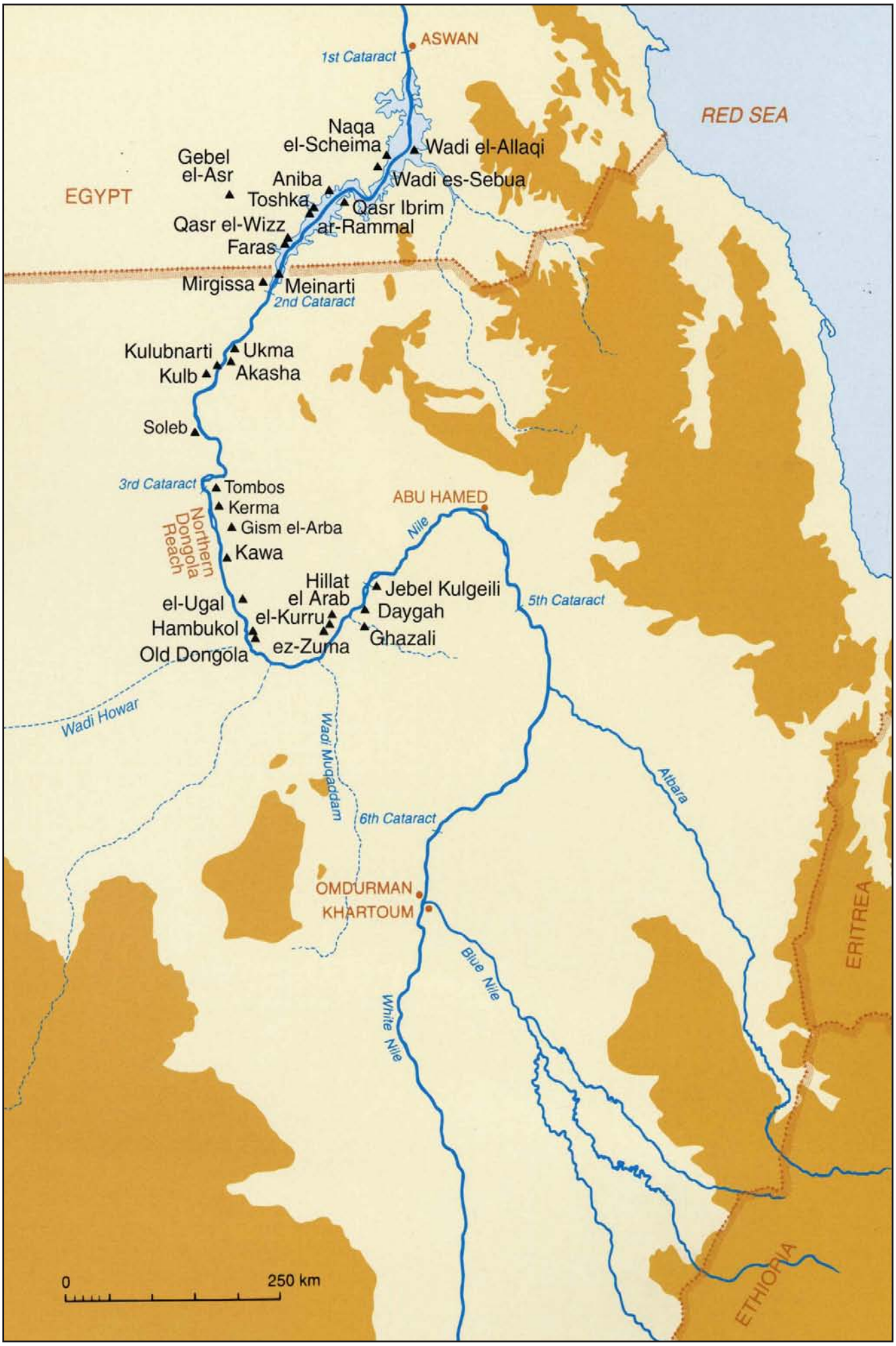
SUDAN & NUBIA

The Sudan Archaeological Research Society *Bulletin No. 3* *1999*


ASWAN
1st Cataract
RED SEA
Naqa
el-Scheima
Wadi el-Allaqi
Gebel
el-Asr
Aniba
Wadi es-Sebua
EGYPT
Toshka
Qasr Ibrim
Qasr el-Wizz
ar-Rammal
Faras
Mirgissa
Meinarti
2nd Cataract
Kulubnarti
Ukma
Kulb
Akasha
Soleb
3rd Cataract
Tombos
Kerma
Gism el-Arba
Kawa
Northern Dongola Reach
ABU HAMED
Nile
Hillat
el Arab
Jebel Kulgeili
5th Cataract
el-Ugal
el-Kurru
Daygah
Hambukol
Ghazali
ez-Zuma
Old Dongola
Wadi Howar
Wadi Muqaddam
Atbara
6th Cataract
OMDURMAN
KHARTOUM
ERITREA
Blue Nile
White Nile
ETHIOPIA
0
250 km

