

# OSTEOLOGICAL EVIDENCE FOR MESOLITHIC AND NEOLITHIC VIOLENCE: PROBLEMS OF INTERPRETATION

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**Abstract:** Initial interpretations of Mesolithic Portuguese material as evidence for violence are questioned: the alternative suggestion is of accidental trauma, especially in childhood. A situation of undoubted extreme interpersonal violence in Kenya is shown to relate to within-population conflict caused by external pressures. Intensified violence between North American groups of Northeast Woodland peoples in the seventeenth can also be related to external factors (and constraints on resources): though documented ethnohistorically, the osteological evidence for this violence is extremely limited, demonstrating that absence of evidence is not to be relied upon. A Neolithic Chinese site is examined next, as the focus of the paper, since it provides clear physical evidence of violence, despite the lack of archaeological recognition of conflict, pointing to the need to be wary of the interpretations in this sensitive area of anthropological study. The background of the Jiangzhai sample is described and it is noted that 64% of the victims were female. Meggitt's research on violence within and between groups is cited in the following discussion, and the conclusions focus around the need for care in concluding that violence has or has not occurred; the need to avoid simplistic explanations for evidence of violence and the necessity of setting that evidence within a broad context – one with chronological and social/geographical depth and breadth; and the need for sensitivity in recording and interpreting violence.

**Keywords:** interpersonal violence, skeletal trauma, Mesolithic Portugal, Jiangzhai Yangshao China, Iroquoian Ontario

## INTRODUCTION

Accurate recognition of the presence of violence in a skeletal sample is not a straight forward matter. Interpretation of the evidence cannot be pushed very far beyond simple description, despite Walker's (2001:2) contention that osteologists have available to them evidence which is "immune to the interpretative difficulties posed by literary sources." In this paper I examine Mesolithic and Neolithic Portuguese burials and previously undescribed material from a Neolithic Chinese site, but I will use examples from ethnographic literature and from my own research on human skeletal material in different areas and from different time periods (pre-Contact Ontario, 20<sup>th</sup> century material from Kenya) to illustrate the problems of interpretation.

## PORTUGAL

From 1984 to 1989 I was involved in a project to analyse and describe the human remains from the classic Mesolithic sites at Muge (Moita do Sebastião and Cabeço da Arruda) as well as a number of Neolithic sites in Portugal (Jackes *et al.* 1997; Lubell *et al.* 1994). Cranial analysis was done in collaboration with Christopher Meiklejohn, and postcranial observations on the Mesolithic material were made in collaboration with an experienced physician, also trained in osteology, Gerd Weih. We observed some, very limited, evidence that might be interpreted to have resulted from violence.

Among the skeletons from Moita do Sebastião was one (Ossada 2) where a broken bladelet is still embedded below

the sustentaculum tali of a right calcaneus. While an accident, rather than violence, might be a reasonable explanation, there was the possibility of interpersonal violence because of the presence of forearm fractures in two females (see APPENDIX 1:1 for a summary of the Portuguese skeletal elements discussed here). Moita Ossada 25a had a healed fracture in the distal third of the right ulna (Figure 1a), and Moita Ossada 10 an interesting lower midshaft pseudarthrosis in the right ulna (Figure 1b). This latter individual, represented by fragmentary remains only, also had slight abnormalities of the right clavicle and proximal ulna which accorded with unusual function of the right arm over a long period. An abnormality of the left acetabulum was also noted. In addition, there was Moita Ossada 30, consisting of two individuals, incomplete and mixed, one a short and heavy male, and one a lighter built individual who was taller, and perhaps female. The distal third of a right ulna shaft had a perfectly aligned healed fracture, perhaps greenstick (a childhood injury in which a bone is not fractured across the shaft) (Figure 1c). Unusual radial morphology perhaps also indicated fracturing, but the radii were too fragmentary to reach a positive conclusion.

Trauma to the forearm, perhaps caused by an attempt to parry a blow, has long been considered a clear indication of violence – a classic "night-stick fracture" occurs in the distal third of the ulnar shaft. While midshaft and lower midshaft forearm fractures can result from a fall on the hand as well as from a direct blow on the forearm (Adams 1972:153, 158), if there was no dislocation or displacement a fall is a less likely cause than a blow. A direct blow sustained by a fairly young individual could have a reasonably well-aligned outcome, but a heavy fall would be likely to result in greater angulation. Falls onto the outstretched hand are most likely to fracture the head of the radius in young adults, or to result in a Colles'

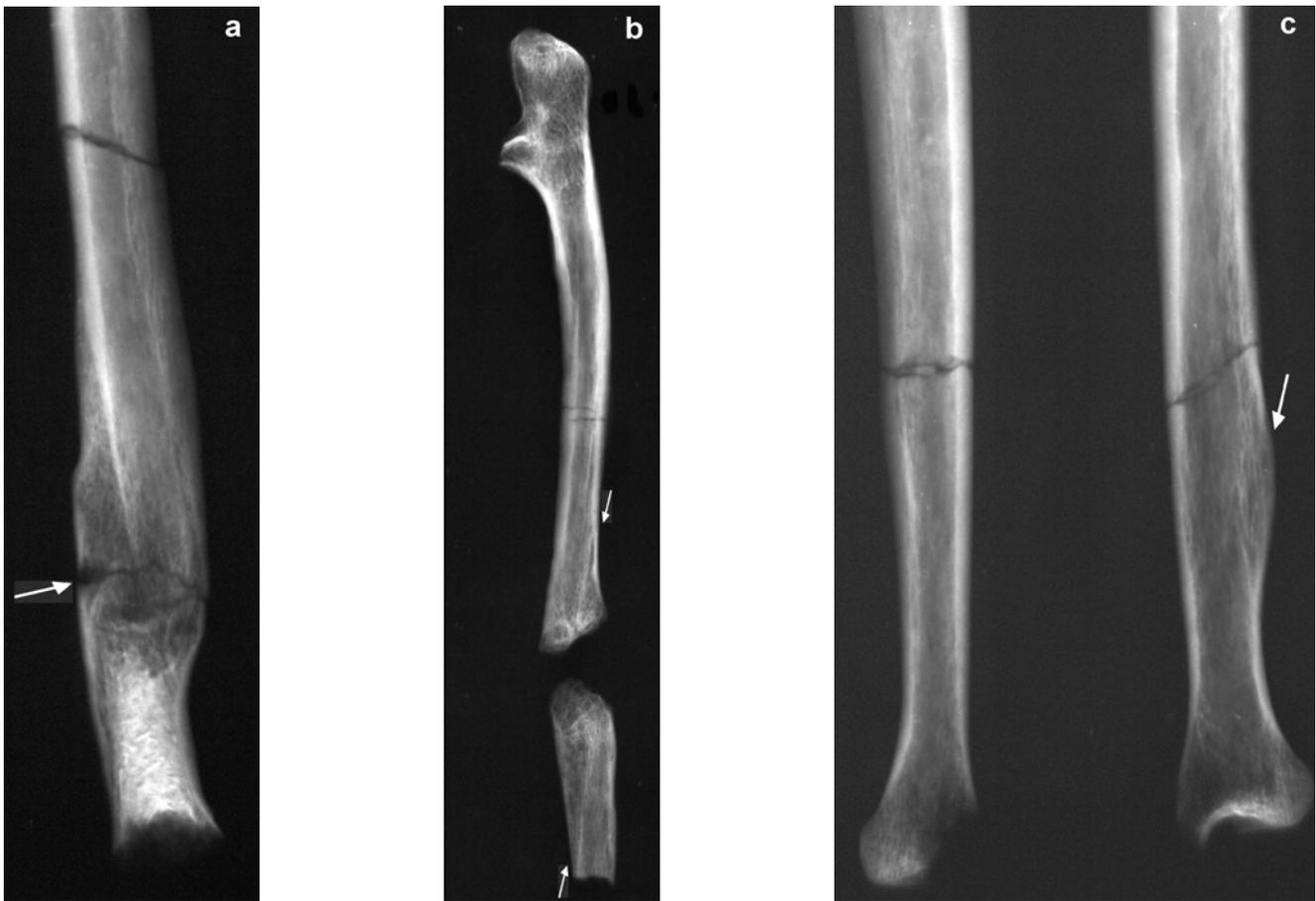


Figure 1a Moita do Sebastião Ossada 25a: healed fracture in the distal third of the right ulna (x ray: 11 14/7/84 Santiago do Cacem).

