one of the sand spits, situated in a bundle parallel to each other. All were oriented in the same proximal–distal direction, and they probably belong to at least two different individuals based on their morphology. Consequently, they must have been disarticulated when deposited. The stones are not naturally occurring in the sand spits and must have been brought in. It is





**Fig. 3.** Main excavation area with distribution of the human remains and selected artifacts. The contours represent the levels of the human remains, which, in the northern excavation, correspond to the surface of the sand-spit deposits. Gray shading indicates the location of the sand spits.

possible that the assemblage was originally kept in an organic container that has not been preserved.

**Characteristics of Physical Anthropology.** The 2,095 new human bones and bone fragments were uncovered in the new excavations represent at least 82 individuals, based on the most frequently occurring bone, the left femur. Mainly long bones like femora, tibiae, and humeri are present, whereas small bones such as those of hands and feet are highly underrepresented, as are crania (*SI Appendix, Supplementary Information 3*). Only 14 crania are complete (*SI Appendix, Supplementary Information 4*).

Estimates of biological sex were based on sexual morphology of ossa coxae, crania, and mandibulae of human adult bones, according to ref. 26 (*SI Appendix, Supplementary Information 5*). Eleven of 2,095 bones are classified as female or probably female morphology, compared with 427 bones as male or probably male morphology. It can well be argued that the whole bone sample is predominantly or exclusively male.

For subadults, the estimated age at death was based on the stage of fusion of skeletal elements, length of long bones, and dental eruption according to refs. 26–28 (*SI Appendix, Supplementary Information 6*). A total of 4.7% of the bone material shows subadult characteristics (age less than 20 y), 68.6% is between 20 and 40 y, and 1.2% is between 40 and 60 y, whereas 25.4% could not be assessed.

Human-induced bone modifications (Fig. 5) were recorded as antemortem trauma, perimortem trauma, and postmortem modification according to refs. 29–31 (*SI Appendix, Supplementary Information 7*). Trauma was classified as sharp force trauma, blunt force trauma, and penetrating trauma following the criteria of refs. 26 and 32–35. Antemortem trauma is recorded on 19 bones, including broken limb bones (femora, humeri, radius, and ulna) as well as injuries to costa, clavicle, and crania. Perimortem trauma is recorded on 139 bones, including sharp force trauma ( $n = 119$ ), penetrating trauma ( $n = 14$ ), and blunt force trauma ( $n = 6$ ). The postcranial perimortem trauma is dominated by small sharp force trauma on femora, tibiae, and humeri. Perimortem trauma on crania are dominated by small to medium-sized sharp force as well as some penetrating and blunt force lesions (Fig. 5).

Some bones show modifications consistent with sharp force trauma, which, in terms of size and appearance, differ from the trauma pattern described earlier and are likely to derive from a postbattle situation. Several parallel superficial grooves are seen on the posterior surface of two femora above the knee joint (Fig. 5G) and on the proximal part of three tibiae on the medial and

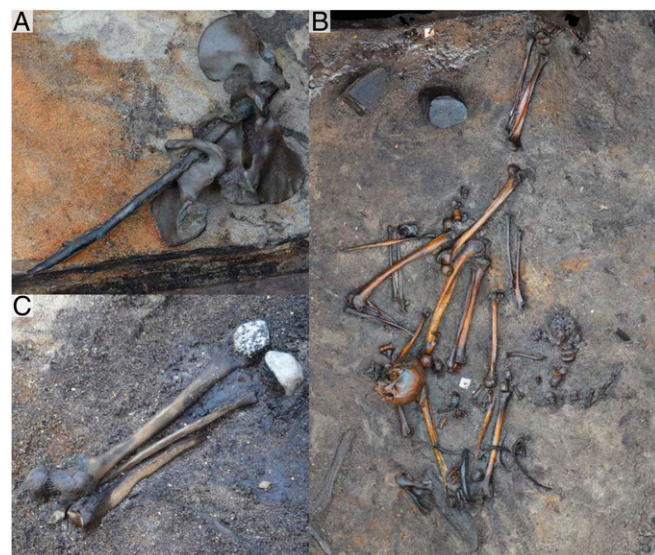
lateral surface of the bones (Fig. 5H). The shallow grooves are all centered around the knee joint.