SUDAN & NUBIA

The Sudan Archaeological Research Society

Bulletin No. 3 1999

Contents

Introduction
Vivian Davies 1

Reports

Written in Bone: Daily Living during the Kerma Period
Margaret Judd 2

Remote Sensing of Palaeochannels in the Northern Dongola Reach of the Nile
Richard Treves, Mark Macklin and Jamie Woodward 8

Some Rural Settlements at Gism el-Arba in the Northern Dongola Reach
Brigitte Gratien 10

Survey and Excavation at the Ancient Pharaonic Gneiss Quarrying Site of Gebel el-Asr, Lower Nubia
Ian Shaw and Elizabeth Bloxam 13

Ancient Stone Quarries at the Third and Fourth Nile Cataracts, Northern Sudan
James Harrell 21

A New Statue of the Kushite Period
Karen Wardley and Vivian Davies 28

Two New Kingdom Tombs at Napata
Irene Vincentelli 30

The Napato-Meroitic Remains at Kerma
Salah Eldin Mohammed Ahmed 39

A New Hilltop Cemetery and Temple of the Meroitic and Post-Meroitic Period at Qasr Ibrim
John Alexander 47

Two Seasons in the Fourth Cataract Region. Preliminary Results
Abdel Rahman Ali Mohammed and Kabashy Hussein 60

Monastic Lifestyles of the Nubian Desert: Seeking the Mysterious Monks of Makuria
Julie Anderson 71

An Early 20th Century Egyptologist in the Sudan: the Travels of F. W. Green
Isabella Welsby Sjöström 84

Miscelleneous 88

Front Cover: Temple of Amenophis III at Soleb visited by F. W. Green in 1909 (Photo D. A. Welsby).

Introduction

As the contents of this year's issue clearly demonstrate, *Sudan & Nubia* goes from strength to strength with a developing international profile. The Society's own work in the Dongola Reach is represented by two papers; the first, based on the analysis of human remains, provides fascinating insights into living conditions during the Kerma Period (Judd); the second outlines progress on the continuing research into the geomorphology of the region (Treves *et al.*). A complimentary project, carried out in the same region by a French Expedition, has among other things identified a rare native settlement dating to the period of Egyptian conquest (reported on by Gratien). At Kerma itself, exciting new work, uncovering remains of the Napatan and Meroitic Periods, is dramatically extending the history of the site (Salah Ahmed), while of equal importance historically are the results from Hillat el-Arab (near Gebel Barkal), a cemetery with elite burials of the New Kingdom and very earliest Kushite Period (Vincentelli). Research into quarrying and stones receives fresh impetus from work at Gebel El-Asr in Lower Nubia (Shaw and Bloxam) and in Tombos and Daygah at the Third and Fourth Cataracts respectively (Harrell). Surveys in the latter region, threatened by a new dam, are confirming its great archaeological potential (Abdel Rahman and Kabashy Hussein). Among other possibilities, sites in the Abu Hamed Reach can be expected to shed important new light on Nubian monasticism, until recently a neglected subject (Julie Anderson). Further north, Qasr Ibrim, which has long been partially submerged, continues to repay the Egypt Exploration Society's commitment under difficult circumstances (John Alexander). Far from the Nile Valley, museum basements can also be a source of significant 'discoveries' (Wardley and Davies), as may unpublished archival material and archaeological diaries (Welsby Sjöström).

During the course of the year, SARS suffered a serious blow with the passing of its distinguished President, Sir Lawrence Kirwan. Larry was a source of encouragement, support and inspiration for us all. We salute his memory and his contribution to Sudanese and Nubian archaeology (see Obituary, by Harry Smith). We also regret the loss of Prof. Jack Plumley, a specialist in Christian Nubia, who for many years directed the EES excavations at Qasr Ibrim (see Obituary, by John Alexander).

Reports

Written in Bone: Daily Living during the Kerma Period

Margaret Judd

What can a scattered collection of bones tell us about an individual, much less a society? While at first the disarticulated skeleton appears confusing, once the bones are reassembled into anatomical position the lifestory of the living, as written in the bones of the dead, emerges. A palaeopathological examination of bone modification accrued during the lifetime of the individuals forms a matrix of disease and skeletal modification for a society. From this structure, comparisons can be made between biological sex and age, and the group and individual dynamics within the biological, cultural and physical environment can be interpreted.