Figure 1b Moita do Sebastião Ossada 10: right ulna with pseudarthrosis at midshaft Figure D (x ray: 7 14/7/84 Santiago do Cacem).

Figure 1c Moita do Sebastião Ossada 30 ("1030"): both distal ulnae pictured - distal third of a right ulna shaft with apparent greenstick fracture (x ray: 11 14/7/84 Santiago do Cacem).

fracture in those over 40 years of age. A fracture at the midshaft of a forearm long bone in a child is most likely to be the result of a childhood fall and it may heal without very severe displacement. Thus, the unknown factor of age of injury is important in the aetiology and outcome.

The radiograph of the Moita Ossada 25a ulna (Figure 1a) demonstrates some misalignment (since the extremities of the bone are damaged it is impossible to estimate the degree of functional impairment): the location and degree of misalignment may make a childhood fall the best guess for the cause, but a parry fracture could not be ruled out. Moita Ossada 10 could indeed have suffered a direct blow to the forearm. Because a false joint developed incorporating new bone following displacement (Figure 1b - note the arrows indicating the border between new bone and the original bone surfaces) and also because the olecranon joint surface was restricted, a very long-standing disability is probable. Moita Ossada 30 (Figure 1c) definitely seemed to have suffered a childhood injury.

The count of adult right ulna fragments examined for Moita in 1984 was 41, but not all of these retained a complete shaft allowing observation: the percentage of right ulnar shaft

trauma is certainly well below than 13% (3/23). However, in none of our Portuguese work did the circumstances of analysis permit systematic checking of all fragments of all individuals for reconstruction, necessary whenever there has been mixing of individuals.

In publications from the very beginning of our work in Portugal, when we were just starting to try to understand the Mesolithic (Lubell and Jackes, 1985; Lubell *et al.*, 1989), we suggested the possibility of violence, mentioning "parry fractures", for example. Subsequently, in 1985 and 1986, we examined material from Cabeço da Arruda, a very slightly later site which we thought more likely than Moita to represent pressures resulting from increased sedentism and higher fertility levels (e.g. Jackes and Lubell, 1999a,b). Nevertheless, Arruda did not provide definite evidence of violence.

The skeleton labelled Arruda Ossada XVII was of an adolescent male, but stored with his bones was an extra right radius (skeletal elements from this site have been extensively mixed since excavation, the extra radius was probably not buried with Arruda Ossada XVII). This fragmentary radius had only the distal end present. The bone appeared to have a

distal shaft fracture, but no obvious fracture was evident from the radiograph. Perhaps a greenstick fracture would explain this case. Exactly the same situation appears in the next specimen to be discussed.

Arruda Ossada XIV had two left radii, one of which might have sustained a hairline fracture with healing in perfect alignment and without callus tissue build-up, but with some wasting of the arm – while a fracture was the initial diagnosis, none is evident from the radiograph and the atrophy could have derived from causes other than bone fracture.

The left ulna radiograph of Arruda Ossada H (an elderly adult, with generally male postcranial dimensions but female sciatic notch form) shows almost perfect alignment of a lower midshaft fracture (Figure 2), and therefore is likely to have been the result of a childhood fall.

A presumably fractured right clavicle, the radiograph showing healing in reasonable alignment, is present in an unidentified individual. Arruda was excavated in the nineteenth century and in the 1980s when we were inventorying and removing the material from wooden sliding drawers for repacking and storage in special individual boxes, this clavicle was found with a number of stray bones, many of them clavicles, as “an individual” whom I nicknamed “Shiva”, or Arruda SH (see Jackes and Lubell 1999 for a



Figure 2 Cabeço da Arruda Ossada H: both ulnae, the left (on the left) with a perfectly aligned fracture (x ray: D3D 5/11/85 Sintra).

summary on the excavation and curation of the Mesolithic sites). Arruda SH also showed several fragmentary left ribs which had probably sustained trauma. The ribs of Arruda Ossada XIII, a fragmentary elderly individual, probably male, are also likely to have sustained fractures. A right ulna stored with a number of stray bones as an “individual” whom I nicknamed “Toes” or Arruda TO (because of the large number of metatarsals present) showed the abnormal curvature of the shaft, which is typical of a “greenstick” fracture.

An individual from another site, Samoqueira (fully discussed in Lubell and Jackes 1985), indicates that traumatic falls or blows to the elbow occurred in Mesolithic Portugal, added to which there were several instances of elbow abnormalities at Arruda. Arruda Ossada Q was a male with a rather unusual amount of arthritic damage for the population. He also had an apparent childhood fracturing of the left elbow (Figure 3). Arruda Ossada 29, a very large middle-aged male, had a bilateral abnormality of the coronoid process of the ulna, with marked deformity of the humeral distal articular surfaces. Once again, the best interpretation seems to be a childhood injury, prior to the complete formation of the distal epiphysis.

The only humerus present in Arruda Ossada XXV (E), the left, shows the possibility of delayed fusion of the medial epicondyle epiphysis which was completely absent, though partial fusion might have been expected in this late adolescent male (Figure 4a). The individual had an early onset of spurring of the eminence between the radial and coronoid fossae of his distal humerus. For comparison, a shorter individual, Arruda Ossada 60, roughly the same age, already had a fused medial epicondyle. Medial epicondylar epiphysis fracture in children is associated with elbow dislocation occurring by violence or more often because of a fall (Adams 1967:142), and is relatively common in young adolescent males (Green and Swiontkowski 1994:239). The possibility of an abnormality in the left elbow of Arruda Ossada XXV (E) is perhaps supported by the fact that one individual from Moita, Moita Ossada XIV, also a male, had a left medial epicondyle quite different from that on his right humerus. On the right the epicondyle extended 1.5 cm beyond the articular surface, whereas the left epicondyle was a small nubbin of bone half the height of that on the right, and extending barely .75 cm beyond the articular surface (Figure 4b).

These two individuals present very puzzling cases, in which congenital factors and/or activity patterns might be implicated. An interesting suggestion comes from Ogawa and Ui (1996) that teenage boys indulging in arm-wrestling are liable to fracture-separation of the medial epicondyle. As Glencross and Stuart-Madacam (2000) have noted in presenting an archaeological case comparable with those under discussion here (see also Glencross and Stuart-Madacam 2001), little attention is paid in the anthropological literature to childhood injuries, because of the lack of certainty in the diagnosis. However it is clear that the early adolescent males are particularly vulnerable to injury: there is “an increase in muscle strength, a decrease in the shear strength per unit area of epiphyseal cartilage immediately before closure, and [a] resultant relative mechanical imbalance” (Ogawa and Ui



Figure 3 Cabeço da Arruda Ossada Q: medial and posterior views of the left humerus and ulna.

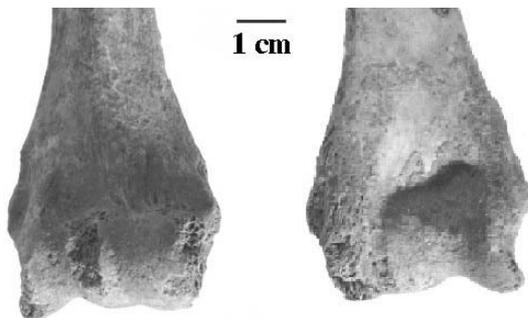


Figure 4a Cabeço da Arruda Ossada XXV (E): anterior (left) and posterior views of left humerus.



Figure 4b Moita do Sebastião Ossada XIV: anterior view of left (on the left) and right humeri.

1996:496). Medial epicondylar fractures of the humerus are likely to lead to displacement and to fibrous rather than bone reunion (see e.g., Josefsson et al. 1986 and Dias et al. 1987).

That extraordinary stresses were placed on Portuguese Mesolithic arms could be deduced from the great development of the ulna supinator crest (see Kennedy, 1983), or signs of unusual muscle activity (examples are listed in Table 1:1, e.g. for Moita Ossada 5 and Ossada 6).

The count of Arruda right ulnae in which the full shaft could be observed for fractures is more accurate than that for Moita,

because the method of recording was more detailed, but again systematic reconstruction could not be attempted. For comparison with Moita, of the 47 whole or fragmentary adult right ulnae present, 23 definitely had the full shaft length available for observation: the trauma rate for the lower middle to distal one third of the right ulna shaft would thus be only 1/23, or 4%. There were 33 observable adult left distal humeri, so the three apparently abnormal left elbows would mean a frequency of around 9%.