On a left os coxa, two long parallel grooves (63 mm and 75 mm) run across the iliac fossa (Fig. 5I), indicating sharp force trauma and a distinctive margin associated with crushing (32, 34). The angle indicates that the grooves were inflicted to a person lying down. One femur has a cut mark through the greater trochanter into the femoral head (Fig. 5C). These modifications could be the result of the deliberate removal of muscles and ligaments postmortem. Similarly, the chop marks (Fig. 5C and I) could originate from a postmortem dismembering of the body with the purpose of separating body parts or mutilating bodies.

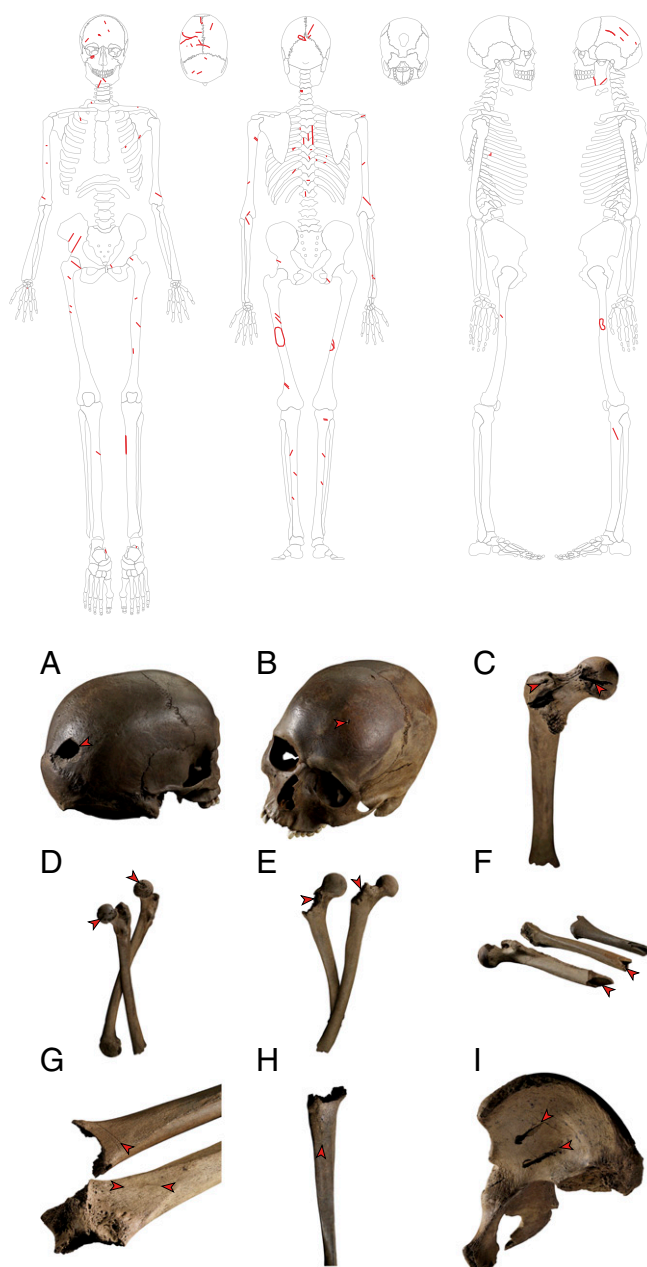
The human bones also exhibit a large number of tooth marks, including punctures, pits, scorings, furrows, and fractured, chipped, and channelled bones (Fig. 5D–F) (24), caused by medium-to-large scavenging animals such as fox (*Vulpes vulpes*), dog (*C. lupus familiaris*) and wolf (*C. lupus*). The taphonomic analysis identified 722 tooth marks on 391 of 2,095 human bones. Femora are the most affected (39% of all tooth marks), followed by the tibiae (22%) and the humeri (21%). The smaller and thinner long bones are less often gnawed (*SI Appendix, Table S1*).