In this skeletal sample two consecutive time periods — Kerma Ancien (2500-2050 BC) and Kerma Moyen (2050-1750 BC) — are represented, which afford the opportunity to trace the transition in disease, health, nutrition, behaviour and physical activity that may coincide with a change in burial practices in a discrete geographic region. The skeletal material for this investigation was excavated during the 1994/95 and 1996/97 seasons of the Northern Dongola Reach Survey directed by Derek Welsby (1995; 1997). The two rural cemeteries from which the material derived, P37 and O16, are located to the east of the Nile, about 100km south of Kerma, the first Nubian city-state and type-site for the Kerma culture. A total of 61 sexed adults was recovered, 32 females and 29 males, with 49 from the Kerma Ancien period. The burials of three Ancien and one Moyen children were also excavated.

Osteoarthritis

One of the more common disease processes observed in ancient skeletal populations and among ourselves is osteoarthritis or joint disease — a progressive disease that causes deterioration to the joint cartilage or disc degeneration in the spinal column. To counteract this process, new bone forms around the joint margin or vertebral body to provide additional support or stabilisation, much like the capital of an architectural column. The epidemiology of joint disease is influenced by numerous factors — age, climate, body weight, biological sex, genetics, trauma, bone density and metabolism. However, after age, physical activity or 'wear and tear' is considered to be the prime contributing component and, therefore, functions as a scale with which to measure the intensity of habitual actions (e.g., Bridges 1994; Jurmain 1991). While we cannot state specifically which motions caused the osteophytes to form, we can comment on the intensity with which people worked relative to their peers, variations in osteophyte production among the joints, and unusual patterns of joint disease that might reflect a specific movement.

The knees were the most severely affected of all appendicular joints. The only significant difference in the prevalence of osteoarthritis among the appendicular joints was the greater amount of osteoarthritic lesions on the male foot and ankle joints of both Kerma periods; some form of activity during both periods demanded extensive walking, climbing or running of the males (Fig. 1). This lack of variation between the Kerma periods suggests that no change in biological factors or general activity occurred that would predispose individuals to joint disease.

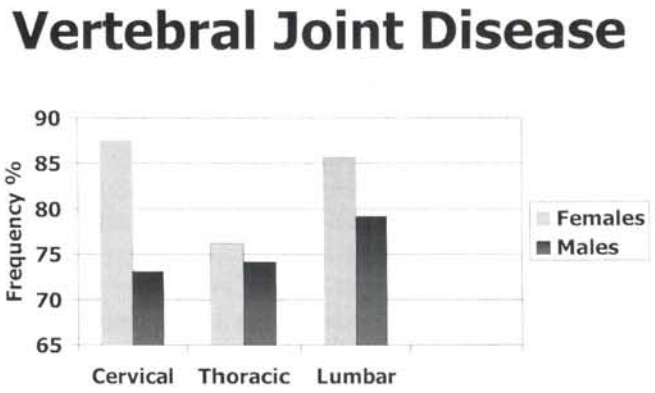


Figure 1. Distribution of Vertebral Osteoarthritis between the Sexes

There was no significant difference in the presence of vertebral joint disease between the Kerma periods, although comparatively the Kerma Moyen individuals had more severe modifications. Figure 1 illustrates the distribution of vertebral osteoarthritis between the sexes. Males displayed the typical pattern seen in clinical vertebral joint disease where osteophytes increase in frequency from the cervical vertebrae that support the skull to the lumbar vertebrae of the lower back (Shore 1934-35). The females, however, exhibited a distinctive 'U'-shaped pattern of vertebral osteoarthritis distribution. This variation in disease distribution may reflect a division of labour and may be attributed to carrying loads on the head as a method of transporting consumables, such as water, wood, food, raw materials — such as clay for pottery — or carrying dishes and clothing to the river for washing. Not only does this method of transport prevent lower back injury, but it is also quite efficient. It allows the individual to carry other items in their hands or hold onto young children who frequently accompany their sisters and mothers during these types of domestic chores in the traditional village. The additional weight to the top of the head creates a vertical force that necessitates the need for increased fortification — this is facilitated by the stabilising bone

growth that projects horizontally from the vertebral body margins. A sheering force is created between the articular facets that causes additional wear and tear leading to the subsequent abrasion of bone rubbing on bone.

Although most adults in this collection had osteoarthritic lesions on one or more joint complexes, severe joint alteration that resulted in fusion of adjacent joints or cystic porosity afflicted 10% of the group. There was no evidence of gross joint distortion causing immobility. Both sexes experienced similarly challenging living and working conditions during the Kerma Ancien and Moyen periods.