From this brief summary, we might validly assume that signs of violence within the Portuguese Mesolithic were not the

result of intergroup aggression, but rather of anger within a domestic setting. We might more validly conclude that there is no evidence of violence, and that the trauma was accidental, and generally suffered in childhood. A further consideration here is the possibility that some activity was placing special stress on the elbows and forearms of young males. It may be that the distal growth plates of the humerus were at especial risk.

Neolithic sites, presumably displaying still further sedentism and population increase, provided no absolutely convincing proof of violence. Before the start of our project we expected to see increased dental and postcranial pathology in the Portuguese Neolithic, based on our preconceptions derived from the literature and work on North American horticulturalists. We also thought that in the Neolithic we might see signs of an immigrant population and that an increase of violence might thus be expected. Our expectations were not met in any area.

Zambujal Cave at the Neolithic site of Melides showed disruption of the distal articular surface of a left humerus, the radiograph showing that there was a complete medial epicondylar area fracture (Figure 5). A right humerus lateral epicondyle from the same site displays unusual spurring perhaps from repeated and forcible extension and rotation at the elbow. Once again, childhood falls or specific activities suggest themselves.

Nowhere did we see clear evidence of cranial/facial trauma. Meiklejohn and I, in collaborating on examining the Mesolithic skulls from Moita and Arruda, had agreed that there was no cranial trauma suggestive of real interpersonal violence. Trephination had previously been reported for the Neolithic of Portugal (Barbosa Sueiro 1933), and we examined and confirmed that attempts had been made in these cases, though a reported Mesolithic trephination seemed to us open to several interpretations. Trephination slightly

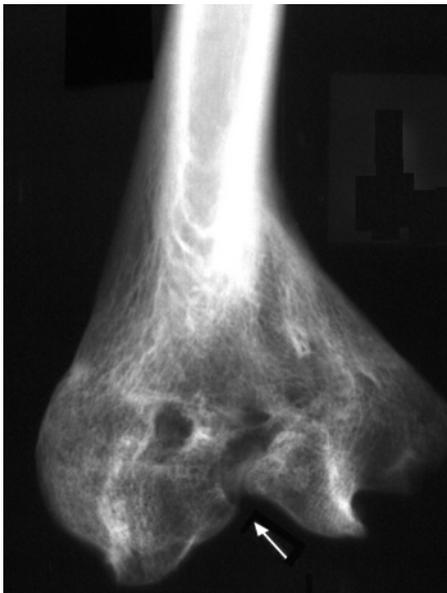


Figure 5 Melides Zambujal 15: left humerus (x ray: 77.9 7/6/86 Sintra).

confuses the issue of the only apparent cranial trauma from Feteira, a Neolithic burial cave (see Zilhão 1984). The skulls from this excavation are in general broken and dispersed. Three small portions of cranial vault showed oval depressions, one (No.1949) definitely suggested trephination, so the fact that the other two seem also to echo the oval form of the identified trephinations in other Portuguese Neolithic sites, along with the extreme fragmentation of the skulls, makes it very difficult to positively identify the cause. Certainly, some form of scalp wounding, with involvement of the underlying bone, has occurred in one (No. 1644), and in the other two cases (Nos. 1949 and 1786) complete healing after removal of bone seems likely. The healing had created deep depressions with thin floors. Each of these three lesions is about 4.5 cm in length and just under 2 cm across.

Our examination of material from the large and important Neolithic burial cave, Casa da Moura, provided no evidence of violence: in fact most of the evidence of trauma was provided by four metacarpals and one metatarsal, which did not surprise us, since trauma and infection of the hands and feet had been evident from the Mesolithic sites as well (some examples noted APPENDIX 1:1), not unexpected since harvesting of shellfish from rocky Atlantic shores must have figured at some point in the lives of all these groups.

Our final conclusion was that we had been premature in suggesting the possibility of violence in the Portuguese Mesolithic – certainly we could not identify warfare between groups. Broadening the chronological context altered interpretation of the trauma. It seems likely that an historical approach to violence should be taken wherever that is possible, and may lead to a modification of interpretations.

## KENYA

On the other hand, evidence of more extensive violence should not lead us immediately to conclude that there was warfare between groups, nor to make simplistic assumptions about the causes of violence.

I have examined the skeletons of those who were pulled from latrine pits in Kikuyu villages after the panga murders of the Mau Mau Emergency in Kenya (Jackes 1977:29). The signs of violence were all too evident. Violent death by panga is marked by deep cuts which are almost random, not clustered at sites of muscle and ligament insertions around major joints. Land alienation following upon European settlement, coupled with population growth, led to land degradation and social and economic disruption (Thrup 1987). The consequence, triggered by the deepening ecological disaster, was a self-destructive frenzy *within* Kikuyu society: the rebellion “turned inwards to consume its own supporters – to become a Kikuyu civil war” (Sorrenson 1967:100). As Carman (1997:10) discusses, internecine conflict may result from the pressures exerted by outside political forces. The historical context is important in this example, as also in the next.

## CANADA

While unequivocal in the Mau Mau instance, there is the possibility that pre-mortem use of blades cannot always be clearly differentiated from post-mortem disarticulation (Havercourt and Lubell 1999, but see Jackes and Lubell, this volume). However, with regard to Eastern Woodland peoples of North America there is no doubt: evidence for post-mortem disarticulation is clear in Canadian Iroquoian Huron skeletons buried in large ossuary pits such as that at Kleinburg in Ontario (Jackes 1977:9). Multiple fine “cutmarks” are very specifically located, for example on femoral necks. Among the Ontario Iroquoian Neutral Nation, in which wholesale disarticulation at burial was not practised, such cutmarks are rare (Jackes 1996). The Huron provide a situation where ethnohistorical evidence of secondary burial following disarticulation is available, and in which it is clearly possible to identify post-mortem cuts to bones. Such cutmarks are illustrated by Ubelaker (1989:106).

Positive identification of violence, on the other hand, seems to be relatively rare for Ontario Iroquoian skeletons. There is little skeletal evidence of interpersonal violence, and yet this was a period of post-contact war well-documented ethnohistorically. Prior to European contact there was a period (known through large-scale archaeological excavations) during which villages of increasing size, placed in strategic locations and with multiple palisades (see e.g. Finlayson 1998:16), add weight and time depth to the ethnohistorical evidence of war between and among various Iroquoian and Algonquian groups.

There are reports of skeletal marks of violence (see Anderson 1986, Ossenberg 1969, Pfeiffer 1986: cranial or facial trauma and two instances of projectile points in bone, both in vertebrae), but in general violence is sparsely reported. For example, at the completely excavated Grimsby Neutral cemetery, in Ontario, there is major trauma, but very little of it can be definitively ascribed to violence – perhaps only two cases of cranial trauma (Jackes 1988:83 ff.). This evidence is surprisingly meagre, given the known fact that warfare was carried out on two fronts by men of the Neutral Iroquoian Nation during the period of use of the cemetery (1615 to 1650 A.D.). Ethnohistorical documents suggest that those who died by violence might not have been given normal burial (see e.g. Tooker 1967), so we would expect to see indications of well-healed or minor wounds only.

Because raiding parties of warriors travelled great distances, those who were severely wounded are unlikely to have survived the return journey. Few wounded warriors are likely to have escaped being made prisoners and killed far from home. Absence of evidence is not necessarily convincing, but the relative paucity of signs of warfare is surprising in view of the fact that every Spring and Summer during the 1630s five to six hundred young Huron men left home to raid Iroquois territory to the south (Tooker 1967: 29-30). The rarity of trauma definitely resulting from violence certainly supports the Jesuits in their contention that the Huron were not violent towards their fellows. Equally, we must take it to

support the ethnohistorical sources which record exclusion from normal burial places of those who suffered violent deaths, and we can validly suggest that not many young men who were wounded in war survived to be buried later in the ossuaries and cemeteries of Iroquoian Ontario.