Some large long bones show perimortem spiral fractures, which are likely to have been caused by large carnivores. Large carnivores break bones by leverage to extract bone marrow (Fig. 5F), which has been identified in several other cases (36–38).

Microscopic analyses of the bones show an absence of bacterial attack in the micromorphology of the human bones. Endogenous (i.e., intrinsic gut) bacteria are the primary cause of bacterial attack to bones, and the removal of the abdomen/intestines prevent bacteria attack of the bone morphology, suggesting that the abdominal and thoracic contents were removed and probably eaten by scavengers before the deposition (24). The general preservation conditions of the bones indicate that the human corpses were left exposed for ~0.5–1 y before being deposited in a lake environment as much as 2 m in depth, where they would have been inaccessible to scavengers. The representation of the various types of bones is consistent with such an exposure, with the small and soft bones being consumed by animals whereas the larger bones remained (*SI Appendix, Supplementary Information 2*).



**Fig. 4.** Examples of structured find situations. (A) Four ossa coxae threaded onto a stick. (B) Lower limbs from two individuals together with further disarticulated remains. Reprinted with permission from ref. 24, with permission from Elsevier. (C) Find assemblages of femur, tibia and fibula, and two small stones. Photos courtesy of P.J.



**Fig. 5.** (Upper) Distribution of unhealed trauma. (Lower) Examples of trauma and taphonomic traces. (A) Sharp force trauma to the back of the cranium. (B) Penetrating trauma on the frontal bone. (C) Sharp force trauma on the posterior part of a left femur. (D) Punctures on the femoral heads, reflecting scavenging animals. (E) Furrows on the proximal joint of two femora, reflecting scavenging animals. (F) Spiral fracture on three femora, reflecting bone breakage by larger carnivores. (G) Sharp force trauma on the posterior surface of two femora. (H) Sharp force trauma on the proximal lateral part of a left tibia. (I) Parallel grooves on the iliac fossa of a right os coxa. Photos courtesy of Museum Skanderborg and graphics courtesy of Casper S. Andersen (Aarhus University, Højbjerg, Denmark).

**Estimated Minimum Number of Individuals.** As the find concentration is not delimited to the north and northeast, the scale of the event can be assessed only as a minimum estimate. The estimated minimum number of individuals (MNI) is calculated by dividing the find area into four zones based on the geology and find frequency. For each zone, a total MNI is estimated based on the MNI per square meter within excavation pits, the mean of which was then used to calculate an approximate MNI for the entire zone. Based on an area of approximately 5,200 m<sup>2</sup>, the estimated MNI is 380.

**Interpretation.** The demographic characteristics of the human remains sample, the trauma evidence, and the accompanying remains of weaponry are compelling indications that the Alken Enge population was involved in a large-scale armed conflict. The human bone material suggests that the entire population of at least 380 individuals consisted of young adult males. The traces of trauma are likely to reflect injuries sustained in combat in which pointed weapons were used, causing more damage to the soft tissue than the bones, whereas large sharp force lesions of the cranium point to the use of weapons with a sharp edge. This lesion pattern is consistent with the weaponry (lances, swords, and perhaps axes) and combat technique of the Germanic tribes in the centuries around the turn of the millennium (39). Some of the trauma, particularly posterior aspects of skeletal elements and cut marks on the femora, may reflect a final stage in the fighting with the immobilization and killing of fleeing, subjugated, and wounded fighters, or it could reflect postbattle treatment of captured fighters.

The estimated number of fighters is almost four times larger than the estimated size of the Hjortspring find (13). Thereby, Alken Enge confirms the indications in the historical sources of early, large-scale military capabilities in Northern Germania.

The provenance of the fighters is still unresolved. The weapons are local Germanic style, but their affiliation with either of the opposing sides in the conflict is uncertain. The relative absence of healed sharp force trauma suggests that the deposited population did not have considerable previous battle experience.

The animal tooth marks show that the bones were exposed to scavenging animals for a period of 0.5–1 y, during which time the human remains must have become at least partly skeletonized. The assemblages of bones and the four ossa coxae threaded on a stick (Fig. 44) demonstrate that the remains of the combatants were deliberately collected at a time when the bones were largely skeletonized.