Dental Disease

Dental wear due to daily tooth contact is not a disease, but a normal process of tearing, shearing, and grinding food or other items. Flat, even dental wear is typically associated with a diet dominant in meat and marine resources. However, once agriculture and the processing of grains are introduced teeth may wear down quickly due to new abrasives introduced during the grinding process such as husks, grinder flakes, and seeds. In the Northern Dongola Reach Survey group both types of wear were present, and like osteoarthritis dental wear is linked to age — the longer we live, the more exposure our teeth have to wear. Females presented a higher prevalence of cupped and heavy wear as well as temporomandibular joint disease caused by excessive stress placed on the condyles, although there was no significant difference between the sexes. Some granular element was a more frequent part of the female diet, but no discernible differential access to food resources indicated by nutritional deficiencies was evident from the bones.

When dental wear was compared between the Kerma Ancien and Moyen periods, however, a statistically significant difference was observed for the presence of cupped dental wear, severity of wear, and temporomandibular joint disease (Fig. 2). This change of dental wear signals a greater reliance on some type of grains and possibly bread. A similar transition in dental wear occurred at Kerma, where evidence of wheat and barley associated with the Moyen period was found. While today's villagers use processed flour, food preparation was more challenging in the past. Particle evidence that reflects each stage of production and processing was discovered in the analysis of ancient breads from Egypt: residual soil from growth, flint chips from sickle harvest, sand during winnowing, grinder chips from grinding with an abrasive grinder and quern, insect shells and sand from outdoor cooking — all infiltrate the final edible product (Leek 1972).

Dental calculus located on the tooth crown is a result of mineralised dental plaque created by the enzymes found in meat and dairy products. Like other disease processes observed here, dental calculus, when present, increased with age. Most adults collected only slight flecks of calculus while 21% of the population yielded chunky three-dimensional deposits that extended from the teeth. There was no significant difference between the presence of calculus and biological sex, which again indicates a consumption of similar foods by all individuals — this relationship did not change in the Kerma Moyen period.

Unlike calculus, dental caries and abscesses are diseases that demineralize the tooth and are associated with sweets and sticky carbohydrates. Areas at risk are the fissures of the occlusal surface and crevices between the teeth where food particles can accumulate, ferment, and tunnel into the tooth. While this is true of dental caries or cavities on the enamel, most of the lesions in this sample occurred below the gum line. Tooth root caries and abscesses are facilitated by oral bacteria that gain access to the concealed tooth root via pockets created by calculus accumulation under the gums or by exposure of the root due to heavy tooth wear (Langsjoen 1998). Bacteria burrow through the pulp cavity, infect and destroy the soft tissue, and force the dead substance to ooze out through the exterior cortical bone or into the maxillary sinuses.

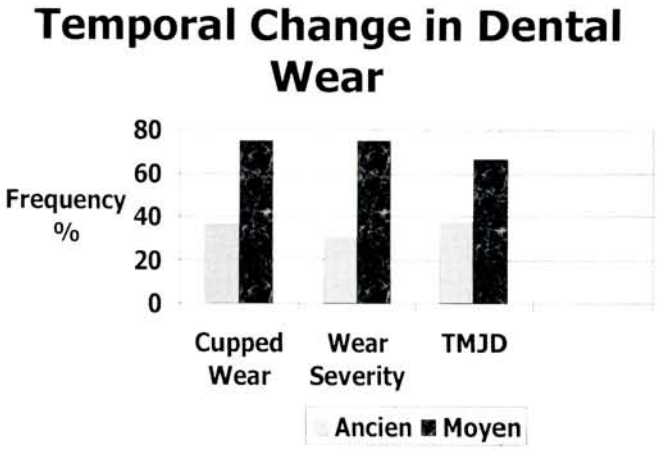


Figure 2. Distribution of dental wear between Kerma periods.

In this sample females featured significantly greater numbers of root caries while the males were predisposed to periapical abscesses. Both sexes were vulnerable to the demineralizing process provoked by calculus deposits or heavy tooth wear. The presence of root caries and abscesses remained constant into the Moyen period — these people did not give up their meat diet in favour of sticky sweets and fruits, but complimented it with grain and agricultural products. Dental calculus, however, was the only dental disease that did decrease in the Moyen period.

The low number of caries and abscesses is at a level for societies that practice a non-agricultural or mixed economy (Lukacs 1989; Rose *et al.* 1984). A similar dental profile was observed among the people of Kerma where botanical and faunal remains and stable isotope analyses revealed that wheat, barley, fruit and vegetables enhanced the protein diet during the Moyen period and no significant differences in dental

diseases were observed between the sexes (Iacumin *et al.* 1998; Kramar 1994).

Trauma

Like dental disease and osteoarthritis, trauma has tormented humans and animals throughout time and registers the hazards of daily living, both environmental and interpersonal. All bones were examined for fractures, dislocation, and muscle pulls including each and every hand and foot phalange. The long bones, which include the clavicles, arms and legs, did not show a significant difference in fracture between the sexes, Kerma period, or side damaged. However, the fracture rate of all longbones observed — 5.79% (28/484) — was exceptionally high when compared to other archaeological fracture studies, for example the Christian sample of Kulubnarti to the north with a fracture rate of 3.7% (Kilgore *et al.* 1997).