Special burial places may have been reserved for the victims of violence, as has been proposed for the nine young males, buried at the Van Oordt Site in central Ontario (Molto *et al.* 1986). Perhaps this site is best interpreted as a special place of burial for a party of warriors ambushed close to home. The absence of burning may indicate that the warriors were not killed on a distant raid, since the Jesuits wrote of the Huron: “they are accustomed to burn the flesh of a person who dies outside their own country and, extracting the bones, to take these with them” (Thwaites 1898; XI [1636-1637]:131). The lack of burning may also indicate a lack of torture.

Iroquoian violence widely encompassed the torture of prisoners of war, described in ethnohistorical sources in too vivid detail (e.g. Thwaites 1898; XIII [1637]: 37ff). The discovery of fragmentary human remains disposed of in village middens, rather than in ossuaries and cemeteries, has been interpreted as evidence of prisoner sacrifice and cannibalism (Jamieson 1983). While a small percentage of Ontario burials occurs outside specific cemetery areas (e.g. Esler 1998), and the cut marks of disarticulation and disturbance of interments by ploughing may confuse matters, there seems to be little doubt that Jamieson (1983) is correct in his association of part of the eastern Ontario Roebuck site human skeletal material with the deaths by torture of prisoners of war.

So there is evidence in Ontario of violence, but it is sparse, and the widespread violence of Iroquoian society might not have been recognized from cemetery and ossuary studies alone, without the benefit of ethnohistorical sources of information. To repeat, at a site like Grimsby there is evidence of violence (Jackes 1988:83) but it is limited and, except in a few cases, equivocal. Yet there was disruption, disease, famine and war on several fronts, and at Grimsby the demographic evidence suggests an influx of refugees (Jackes n.d.). We know that the Grimsby cemetery covers the period of the breakdown of a society under the combined influence of the European fur trade, the introduction of European weapons, and the final incursions of Iroquois from the south to destroy the Neutral Nation.

## CHINA

A background in Iroquoian studies was long considered appropriate for examination of material from northern Chinese Neolithic villages. As far back as 1921 when Andersson and Zdansky were excavating at the first Yangshao site, they were visited by the Canadian, Davidson Black, who drew their attention to publications on North American material (Andersson 1973), believed to be especially relevant because of shared multiple burial practices. More relevant to

later interpretations of Yangshao material by Chinese archaeologists was the matrilineality of Iroquoian nations. This was interpreted as according well with the matriarchal clan phase of Engels' unilinear scheme adopted by Marxist archaeology (Trigger 1989), deriving from L.H. Morgan's work. Since Morgan was, himself, an adopted Seneca of the Iroquois Confederacy his work gave special emphasis to Iroquoian kinship and social organization.

Whatever interpretation was laid on the early Neolithic of North China, in setting out to examine material from the Yangshao stages at Jiangzhai, now preserved at the BanPo Museum, I did not expect to meet any more evidence of violence than I had seen in Ontario skeletal collections.

The site of Jiangzhai lies in Lintong County to the northeast of Xi'an City on a terrace of a tributary of the Wei River. It was partially excavated between 1972 and 1979, an area of about 17,084 square metres being dug of the total site area of about 30,000 square metres.

The cemeteries which provided the material to be discussed here represent the first two stages of Jiangzhai, both within the Yangshao culture. Earlier dates for the site (Chang 1992:390), shown in Figure 6 (atmospheric data), are consonant with those from the nearby site of BanPo, near Xi'an, which is equivalent to Stage I Jiangzhai. Stage II must provide the youngest date, and a representative site equivalent to Jiangzhai Stage II is Shijia, Weinan County, also in Shaanxi (for Shijia dates see Chang 1992:390; Gao and Lee, 1993).

A major difference between Jiangzhai Stage I and Stage II is the switch from primary interments to multiple secondary burials (that is, collective burials).

Shijia was a complete excavation of a cemetery of just under 250 square metres with a thickness of about 1 metre average depth. Forty three graves were excavated, and the minimum number of individuals recognized by the Anatomy Division of the Xi'an Medical Institute in 1978 amounted to 730, mostly placed in rows with skulls placed in the centre.

Individual identity seems to have been retained despite disarticulation (Gao and Lee 1993).

The arrangement contrasts with the earlier BanPo site, where the village cemetery contained 175 individuals, almost all as single adult extended burials, while 73 young children were buried in urns in the village area (Hsi-an Pan-p' o po wu kuan, 1987).

It is to be noted that these sites of the Yangshao culture do not represent the earliest phase of millet agriculture on the loess terraces near the middle reaches of Yellow River in northern China. The earlier Peiligang sites are already large settlements with varied domestic architecture and distinct cemetery areas. Nevertheless, Jiangzhai is a site of great importance, in that it uniquely, perhaps, encompasses several phases of the Yangshao culture.

Like Shijia, Jiangzhai was excavated during the 1970s. This was a period of the encouragement of extremely large-scale excavation with emphasis on archaeology by and for the peasant/worker/soldier (Chang 1977). As Chang points out (Ferrie 1995:315), the first scholarly publications restored after the Cultural Revolution were in archaeology, and the political context for the emphasis on Yangshao sites is clear (Tong 1995; see also Trigger 1989:177). With a change of emphasis, the interest is still high (Li 1999:602 referring to the BanPo Yangshao burial pattern demonstrating "a non-hierarchical social organization, where ancestor cult was probably conducted on behalf of and for the common interests of the entire community").

As described in Jackes and Gao (at the 1995 Jomon to Star Carr conference, in press) and Fu (1994), nearly 3,000 skeletons were excavated from the cemeteries at Jiangzhai. The Stage I cemetery areas lay beyond the village, separated from the village area by ditches. The cemeteries were not completely excavated (see Figure 7), but yielded 174 burial pits, generally single primary extended burials of adults and adolescents. The remains of infants were contained in 206 urns which were found, for the most part, among the houses. Stage II burials were mostly excavated from a cemetery which

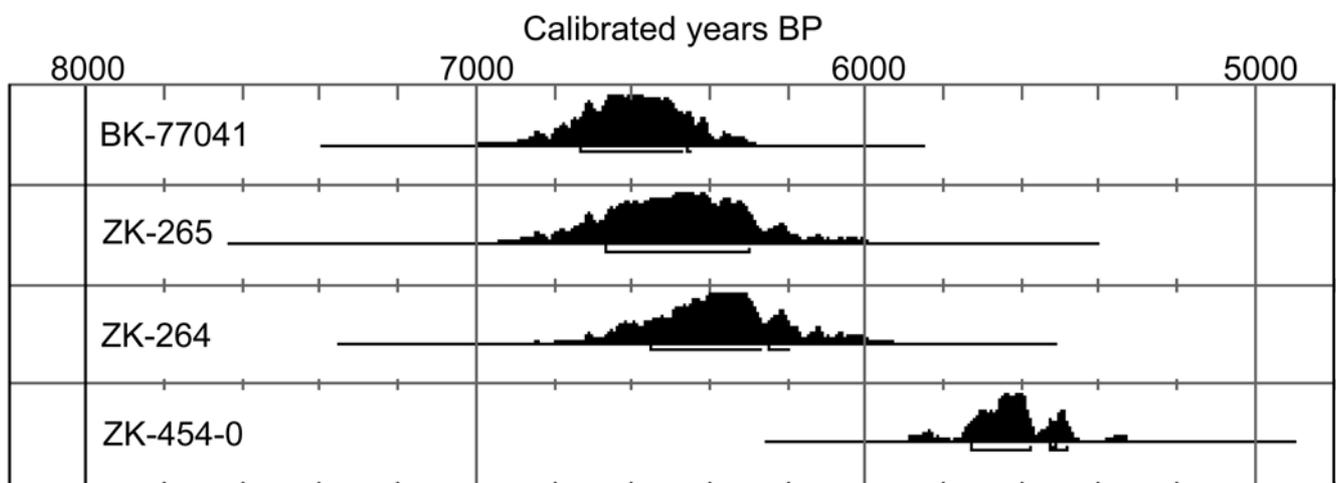


Figure 6 Calibrated dates for Jiangzhai using OxCal v3.5 (Bronk Ramsey, 2000).