The cut marks suggest that there was some form of treatment of the remains after battle, possibly a separation of some of the bones that were still held together by ligaments. Moreover, the underrepresentation of crania (*SI Appendix, Supplementary Information 4*), of which a large part occurred as cranial fragments, suggests the deliberate selection and possibly crushing of particular body parts. The relatively few artifacts uncovered at the sites suggests a selective treatment of the equipment of the dead individuals.

Based on the characterization of the sediments, the finds are interpreted as being located in a near-shore environment with some wave energy, which implies that some relocation after deposition may have occurred. However, particularly in the northern trench, the unsorted distribution pattern and the absence of abrasions suggest that the relocation was limited. The find pattern is therefore best explained as the result of a deliberate deposition of the human remains in the water.

The overall distribution of the human remains and the landscape reconstruction suggest that the deposition occurred from the edge of newly formed sand-spits extending out into the lake, with a particular concentration at a slow small water course between two sand spit-barriers. Collection and redeposition in the lake may have contributed further to the overrepresentation of the large bones (*SI Appendix, Table S3*), as smaller bones may have been overlooked.

The site at which the first (natural) skeletonization of the human remains took place has not been identified. It is plausible that this would have coincided with the actual battlefield, where corpses were left exposed for some time before the remains were collected and redeposited in the lake. At Kalkriese (Germany), a small passage in the landscape, comparable to that at Alken Enge, has been pointed out as the likely battlefield (40). The relocation may also have occurred over a considerable distance, as other battle-related depositions suggest that, for example, at Hjortspring, the war booty was carried for at least 2 km from the coast to an inland bog. It is also possible that the sand spits were



the actual scene of the battle, as they constitute a potential transport corridor and hence a tactically advantageous setting.

The dates from the new excavations are consistent with the human bones belonging to a major event taking place in the first half of the first century AD. There appears to have been periodic ritual activities at the location, not unlike other martial sites (41).

## Conclusion

Alken Enge provides unequivocal evidence that the people in Northern Germania had systematic and deliberate ways of clearing battlefields. Practices of corporeal dismemberment, modification, and bone assemblage composition suggest a ritual dimension in the treatment of the human corporeal remains. Taphonomic studies indicate a postmortem exposure interval before a deposition in the lake of 0.5–1 y, which is unprecedented in relation to the known burials and bog bodies.

The estimated MNI in Alken Enge significantly exceeds the scale of any known Iron Age village community and presupposes that the fighting groups of men were recruited from a large area beyond its immediate hinterland.

The preponderance of young adult males suggests that a selected group ended up in the wetland area. High incidences of perimortem trauma show that the conflicts were extremely destructive in character, with consequently comprehensive slaughter.

Overall, the Alken Enge find is exceptional of the period, but it anticipates the comprehensive postbattle weapon depositions from the second to fifth centuries AD in Northern Germania. In this way, Alken Enge provides a new, yet older, testament to the history of the militarization of the Northern Germanic societies and stresses the formative significance of the expansion phase of the Roman Empire at the turn of the era.