The line of the fracture provides a clue to the type of force that caused the break and can suggest a deliberate or accidental mechanism. One type of injury frequently seen is the fractured radius (Plate 1), commonly caused by breaking a forward fall with an outstretched hand where the arm is pronated and the radius snaps over the underlying ulna (Sacher 1996). It is identified by the twisted shaft and oblique fracture line, typical of a force that is transmitted from a distant point of contact. In this case the hand is the point of contact with the surface and the break is transmitted to the point on the forearm shaft over which the body's weight shifts during the final stages of the fall. While this type of fracture is rightly attributed to a fall, we tend to forget that a deliberate push may also initiate a fall, as well as unintentional accident or clumsiness.

Plate 1. Fractured Radius

Like the findings of the earlier investigators (Smith and Jones 1910), the majority of fractures observed in this sample occurred on the ulnar shaft (9/28 = 32.14%). The most typical ulna fracture (7/9 = 77.78%; Plate 2) was identical to the distal ulna fractures described by Smith and Jones (1910, 312-314): '...a fracture line about 3.5 cm from the ulna head, accompanied by a fusiform swelling with no linear deformity in any direction.' The researchers attributed the cause to a blow from a staff or *naboot*, commonly used among the locals. X-rays of the bones from the current collection revealed a transverse fracture line, which in clinical practice is associated with a force from a direct blow to the bone—typically while trying to protect the skull from more serious danger (Schultz 1990, 265).

The presence of healed skull trauma was also high in this population (7 of 36 = 19.4%) and consisted of punctures created by a sharp implement or oval depressions caused by a blunt instrument. Two wounded Moyen females (2/17 = 12%) sustained an elliptical depressed type wound on the left parietal that measured about 30mm in length. The distal forearms were inconveniently absent from these burial contexts and the injury cannot, therefore, be unconditionally associated with defensive actions against a cranial assault.

Five Ancien males (5/19 = 26%) had lesions on either the parietal or frontal. Three wounds were punctures to the right side of the skull. One male also presented breaks to the left radius and hand that could be associated with defensive actions against an attack to the upper body had the injuries occurred during a single incident. In clinical practice, the presence of punctures to the skull is more frequently associated with a lethal attack rather than continual abuse or accident. The two remaining males displayed oval-shaped, depressions, smaller than those of the females — only about 10mm long — but again to the left side of the skull. It is noteworthy that all of the depressions occurred on the left side of the skull, while punctures pierced the right side. This may be indicative of the handedness of the attacker or may reflect the method of brandishing different weapons.

Most intriguing among this population was the high frequency of hand and foot trauma. The recovery of these small bones for this sample was exceptional — 70 and 80% of the expected number of hand and foot bones respectively were retrieved. Comparable studies are rare, especially in

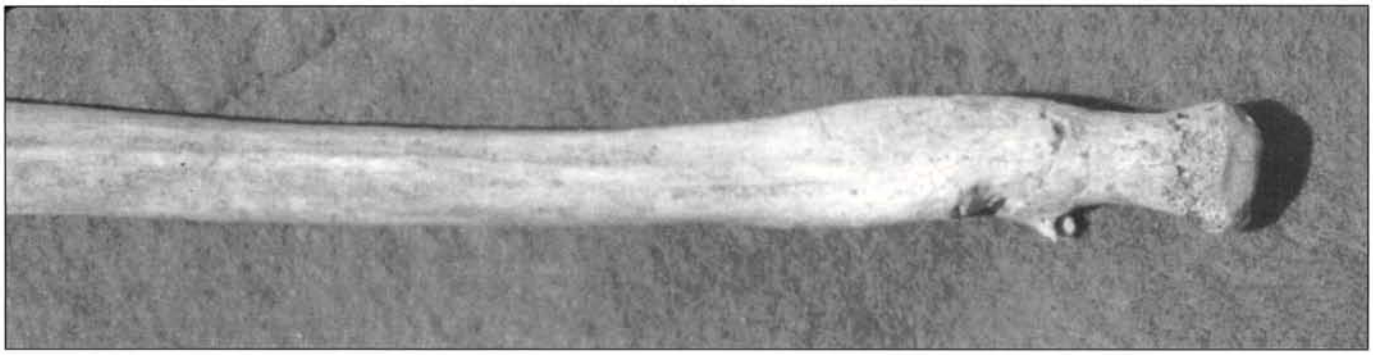


Plate 2. Fusiform Fracture of the Ulna

Sudan and Egypt where mummification prohibits the examination of the extremities in other collections (e.g., Kilgore *et al.* 1997). While one might hastily recommend radiology or CAT-scan imaging, modifications to articular surfaces of these small bones are frequently unobservable or missed in clinical examinations as well, even when radiology is applied (e.g., Juhl *et al.* 1990).