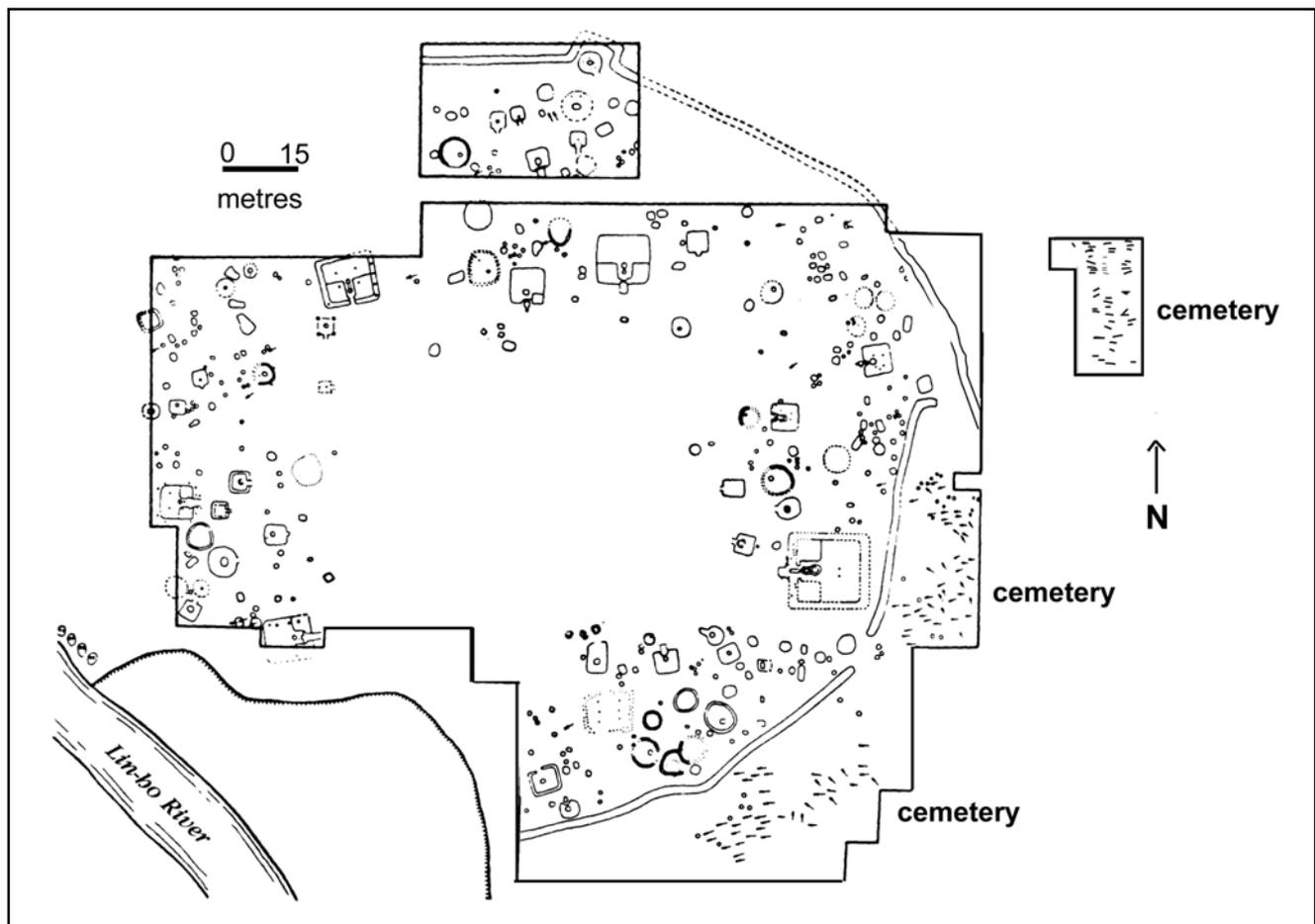


Figure 7 Map of Stage I Jiangzhai (after Gong, 1988) showing location of excavation of cemeteries.

was located in the centre of the Stage I village. The Stage II cemetery itself contained around 2,200 individuals, mostly in collective secondary burials of about 20 people. The bones were for the most part carefully arranged within large burial pits, square or rectangular, with vertical sides. Funeral urns again contained the skeletons of children, though occasionally adults were identified in urns.

The skeletons were examined on site, and an anatomist (Xia Yuan-Ming) who lived in Shanghai was very occasionally present (Gao, pers. comm. 1993). Eventually all but parts of a very few individuals were reburied, and it was disappointing to be able to identify no more than 54 individuals retained in 1993 at the BanPo Museum, Xi'an, 24 of them belonging to Stage I. Interviews with Gao, who had been present at the excavations and was assistant curator on the BanPo Museum staff, and Gong of the Shaanxi Provincial Archaeological Institute who was responsible for the excavation and publication of Jiangzhai (1988), made it clear that perhaps half of the skeletons were reburied immediately and that the selection of skeletons for reburial was completely random (Gong pers. comm., 1.vi.1993). Sometime in the late 1980s the majority of these retained skeletons were placed in a pit in the grounds of the BanPo Museum, because of lack of storage facilities. This operation would have been supervised by Gao, who informed me upon several occasions, in response to different types of questions, that there was no pattern of choice regarding the retained material.

The initial choice immediately following excavation was certainly quite random since no one with osteological expertise was involved in deciding which skeletons were to be retained. Gao, himself, at the time of the excavation was a late adolescent sent north from Guangdong during the Cultural Revolution, and I understand that none of the excavators was trained. I also infer the lack of osteological expertise from facts such as the following examples. M155 is described in the literature (1988) as a single individual, a 30 year old male. The individual in fact consists of the skull of a 13-15 year old female and the postcranials of an elderly male, an individual with a severe lumbar compression fracture. M159 is a 5 year old child, not a 9 year old, as described. M54 is described as a 15 year old female, but is, in fact, a 5 year old child. It appears that not even skeletons recognized as important by the excavators were retained in the museum by the time of my visit in 1993. While M54, just discussed above, was noteworthy for being buried with 2,052 bone beads, the individual (M7) frequently mentioned in the literature (e.g. Chang 1986:119, also Fig. 73) as having impressive grave goods (8,577 bone beads, 12 stone beads and funerary vessels) was not retained.

The random nature of the choice, and the lack of knowledge of the effects of trauma on bone, is important. Since the material available for study is a tiny percentage of the original, it is important to ask whether it is in anyway representative of the whole. I was not able to determine that anyone who

had seen the bones had recognised trauma. (Criticism is not implied by this; it is merely a statement of fact. The difficulty faced by the excavators of these sites is acknowledged, see Howells and Jones Tsuchitani 1977).

The retained material from Jiangzhai presents an extraordinarily large assortment of trauma that could be attributed to violence. Smith (1996:85) has stated that the presence of “parry” fractures is not sufficient in and of itself: “A violent aetiology for mid-shaft fractures becomes more tenable when potentially corroborative craniofacial injury data are considered”. By this standard, Jiangzhai is a persuasive example of interpersonal violence. Added to this, Jiangzhai is a sample of skeletons in which the lower limbs give NO indication of trauma, or of infection following upon superficial trauma: this does not suggest high rates of accidental trauma. At Jiangzhai the lower limb bones provide no evidence of trauma sustained during cultivation or falls resulting from difficult terrain. This can be compared with Grimsby where tibial periostitis typical of Iroquoian horticulturalists’ skeletons (Jackes 1988:63) is coupled with clear evidence of accidental lower limb fracturing (ibid. 85).

Fractures of the clavicle are not necessarily the result of violence. However, the M238 clavicle represents 50% of the entire collection of retained clavicles of same sex, stage and side. The M112 clavicle represents 100% and may well be the same individual as a female with a fractured nose. This suggests (but can not confirm) that clavicular fracturing was not rare.

Similarly, two apparent parry fractures at Jiangzhai may be unimpressive, but together the two constitute 33% of all Stage I left male ulnae. In fact, a third left ulna of a young male from Stage I (M275) had necrotic bone at the mid-shaft, suggesting a wound in the overlying soft tissue of the forearm — in fact, a third parry wound.

An additional consideration is the 100% representation of the left side in fractures of the arm (see Table 1) allowing the reasonable speculation that fighting was undertaken with a weapon held in the right hand. The use of weapons is confirmed by the presence of a depressed fracture of an unusual circular form (Figure 8), which is exactly in accordance with the numerous bola stones on display in the BanPo Museum.

Why does Table 1 record a preponderance of cranial trauma in Stage II? The retained material from that stage is, in general, of isolated skulls: for example, there are 10 observable adult male left malars from Stage II, but only one male left clavicle and one male left humerus. Bias in burial, collection and retention must always be taken into account when comparing frequencies of features between single and multiple burial sites (e.g. Jackes and Lubell 1996).