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- Steuer H (2001) Kriegswesen III Kulturgeschichtliches und Archäologisches. *Hoops Reallexikon der Germanischen Altertumskunde*, eds Beck H, Geuenich D, Steuer H (Walter de Gruyter, Berlin), Vol XVII, pp 347–373.
- Steuer H (2006) Warrior bands, war lords, and the birth of tribes and states in the first millennium AD in middle Europe. *Warfare and Society: Archaeological and Social Anthropological Perspectives*, ed Otto T (Aarhus Univ Press, Aarhus, Denmark), pp 227–236.
- Jørgensen L, Storgaard B, Thomsen LG, eds (2003) *Sejrens triumf: Norden i skyggen af det romerske Imperium* (National Museum of Denmark, Copenhagen).
- Derks H (2009) Die Varusschlacht. 2000 Jahre Varusschlacht, Band 2 - Konflikt, eds Burmeister S, Derks H (Konrad Theiss, Stuttgart), Vol 2, pp 37–55.
- Burmeister S (2015) Roms Kampfim Norden: Die Eroberung Germaniens. *Ich Germanicus Feldherr Priester Superstar*, eds Burmeister S, Rottmann S (Konrad Theiss, Stuttgart), pp 9–16.
- Lund J (2003) Ve de besejrede! *Sejrens Triumf: Norden i skyggen af det romerske Imperium*, eds Jørgensen L, Storgaard B, Thomsen LG (National Museum of Denmark, Copenhagen), pp 166–171.
- Geschwinde M, Haßmann H, Lönne P, Meyer M, Moosbauer G (2009) Roms vergessener Feldzug. Das neu entdeckte römische Schlachtfeld am Harzhorn in Niedersachsen. *2000 Jahre Varusschlacht*, Band 2 - Konflikt, eds Burmeister S, Derks H (Theiss, Stuttgart), Vol 2, pp 228–232.
- Rost A, Wilbers-Rost S (2010) Weapons at the battlefield of Kalkriese. *Gladius* 30: 117–136.
- Lövsholm M, Holst MK (2018) Governing martial traditions: Post-conflict ritual sites in iron-age northern Europe (200 BC–AD 200). *J Anthropol Archaeol* 50:27–39.
- Caesar GJ (58–49 BC) *De Bello Gallico/Caesar's Gallische Kriege*, trans Koch JB (1942) (Nordisk Forlag, Copenhagen).
- Tacitus C (AD 98) *Germania*, trans Bruun NW, Lund AA (1974) (Wormianum, Aarhus, Denmark), p 14.
- Jensen J (1982) *The Prehistory of Denmark* (Methuen, London).
- Randsborg K (1995) *Hjortspring: Warfare and Sacrifice in Early Europe* (Aarhus Univ Press, Aarhus, Denmark), p 40ff.
- Søe NE, Odgaard BV, Nielsen AB, Olsen J, Kristiansen SM (2017) Late Holocene landscape development around a Roman Iron Age mass grave, Alken Enge, Denmark. *Veg Hist Archaeobot* 26:277–292.
- Odgaard BV, Rasmussen P (2000) Origin and temporal development of macro-scale vegetation patterns in the cultural landscape of Denmark. *J Ecol* 88:733–748.
- Aaris-Sørensen K (1998) *Danmarks Forhistoriske Dyreverden* (Gyldendal, Copenhagen).
- Selleveid BJ, Hansen UL, Jørgensen JB (1984) *Iron Age Man in Denmark. Prehistoric Man in Denmark* (The Royal Nordic Society of Antiquaries, Copenhagen), Vol III.
- Andersen H (1959) Voldsomdød. *Skalk* 1959:8–9.
- Christensen O (1968) Skeletfundet ved Vædebro. *Kuml* 1967:151–155.
- Jouttijärvi A (2014) Jerngenstandene fra Alken Enge (SBM 1028). Heimdal-archaeometry Report 14-7 (Heimdal-archaeometry, Virum, Denmark).
- Becker CJ (1972) “Mosepotter” fra Danmarks jernalder. Problemer omkring mosefundne lerkarogderes tolkning. *Aarbøger for Nordisk Oldkyndighed Og Historie* 1971:5–60.
- Lund J (2002) Forlev Nymølle: En offerplads fra yngre forromersk jernalder. *Kuml* 2002:143–195.
- Haglund WD, Sorg MH (2002) Human remains in water Environments. *Advances in Forensic Taphonomy. Method, Theory, and Archaeological Perspective*, eds Haglund WD, Sorg MH (CRC Press, Boca Raton, FL), pp 201–218.