Individuals with hand fractures far outnumbered other upper body fractures; males suffered a significantly greater number of injuries. Metacarpals, which compose the palm of the hand, sustained 28% of the hand injuries. Like the longbone, metacarpal fractures also disclose information about the trauma mechanism and may be due to a multitude of causes such as a direct blow or crush, punching a blow with an ungloved fist, or falling on a clenched fist (e.g, Kraemer and Gilula 1992)

Likewise, the presence of foot trauma overshadowed breaks to the longbones of the lower limbs, but both hand and foot injuries fell within the expected range of clinical trauma for these elements (e.g., Barton 1988). Foot trauma was more prevalent during the Moyen period among both sexes. Most damage to the feet was an impacted base or head, which is not surprising considering the remains of the delicate sandals found in the Northern Dongola Reach Survey burials and those at Kerma (Bonnet 1990, 177, fig. 121) — that is if sandals were worn on a daily basis. While sandals protected the sole of the foot, the dorsal surface was exposed to a variety of stationary and mobile assaults. Fractures to the foot are clinically associated with actions such as direct trauma from an object dropped on the foot and the accidental or intentional kicking of a hard object.

A unique fracture was noticed on the metacarpals of two individuals — the stress fracture. Habitual stress due to walking, running or marching creates vibrations on these miniature longbones that cause the bone to fracture and heal internally; occasionally a complete fracture occurs. These lesions are common among people involved in intense physical regimes, such as long-distance runners, joggers, and new military recruits who are plunged into an unrelenting routine of hikes and physical endurance (Wilson and Katz 1969).

A vexing problem encountered in the interpretation of trauma is our inability to detect which injuries, when multiple, occurred simultaneously. Precise determination of the age of the fracture is even more elusive than determining the biological age of the individual — bone mass, type of bone damaged, age of the individual, complications, and the individual's health all contribute to the healing process. Therefore, it cannot be assumed that each lesion was attributed to a discrete incident, nor can one suppose that all wounds manifest by each individual occurred concurrently. In order to explore the possibilities of this tangle of trauma, the affected bones of each person are first examined individually and then as a complex of injuries or 'worst case scenario'.

Many individuals suffered from multiple trauma due to fracture and muscular pulls, but neither sex was predisposed to multiple injury. In most cases, damage was minor, such as articular impaction to the hands, feet or vertebral facets that heal quickly with little disturbance to normal function. The Kerma Moyen group was susceptible to trauma — all had some type of traumatic lesion even if only to the hand or foot with 75% sustaining multiple wounds. Among the Kerma Ancien group, 74% suffered some type of injury, with 58% of that group exhibiting multiple breaks. The prevalence of trauma did increase during the later period, but the more severe occurrences were observed during the Ancien period.

One Kerma Ancien male presented 28 healed lesions, the more serious wounds included: a crushed scapula, six crushed spinous processes in sequence, soft tissue trauma to the humerus and remaining scapula due to muscle overexertion, three fractured forearm bones — two which did not reunite — and finally seven hand and five foot injuries. While these injuries were healed, a series of small pecks and puckered lesions in various stages of healing were present on the skull.

This combination of injuries is characteristic of nonlethal but deliberate violence that features multiple trauma, various locations, and poorly healed wounds (Walker *et al.* 1997). A second clue is the combination of lower forearm and skull fracture possibly obtained while trying to shield his face from a blow. The skull injuries are not typical of those associated with blunt objects, manual assault, or punctures from a sharp object — perhaps stoning might be a plausible explanation. The hand and foot fractures, however,

are more characteristic of offensive injuries — this individual fought back — and survived.

How else can we account for the high prevalence of trauma? Evidence for a protein diet as shown by the dental remains, combined with the presence of bucrania and caprines in the burial contexts of the Kerma Moyen period, confirm the importance of animals to this culture. However, the presence of animals has ominous repercussions. While early investigators considered Nubia to be free of occupational hazards (e.g., Smith and Jones 1910, 296-298), modern emergency units reveal that farming is one of the most hazardous occupations in modern society accompanying mining and construction. While many of the more gruesome and fatal accidents are attributed to mechanised equipment such as tractors and combines, 30-40% of injuries are still attributed to animal agents (e.g., Busch *et al.* 1986; Jones 1990). Tending animals requires close proximity — think of the traditional methods of milking, feeding, dehorning, calving, slaughtering, and general maintenance. And how many of us have not just tripped over the family cat or dog?