Despite the poor and probably unrepresentative sample, we begin to get a picture of a society in which there was a great deal of violence. For example, there were seven observable sets of adolescent and adult female nasal bones from Stage II at Jiangzhai, and three of those women had had their noses broken: one can only assume that this indicates violence

Table 1:

Indiv.	Cultural Stage	Sex	Age (see note)	Bone	Side	Percent of observable elements, same side, sex and stage
M238	II	male	a3	clavicle	right	50
M112	II	female	a3?	clavicle	right	100
M75.2 Figure 8	I	female	a1	frontal depressed fracture		12.5
M112:13 Figure 9	II	male	a3?	left malar fracture		10
M84:10	II	female	a3	symphysis mentis, teeth, TMJ fracturing		11
M84:10 Figure 10	II	female	a3	nasals		14
M112:10	II	female	a2?	nasals		14
M216:11	II	female	a2?	nasals		14
M162	I	female	a1	distal humerus	left	17
M151	I	male	a4	distal humerus	left	20
M150	I	male	a3	ulna (also ribs)	left	17
M275	I	male	a1	ulna	left	17

Note: The age estimates in Table 1 are derived initially from dental crown heights, periodontal disease and dental attrition, with extrapolations, since not all individuals were complete: the youngest are a1, who are adolescents; the oldest, a4, are individuals with great wear, dental pathology, extensive suture fusion, arthritic changes to the bones, osteoporosis and thinning of bones.



Figure 8 Depressed fracture which may have been caused by a bola stone (M75.2). The cut on the parietal is considered to be excavation trauma (the author observed large-scale excavation in similar loess sites being undertaken with hoes by village women).

against around 40% of women – excluding from consideration those without hard tissue damage, and those dying without bone healing. What are the chances that, from among the over 2,000 individuals excavated from the Stage II cemetery, a random selection of females would give such a high percentage of healed nasal fractures? In the context, Walker’s comments (2001:10) regarding facial injuries in women are pertinent.

In official publications until recently (for example in the China Internet Information web material dated 1999) and in the work of Chinese archaeologists in the past (as summarized by Gao and Lee 1993), Yangshao society was seen as dependent upon the agricultural work of women, with women having high social status because of this important work. Yangshao, according to this interpretation, was egalitarian and cohesive, based on endogamous matrilineal and matrilocal clans. Matriarchy was specifically referred to (An 1988, and is still mentioned by China Internet Information 2001: “the matriarchal society at Banpo Village near Xi’an”), and was no doubt invoked on the basis of an incomplete understanding of Iroquoian parallels or problems in translation (Pearson 1988 has reviewed Chinese interpretations of Neolithic burials). The Iroquoian parallels could be drawn because both societies had collective burials, and great emphasis was laid on the importance of collective secondary burials as a reflection of basic social organization (Wang 1985-1987 has written critically on this matter, specifically in relation to Yangshao burial practices; see also Jackes 1996).

We can support the Chinese archaeological hypothesis that the females worked hard, based on activity-dependent trauma in young females (for detailed discussions of the interpretation

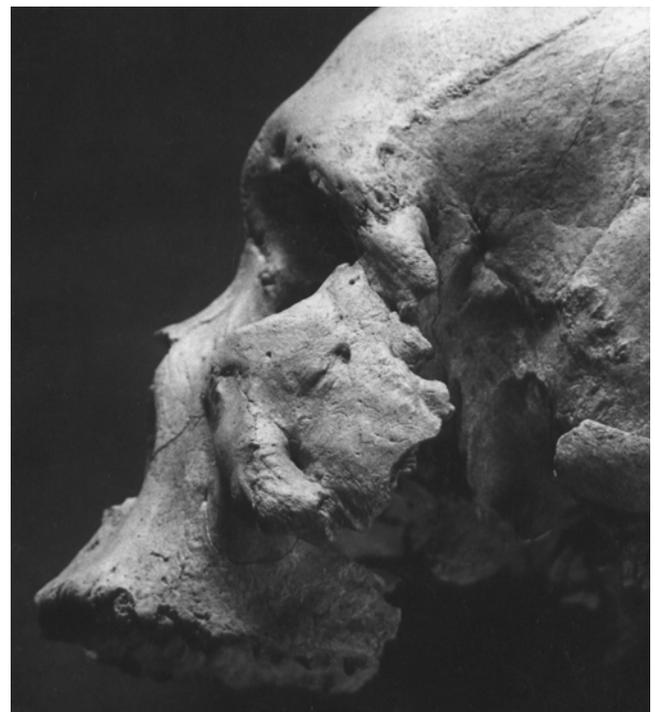


Figure 9 Healed fracture of the cheek bone (M112:13). Note the fracture and deflection backwards of the frontosphenoidal process of the zygomatic bone.



Figure 10 Healed fracture of the nasals (M84:10). The left side of the nose is depressed and distorted.

of this type of evidence of activity levels see Jackes 1977, 1988). Female vertebrae seem to have been subjected to constant stress of the type that suggests sustained labour in the fields. M181 and M161 were two Stage I females, both young, one still adolescent. Both women had extensive disruption of the vertebral body endplates, with severe intervertebral disc rupturing in the region of the thoracolumbar junction. In males, by contrast, there is no comparable vertebral trauma. M155 was mentioned above as the postcranials only (no skull) of a male with a lumbar compression fracture. This is the only example of major vertebral trauma in a male, and it has a different aetiology. Minor vertebral trauma is seen as small lumbar vertebral end plate defects in three elderly males from Stage I (M149, 150 and 151).

## DISCUSSION

The suggestion that Yangshao women did agricultural work is maintained by the present findings, while the identification of young girls' burials with rich grave goods which is often mentioned in the literature on Yangshao sites (Pearson 1988) is questioned (see also Gao and Lee 1993). The idea propounded in the Chinese literature that women had high status is not well-supported by the osteological evidence of violence against females. One might argue that women were victims during an attack by outsiders, but that certainly would not accord with the general Iroquoian pattern (see discussion

below) which were appealed to in the initial interpretations of Yangshao society.

Underhill (1989) has pointed out that evidence for warfare in Yangshao sites is very poor (see also Pearson 1988:12). Thus we might conclude that the evidence of aggression indicates violence internal to villages, and that the society could not be described as "cohesive", contrary to the Chinese initial archaeological interpretation of Yangshao society (Pearson 1988 provides a useful summary of the rather complex history of interpretations). The problem is, of course, that the term "cohesive" may say little. We can assume that Chinese scholars were using it to refer to a close interdependency of individuals within a group, without status differentiation, and with a degree of gender equality. Such cohesion may depend upon ecological and economic circumstances, and whether the group finds greater definition in opposition to external forces (when internal divisions threaten your society, proclaim an enemy). As we will see below, the mutual interdependence of the members of a small group within a harsh environment does not always preclude interpersonal violence.

Jackes and Gao (prepared in 1995, in press) discuss the evidence for population heterogeneity in Neolithic northern China, noting that this evidence is based on meagre samples, and pointing to the urgent need for full studies of large samples in order to clarify the situation. The possibility of fortified villages, usually referred to only in the context of the later Longshan settlements, is also mentioned: this is based on the fact that even at Jiangzhai I the cemetery areas are placed beyond a series of ditches which the excavators considered to have been joined by palisade fences. We can certainly not exclude the possibility that Jiangzhai provides an example of inter-group violence.

Could we distinguish intra- and inter-group violence?

In Iroquoian society the violence was externally directed. The French administrators and missionaries who worked among the Montagnais and Huron in the first half of the 17<sup>th</sup> century were horrified by the wars among the Iroquoian and Algonquian peoples, and especially by the institution of prisoner torture. But they also commented on the rarity of internal strife, noting that it was ascribed to gambling (Thwaites 1898; X [1636]:81), and writing "It is strange what enemies the Savages are of anger, and how this sin shocks them" (Thwaites 1898; XX [1640-41]:197). The Jesuits recognized that there was public gift giving to prevent vengeance (Thwaites 1898; XXVIII [1645-6]:51) and that the system worked so well that "we find without comparison much less disorder than there is in France, though here the mere shame of having committed the crime is the offender's punishment" (Thwaites 1898; XXVIII [1645-6]:63). The more thoughtful among the priests found it salutary to contemplate the acceptance in France of harsh punishment of children, of the disturbed and the disruptive, and some of the priests came to realise that the Hurons and Montagnais viewed such French-style punishment as barbaric.