- Møllerup L, Tjældén AKE, Hertz E, Holst MK (2016) The postmortem exposure interval of an Iron Age human bone assemblage from Alken Enge, Denmark. *J Archaeol Sci* 10:819–827.
- Tjældén AKE, Matthies H, Petersen LMM, Søe NE, Kristiansen SM (2016) *In situ* preservation solutions for deposited Iron Age human bones in Alken Enge, Denmark. *Conserv Manage Archaeol Sites* 18:126–138.
- Buikstra JE, Ubelaker DH, eds (1994) *Standards for Data Collection from Human Skeletal Remains: Proceedings of a Seminar at the Field Museum of Natural History* (Arkansas Archeological Survey, Fayetteville, AR).
- Primeau C, Friis L, Sejrsen B, Lynnerup N (2012) A method for estimating age of Danish medieval sub-adults based on long bone length. *Anthropol Anz* 69:317–333.
- White TD, Folkens PA (2000) *Human Osteology* (Academic, New York).
- Brickley M, McKinley JI (2004) *Guidelines to the Standards for Recording Human Remains*, IFA Paper No. 7 (IFA BABAO, Reading, UK).
- Ubelaker DH, Montaperto KM (2014) Trauma interpretation in the context of biological anthropology. *The Routledge Handbook of the Bioarchaeology of Human Conflict*, eds Knüsel C, Smith MJ (Routledge, London), pp 25–38.
- Knüsel CJ (2005) The physical evidence of warfare—Subtle stigma? *Warfare, Violence and Slavery in Prehistory*, Thorpe IJN BAR International Series 1374, ed Pearson MP, (Archaeopress, Oxford), pp 49–65.
- Berryman HE, Natalie R, Shirley A, Lanfear K (2013) Low-velocity trauma. *Forensic Anthropology: An Introduction*, eds Teresa M, Tersigni-Tarrant A, Shirley NR (CRC Press, Boca Raton, FL), pp 271–290.
- Boylston A (2000) Evidence for weapon-related trauma in British archaeological samples. *Human Osteology in Archaeology and Forensic Science*, eds Cox M, Mays S (Cambridge Univ Press, Cambridge, UK), pp 357–381.
- Kimmerle E, Baraybar JP (2008) Sharp force trauma. *Skeletal Trauma Identification of Injuries Resulting from Human Right Abuse and Armed Conflict*, eds Kimmerle E, Baraybar JP (CRC Press, Boca Raton, FL), pp 263–321.
- Symes SA, et al. (2002) Taphonomic context of sharp-force trauma in suspected case of human mutilation and dismembering. *Advances in Forensic Taphonomy. Method, Theory, and Archaeological Perspective*, eds Haglund WD, Sorg MH (CRC Press, Boca Raton, FL), pp 403–434.
- Binford LR (1981) *Bones: Ancient Men and Modern Myths* (Academic, New York).
- Haglund WD, Reay DT, Swindler DR (1988) Tooth mark artifacts and survival of bones in animal scavenged human skeletons. *J Forensic Sci* 33:985–997.
- Haynes G (1983) Frequencies of spiral and green-bone fractures on ungulate limb bones in modern surface assemblages. *Am Antiq* 48:102–114.
- Jensen XP, Jørgensen L, Hansen UL (2003) The Germanic army: Warriors, soldiers and officers. *Sejrens Triumf: Norden i skyggen af det romerske Imperium*, eds Jørgensen L, Storgaard B, Thomsen LG (National Museum of Denmark, Copenhagen), pp 310–330.
- Schlüter W (1999) Zum Stand der archäologischen Erforschung der Kalkriese-Niewedder Senke. *Rom, Germanien und die Ausgrabungen in Kalkriese*, eds Schlüter W, Wiegels E (Rasch, Osnabrück, Germany), pp 13–60.
- Jensen XP (2009) From fertility rituals to weapon sacrifices: The case of the south Scandinavian bog finds. *Glaube, Kult und Herrschaft. Phänomene des Religiösen im 1. Jahrtausend n. Chr. Mittel- und Nordeuropa*, eds Freedon Uv, Friesinger H, Wamers E (Dr. Rudolf Habelt, Bonn), pp 53–66.
- Søe NE, Odgaard BV, Hertz E, Holst MK, Kristiansen SM (2017b) Geomorphological setting of a sacred landscape: Iron age post battle deposition of human remains at Alken Enge, Denmark. *Geoarchaeology* 32:521–533.