A further 10% of modern farming injuries are accredited to falls from ladders, lofts or short heights and this does not even include the common domestic falls (e.g., Jones 1990). In modern regional African hospitals that serve surrounding villages, injury is attributed to falls from trees, the collapse of a house wall or roof, stumbles into pot-holes at night, and animal bites, in addition to farming accidents (e.g., Ebong 1978; Souza 1968). No doubt comparable hazards jeopardised daily living in antiquity.

The Children

The discussion of trauma provides an appropriate place to divert our attention to the young as any discussion of interpersonal violence is incomplete without reference to the treatment of children. Four child burials were fully excavated and the fragments of five others recovered from the surface survey. Three were aged at birth +/- 2 months, three at 4 years +/- 1 year, and the remainder under 6 years of age. What was particularly noticeable was the absence of adolescents and teenagers — did they all achieve biological adulthood after surviving childhood or were they simply buried elsewhere? The death of an infant in antiquity is frequently attributed to birth complications, while older infants and children are deemed to have succumbed to acute childhood diseases that rarely leave skeletal scarring. In both cases, we really are speculating as to the health of the child and cause of death but tend to forget about drowning, exposure and suffocation that also leave no skeletal traces and are the common causes of death among rural children today (Wilk 1993). With the close proximity of the Nile, we would indeed be remiss to overlook accidental drowning as cause of death for children as well as adults.

There was no evidence of interpersonal or accidental injury among the children — on the contrary, of those excavated, the children were honoured with more unusual grave goods (Colour Plate I). Perhaps most telling of this society's attitude toward children and 'the other' was shown in the burial of a 4-year old child. Sequestered in a cavity in the south portion of its grave, this child was adorned with strands of faience beads around the arms and neck, but most impressive was a pelvic belt composed of chalcedony, black porphyry(?), bone, faience, cowrie and ostrich egg-shell beads that cascaded along the contracted femur. Equally unique was the appearance of this individual, whose skull appears to be lopsided or plagiocephalic (Colour Plate II). This phenomenon is caused by the early closure of the sutures on one side of the anterior portion of the skull and induces a spiral rotation of the cranium, orbits, and face (Sakurai *et al.* 1998); it has been attributed to birth trauma, intrauterine infection, genetic predisposition, as well as sleeping position (Norton 1997). This cranial modification can be distinguished from soil pressures that may also deform and elongate the skull. Firstly, the cranium was not elongated and secondly, the involvement of the opposing mandible that compensates for the cranial asymmetry was present. This facial alteration does not affect the individual's health — only appearance — today surgical intervention corrects this early closure.

Conclusion

So what is written in the bones of these individuals from the Kerma period in the Northern Dongola Reach? Like us, they were victims of dental disease, osteoarthritis and trauma. There was no difference in the severity or prevalence of osteoarthritis between the sexes or Kerma periods, which suggests that the intensity of activity levels and the complex of muscle involvement remained constant over time. One task that was indicated in both periods was the transport of loads balanced on the head, particularly among females. A distinct pattern in dental wear emerged in the Moyen period. A change from homogenous flat dental wear to a cupped, angled, and severely abraded dental wear reflects the introduction of a grittier substance to the diet, although like at the urban site of Kerma protein probably remained a dominant food source. Prevalence of trauma was high among the adults in this population, especially among the extremities, and may be attributed to trips or falls due to clumsiness or accident and stubbing the toes especially in the absence of footwear or with the use of very delicate sandals. However, the proximity of bovines and caprines, integral to the subsistence and ritual of this community, and interpersonal aggression are also contending factors.

These individuals survived the sometimes 'relentless' environment of the Dongola Reach. Subsistence tasks were performed equally by all adults and did not appear to be exceptionally harsh for either sex. Individuals could expect to live to a respectable age — 32% of the Kerma Ancien and 50% of the Kerma Moyen population reached an age of between 35 and 50 years — and were not susceptible to infectious diseases or nutritional deficiencies — they were well

nourished. Interpersonal violence existed, but was not habitual or fatal and violence was not directed towards children. So aside from the occasional disgruntled goat, petty squabbles and an influx of grit in the diet .... daily living among the people from the Northern Dongola Reach Survey area looks to have been reasonably agreeable.

Bibliography

Barton, N. J. (ed.). 1988. *Fractures of the Hand and Wrist. Vol. 4. The Hand and Upper Limb.* London.

Bonnet, C. (ed.). 1990. *Kerma, Royaume de Nubie: L'Antiquite Africaine au Temps des Pharaons.* Catalogue d'Exposition (Musée D'Art et d'Histoire, Genève). Genève.

Bridges, P. S. 1994. 'Vertebral arthritis and physical activities in the prehistoric Southeastern United States', *American Journal of Physical Anthropology* 93, 83-93.