In fact, we cannot be simplistic in our approach to Iroquoian violence, based on what is known about war among the

Iroquois of the Five Nations (see Richter 1992). The wars were “mourning-wars” designed to provide war captives in order to assuage the grief of female relatives who were in mourning. Such raids into enemy territory were not designed to lead to deaths, but rather to the taking of a few prisoners, to be given to women in mourning who could choose adoption or (generally for adult males only) death for the captives. A warrior was judged by his success not in killing the enemy, but in bringing home captives. To die in battle was not glorious. War was based on premises that had nothing to do with seeking power and acquiring land; indeed peace was prized above war. We may therefore understand that the scale and frequency of the early seventeenth century prisoner torture, death and consumption, the aspect of Iroquoian life which Europeans found so offensive, was a response to the demographic crisis of the period. The demographic crisis, brought about largely by the European search for furs, led to the deaths of many: the grief for those deaths had to be assuaged by “mourning wars” and by the deaths of captives, a continuing cycle, until the Iroquoian nations in Canada were quite destroyed.

Iroquoian peoples were not violent towards females: the nation known as “Neutral”, because they avoided war against other Iroquoian peoples, was exceptional in this, in that females could be tortured (Jackes 1988:32). Evidence for violence against males alone may well be a mark of societies with institutionalized inter-group aggression, such as that among the Iroquoians, and in the well-known “great fights” of Highland New Guinea (Meggitt 1977). This is not the appropriate context for a discussion of what may constitute inter-group versus intra-group aggression within the shifting focus of human conglomerates, but the referents of “us” and “them” are fluid, and this is as true in small scale societies like the Mae Enga and the inhabitants of the northeastern woodlands of North America, as among societies with populations numbering in the millions, in which defined groups may range from football team supporters to affiliates of world religions or inhabitants of whole continents.

Highland New Guinea “proxy warfare” between groups of males over access to resources may be contrasted with Warlpiri (Walbiri) violence, described in another study by Meggitt (1962) — the use of examples studied by the same anthropologist is deliberate, since the interpretation of social facts may be coloured by the personal viewpoint of the observer. Meggitt clearly found warfare to be of great importance among the Mae Enga (Meggitt 1977), whereas Warlpiri fighting was “restricted” (Meggitt 1962:49,246). Warlpiri violence was overwhelmingly intra-group. Enforcement of Warlpiri social norms might entail physical punishment (ibid. 252, 258), and physical violence towards women was common (ibid. 88, 92, 100), and viewed as punishment. Violence occurred even among women (ibid. 94, 111) and there are multiple references to women beating their adult daughters for misbehaviour (e.g. ibid. 96).

The Warlpiri may not be typical of Central Australians, and behaviour in the 1950s must already have been influenced by European encroachments (ibid. 335), so no general conclusions should be drawn from this one example of desert

dwellers (but see a discussion on adult females as victims and perpetrators of violence in Australia in Larsen 1997:140-142, and on the almost uniquely high incidence of cranial trauma in Australia, Jurmain 1999:199). However, the message of Meggitt’s work is that the stability of the marital relationship is central to Warlpiri society (ibid. 103) and that social cohesiveness is of prime importance. Violence against women was interpreted as an expression of cohesiveness. Noone can doubt the importance of cohesiveness to a small, egalitarian, kin-based socio-economic unit in a harsh environment.

The Mae Enga and Warlpiri are non-hierarchical societies in very different environments, one society horticultural, the other without permanent settlements, with very different relationships to the land and its resources. Iroquoians had a slightly more hierarchical system. For at least 500 years they had practised shifting agriculture across a wide sweep of the Eastern Woodlands (Hart 2001), and we might see in that movement across the land the root cause of the emphasis on shifting alliances and wars with various Algonquian and Iroquoian neighbours. Each of the three societies discussed here had a different pattern of violence, internal and external, yet none lacked social cohesion. In light of this, it seems unlikely that we could deduce a lack of cohesion from skeletal evidence of violence; indeed, we may not even be able to deduce whether a society is under great stress. The people at Grimsby were suffering extreme crisis, and were literally facing the extinction of their nation, yet it is difficult to provide direct evidence of this; we know of it from the ethnohistorical documentation. Mau Mau may well be seen as an expression of the breakdown of social cohesion among the Kikuyu as a reaction to an incipient major ecological disaster: without historical documentation, the village latrine pit skeletons would no doubt be taken as evidence of a massacre by outsiders during a war.

## CONCLUSION

In summary, the recognition of violence in human skeletal remains, and its interpretation, is difficult for a number of reasons.

Evidence from the classic Portuguese Mesolithic sites must be considered equivocal, and this can be highlighted by comparison with other sites – a good archaeological contrast could be made with a late Pleistocene site in which the evidence for violence is not in dispute. Site 117 near Jebel Sahaba in Nubia (Anderson 1968; Wendorf 1968) where a number of skeletons have embedded artifacts, chips embedded in pelvis and vertebral centra and neural arches, is a good example. Coupled with rather random cut marks, and many ulnar and radial fractures, the points add up to a clear picture of violence.

Firstly, since most sites lack evidence as convincing as that from Site 117, there needs to be a patterning of trauma in order to recognise violence accurately. The pattern must allow us clearly to distinguish violence from accident, and the

trauma must not simply be consistent with specific activities and settings. We must be able to exclude factors like hoe trauma to the shins of agriculturalists as in Ontario, broken foot bones among those living on rocky ground as in Mesolithic Portugal, breakage consistent with falls among those living near cliffs and escarpments as in Portugal and Ontario, or hunting accidents (Portugal?).

The classic “parry” fracture, when found in conjunction with cranial trauma, may provide a good indication of interpersonal violence. But the absence of such signs of violence does not mean a non-violent society. From the human skeletal material in ossuaries and cemeteries, it would not be possible to know that the Ontario Iroquoian societies, Huron and Neutral, during the early seventeenth century were actively engaged in war on several fronts, and were on the verge of total collapse. The other side of the coin is that one cannot assume from the abundant Jiangzhai evidence of violence that the society was warlike. Information from the Mae Enga and from Iroquoian nations tells us that warfare may be institutionalized in such a way as to limit bloodshed. On the other hand, warfare was of little importance in Warlpiri society: there was a great deal of inter-personal violence, focussing especially upon polygynous marital relationships.

Violence in society may be directed inwards, or outwards. Among the Huron, internal violence was rejected - especially violence towards women (even women prisoners of war were unlikely to be harmed, Tooker 1967:31). Coupled with this, however, was a ritualized ferocity towards a broad spectrum of those outsiders with whom one’s nation happened to be at war at any particular moment. The rarity of trauma definitely resulting from violence in the ossuaries and cemeteries of Ontario Iroquoian nations arises from an exclusion of those who died from violence. It also suggests that few warriors on spring and summer raiding trips survived to return with wounds that would show up in hard tissue.

Chinese archaeologists have based interpretations about Neolithic society on that stage of Yangshao culture in which there were collective burials, and cohesiveness of the society was deduced from the burial practice. However, the differences in Huron ossuary burial and Neutral multiple and single burial cemeteries cannot be used to interpret one society as more cohesive than the other, and the differences between the two nations, Huron and Neutral, demonstrate that one cannot extrapolate from mortuary practices to make broad statements about the nature of society.

Similarly, the switch from single to collective burials at Jiangzhai does not appear to have resulted in a more “cohesive” society, in the sense of a reduction of violence. With regard to the violence at this one particular Yangshao site, the most economical explanation is internal village violence, perhaps with increasing violence towards females (it must be made clear that the sample size is too small to test this statistically). But in Jackes and Gao (prepared in 1995, in press), I suggested that an important next step in Yangshao osteology was to search for the possibility of people coming into the Wei Valley area from outside, based upon the limited evidence from cranial metrical and non-metrical and dental

non-metrical data. The evidence is as yet minimal, but it is clearly worth pursuing (and the methodology is established, see Jackes *et al.* 2001).