Busch, H. M., T. H. Cogbill, J. Landercasper and B. O. Landercasper 1986. 'Blunt Bovine and Equine Trauma', *Journal of Trauma* 26, 559-560.

Ebong, W. 1978. 'The pattern of fractures and dislocations in Western Nigeria', *Injury* 9, 221-224.

Iacumin, P., H. Bocherens, L. Chaix and A. Marioth 1998. 'Stable carbon and nitrogen isotopes as dietary indicators of ancient Nubian populations (Northern Sudan)', *Journal of Archaeological Science* 25, 293-301.

Jones, M. W. 1990. 'A study of trauma in an Amish community', *Journal of Trauma* 30, 899-902.

Juhl, M., B. Møller-Madsen and J. Jensen 1990. 'Missed injuries in an orthopaedic department', *Injury* 21, 110-112.

Jurmain, R. D. 1991. 'Degenerative changes in peripheral joints as indicators of mechanical stress: opportunities and limitations', *International Journal of Osteoarchaeology* 1, 247-252.

Kilgore, L., R. Jurmain and D. V. Gerven 1997. 'Palaeoepidemiological patterns of trauma in a medieval Nubian skeletal population', *International Journal of Osteoarchaeology* 7, 103-114.

Kraemer, B. and L. Gilula 1992. 'Metacarpal fractures and dislocations', in L. Gilula (ed.), *The Traumatized Hand and Wrist. Radiographic and Anatomic Correlation.* Philadelphia, 171-219.

Kramar, C. 1994. 'Rapport de l'étude de la pathologie dentaire à la connaissance des populations de Kerma', in C. Bonnet (ed.), *Etudes Nubiennes. Congrès Int. d'études nubiennes, Genève, 1990*, Vol. 2. Genève, 295-303.

Langsjoen, O. 1998. 'Diseases of the dentition', in A. Auferheide and C. Rodríguez-Martín (eds), *The Cambridge Encyclopedia of Human Paleopathology.* Cambridge, 393-412.

Leek, F. F. 1972. 'Teeth and bread in ancient Egypt', *Journal of Egyptian Archaeology* 58, 126-132.

Lukacs, J. R. 1989. 'Dental Paleopathology: Methods for Reconstructing Dietary Patterns', in M. Y. Iscan and K. A. R. Kennedy (eds), *Reconstruction of Life from the Skeleton.* New York, 261-286.

Norton, M. 1997. *Anthropometry in the treatment of infants with cranial deformities: a statistical and historical description.* MA thesis, California State University.

Rose, J., B. Burnett, M. Nassaney and N. Blaeuer 1984. 'Paleopathology and the origins of maize agriculture in the Lower Mississippi Valley and Caddoan culture areas.', in M. Cohen and G. Armelagos (eds), *Paleopathology at the Origins of Agriculture.* New York, 393-424.

Sacher, A. 1996. 'The application of forensic biomechanics to the resolution of unwitnessed falling accidents', *Journal of Forensic Sciences* 41, 776-781.

Sakurai, A., S. Hirabayashi, Y. Sugawara and K. Harii 1998. 'Skeletal analysis of craniofacial asymmetries in plagiocephaly (unilateral coronal synostosis)', *Scandinavian Journal of Plastic ana Reconstructive Hand Surgery* 32, 81-89.

Schultz, R. 1990. *The Language of Fractures*, 2nd edition. Baltimore.

Shore, L. R. 1934-35. 'Polyspondylitis marginalis osteophytica', *British Journal of Surgery* 22, 850-863.

Smith, G. E. and F. W. Jones 1910. *The Archaeological Survey of Nubia. Report for 1907-1908. Volume II: Report on the Human Remains.* Cairo.

Souza, L. D. 1968. 'The pattern of trauma at Mulago hospital, Kampala', *East African Medical Journal* 45, 523-531.

Walker, P. L., D. C. Cook and P. M. Lambert 1997. 'Skeletal evidence for child abuse: A physical anthropological perspective', *Journal of Forensic Sciences* 42, 196-207.

Welsby, D. A. 1995. 'The Northern Dongola Reach Survey, the 1994/95 season. a: The Survey', *SARSN* 8, 2-7.

Welsby, D. A. 1997. 'The Northern Dongola Reach Survey: the 1996/7 season. Excavations at Sites O16, P1, P4 and P37', *Sudan & Nubia* 1, 2-10.

Wilk, V.A. 1993. 'Health hazards to children in agriculture', *American Journal of Industrial Medicine* 24, 283-290.

Wilson, E.S. and F.N. Katz 1969. 'Stress fracture analysis of 250 consecutive cases', *Radiology* 92, 481-486.

Plate II. The Kerma Ancien child's burial P37(J3)14 (Photo D. A. Welsby).

Plate I. The Kerma Ancien child's burial P37(K3)15 (Photo D. A. Welsby).