It is obvious that one can reach no firm conclusions, even when provided with unequivocal evidence of violence. We have seen that societies in which there is internal violence, perhaps especially those in which women suffer violence, may be “cohesive” and not warlike. We have also seen that societies in which women generally escape violence may be equally “cohesive”, but warlike to varying degrees, the violence among close neighbours perhaps being limited by ritualization of warfare. We have seen that even societies under extreme stress may display little evidence of internal or external violence, while a situation that seems to demonstrate massacre by outsiders actually shows the results of internal dissension under ecological and political pressure (and civil wars are generally accepted to entail particular ferocity).

It is worthwhile being extraordinarily careful when making broad statements regarding violence in a society, for the simple reason that there are political and judgmental overtones additional to osteological interpretations – we must be sure that we are being strictly neutral when we identify violence. In two instances discussed here, the First Nations of Canada, and the interpretation of the nature of Chinese society, whether according to the tenets of Maoism of the 1970’s or the changed perspective of more recent China, the identification of violence is a loaded issue. The origin and ethnohistory of scalping and the treatment of prisoners became a political issue in the 1970s in North America, and the cohesiveness of Yangshao society and the high status of women were important political tenets of the late Maoist period.

We began by quoting the suggestion that osteologists have available to them a truthful record of violence, unadorned by biased reportage that could confuse historians (Walker, 2001:2). Certainly, “...there could never be any logic to ... human violence without the distance of time” (Ondaatje, 2000:55) – a distanced understanding of the roots of violence in competition for resources, oil, water, kangaroos, arable land, gold or coconuts, set within the context of what went before and what came after. But osteologists working on ancient remains have only the sad results of trauma. Their conclusions, for the most part, must be acknowledged for what they are – speculation. The accurate recognition of interpersonal violence, and – above all – the accurate interpretation of such violence, is a difficult matter which can not be separated from a deep, interdisciplinary and cautious study of the context of that violence.

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**APPENDIX 1:1****Portuguese skeletal remains mentioned in text****1. Material from Mesolithic shell middens stored in the Serviços Geológicos de Portugal in Lisbon.**

**Moita do Sebastião Ossada 2:** A heavy male with unusually strongly marked muscle attachments. A broken bladelet is still embedded below the sustentaculum tali of the right calcaneus. Reactive bone surrounds the bladelet in the form of a spur. The individual had a variety of arthritic changes and there are areas of hyperostosis. The pronator quadratus ridge on the distal ulna shaft very well developed (strong pronation of the forearm) and also, just above, the distal end of the flexor digitorum profundis origin (strong flexing of the hand, as with pressure flaking in and down, is indicated).

**Moita do Sebastião Ossada 5:** Mixed “individual” - on the male, pectoralis muscle insertion on left humerus certainly, and on the damaged right humerus probably, indicates great muscle development, action is of drawing arm in and rotating it in and down, as with hammering.

**Moita do Sebastião Ossada 6:** Male. Forceful extension of the elbow and supination (i.e. in the anatomical position with the palm up or facing forwards) deduced from the ulna supinator crest development and extension of olecranon facet onto the olecranon process. Also abnormal right metatarsal II.

**Moita do Sebastião Ossada 10:** Fragmentary ?female. Figure 1b Lower midshaft pseudarthrosis in the right ulna and right olecranon joint surface was restricted. Abnormality of the left acetabulum also noted; slight abnormality of the right clavicle. Association with Craneo xvii - adult attrition level 5 (see note below).

**Moita do Sebastião Ossada 14:** A large male. Figure 4b Left humerus: the medial epicondyle is reduced almost to absence, while on the lateral epicondyle there is a build-up of bone at the posterior medial border. The ulnae are equivalent in length but the distal portion of flexor digitorum profundis origin produces a marked ridge on the right ulna only: the distal right ulna articular surface is larger than the left and has slight arthritic lipping at the radial articular surface. The left radius is ca. 3 mm longer than the right. The first metacarpals and the clavicles differ from each other in robusticity. There would have been difficulty in pronating the left hand (i.e. turning the palm down to the ground or facing backwards) and flexing the fingers - fine control would have been compromised. Association with Craneo xxi - adult attrition level 5 (see note below).

**Moita do Sebastião Ossada 25a:** Very fragmentary ?female. Figure 1a Healed fracture in the distal third of the right ulna. The right radius was not available for examination. Possibly associated with Craneo xxx (adult attrition level 6). On a phalanx manus (distal, unsided), the proximal articular surface and adjacent shaft has pathology from inflammation inflammatory reaction to infection and cut marks.

**Moita do Sebastião Ossada 30 (“1030”):** Probably male, but mixed “individual” . Figure 1c Apparent greenstick fracture to distal third of right ulna shaft. Right clavicle with unusually strongly developed deltoideus attachment. The radii have very broad necks and strongly angled radial tuberosities.

**Moita do Sebastião Ossada CT:** Male with arthritis of right elbow: Ph II manus Digit V spurring at insertion of flexor superficialis (without infection).

**Cabeço da Arruda Ossada XIII:** A fragmentary elderly individual, probably male, fractured ribs.

**Cabeço da Arruda Ossada XIV:** Had two left radii, one of which might have sustained a hairline fracture.

**Cabeço da Arruda Ossada XVII:** Unknown individual. Extra right radius considered to have parry fracture, but radiograph show no clear break. Childhood injury.

**Cabeço da Arruda Ossada XXV (E):** The only humerus present, the left, shows the possibility of delayed fusion of the medial epicondyle epiphysis which was completely absent, though partial fusion might have been expected in this late adolescent male. There is a completely normal humerotangential angle (HTA), with the medial angle 94 and the lateral 86 (see Glencross and Stuart-Macadam, 2001).

**Cabeço da Arruda Ossada 29:** A very large middle-aged male, had a bilateral abnormality of the coronoid process of the ulnae. Marked deformity of the left humeral distal articular surfaces with arthritic changes. Right radius head particularly abnormal, but both radial heads broad and sharply angled down.

**Cabeço da Arruda Ossada H:** Figure 2 A fragmentary elderly ?female with osteoporosis and arthritis, mandibular dentition indicates attrition level 11, one of the 2 or 3 very oldest people studied. Left ulna fractured, and left distal humerus arthritic.

**Cabeço da Arruda Ossada (900)F:** Lateral spurring on clavicle.

**Cabeço da Arruda Q: Figure 3** The left humerus and ulna of an arthritic male with long-standing (childhood?) fracturing of the left elbow. Apparent fracture of olecranon and through the medial distal humerus. More arthritis on the humerus than is usual for the population.

**Cabeço da Arruda “SH”:** A mixed “individual” — fractured right clavicle, arthritis on five left ribs (bone growth unrelated to either of the facets for vertebrae), one rib appears to have a false joint, humerus with marked cortical thinning. A right ulna has abnormal supinator crest morphology.

**Cabeço da Arruda “TO”:** A mixed “individual” left MC IV and right MC V strongly curved –broken in childhood? A slightly arthritic right ulna with flattened shaft and abnormal curvature.

Note: Mesolithic individuals from the above two sites are not complete, especially for Cabeço da Arruda. Moita do Sebastião skulls had been removed for display and numbered separately, and therefore associations are uncertain: during our research, Jackes and Meiklejohn drew up an inventory attempting to reconcile drawer contents with previous records made by Ferembach and Meiklejohn. For attrition level explanation see Lubell *et al.* 1989.

**2. Samoqueira 1:** Broken humerus (see Lubell and Jackes 1985 for details). Humerotangential angle (HTA) (see Glencross and Stuart-Macadam, 2001): medial angle 64, lateral angle 116, showing the extent to which the distal portion of the humerus has deviated medially. Also has broken metatarsal.

### 3. Neolithic ossuaries: isolated skeletal elements only

**Melides Zambujal 15:** (Figure 5) Left humerus in which a break at the trochlea has resulted in the medial articular surface being driven up so that it lies precisely 1 cm above (proximal to) the capitulum. The medial angle with the long axis of the humeral shaft of the line drawn from the trochlea to the capitulum is 74 degrees, and the lateral is 106 degrees - this can be compared with the expected lateral angle of slightly under 90 degrees and the expected medial angle correspondingly slightly above 90. The normal angle is therefore reversed and exaggerated. So we can understand that this is a proximal displacement of the medial epiphyseal portion of the distal humerus, which is most likely to have occurred prior to the age of fusion, and was the result of compressive forces upward on the ulna. In other words, a childhood fall.

