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Prehistoric origins: The compassion of far distant strangers

Penny Spikins

Introduction

Human compassion has a long history. Archaeological evidence suggests that sustained care for those in need was part of daily life from the emergence of the very first early humans, over one and half million years ago. Though barely on the path to 'humanity' in biological terms, and physically and cognitively unlike us, such groups were nonetheless capable of something which feels quintessentially *human* on an emotional level - sustained care for those in need. In later species such as Neanderthals vulnerable individuals could be looked after for almost their whole lifetimes, apparently irrespective of circumstances. A whole range of injuries, from physical conditions leaving people unable to walk to brain injuries which will have affected cognitive abilities were accommodated. Moreover, wherever we find sizeable groups of individuals we also find some amongst them who must have been supported by the others. This extent of care challenges our preconceptions about survival in the distant past, seeming *costly* in functional terms. However far from being a weakness, emotional commitments to others seem to have been the basis for the in depth collaboration which was the basis for evolutionary success as well as being the starting point for those changes, such as brain expansion, that made us human. A human dependence on emotional commitments was not without its own costs - felt in terms of vulnerability to social emotions such as shame, anxieties over one's social value, and vigilance over social threats. However these in turn drove motivations to help and alleviate emotional and well as physical suffering.

Ignoring the uncomfortable?

Evidence for care is found both earlier in our evolutionary past than evidence for interpersonal violence and is more widespread. However such evidence receives remarkably little acknowledgement or attention (Hublin 2009; Spikins et al. 2010; Spikins 2015a; Tilley 2015). Clear signs of extended care for illness or vulnerability is even more or less ignored, at best a short sentence in any lengthy paper (Tilley 2015). Why this should be so is difficult to understand - we might think we should be proud of a willingness to help others. The only explanation seems to be that care and compassion feel like a *weakness*. In our modern cultures the deep seated concept that success, and by implication evolutionary success, lies with selfish competition makes both the vulnerability of our ancestors, and their willingness to care for others, a strangely disturbing concept, one which is challenging to who we think we are.

It is only over the last few years that we have begun to even recognise the compassion of these distant strangers and believe that it matters. And yet it does.

The narrative of our past influences who we feel we are and what we believe in subtle ways. Past cruelty instils a certain fear, and makes us somewhat more lacking in trust about other's intentions, whilst acts of kindness in the far distant past have a certain power to inspire, especially if they took place in conditions in which compassion might be hard to find. Moreover the supposed behaviours of our distant ancestors have a surprising influence on

modern behaviours and beliefs through what is described as 'natural'. Descriptions of a heartless part, in which humanity was forged through violent competition, fed into justifications for the elimination of the disabled, epileptic or mentally ill that was the start of the Holocaust for example. Even now many believe that care for the vulnerable is something new to modern societies and that natural selection would, and moreover should, favour the independent, hard-hearted and tough. Evidence for compassion, and the range of complex human social emotions in the past challenged perceptions of our ancestors as hard hearted and even callous.

Material evidence also provides important clues to understanding the challenges and constraints of our own emotional minds (Gilbert this volume). We share a remarkable evolved capacity for compassion, however this same capacity to care also be lacking in resilience - influenced by attachment (Mikulincer and Shaver this volume, Narvaez this volume), and frequently lost when faced with outgroups or compassion fatigue (Singer, Favre and Vrticka this volume). Equally our emotions, the product of many different evolutionary processes each often in conflict, bind us to each other, and are a source of great comfort, yet also cause us much distress. Evidence for the evolution of past behaviours and the motivations which underlie them makes sense sense of the minds we are left with.

The Prehistory of Compassion

Early Transformations

The material record from as far back as one and half million years ago demonstrates emotional bonds and motivations to relieve suffering which were already different in nature from those seen in our nearest relatives, chimpanzees and bonobos, and which formed part of the key transformations which made us human.

Two exceptionally early examples of care are particularly significant. The first is a homo ergaster female (KNM ER 1808), one of the most complete skeletons of the time period found at Kobi Fora in Kenya, and dating to around 1.6 million years ago. Indications her long bones are consistent with a severe and fatal case of hypervitaminosis A, identified through an abnormal outer layer on the bones which will have taken weeks or even months to form (figure 1). She will have been in extreme and immobilising pain, often losing consciousness, for this time, leading to the conclusion that even at this date those around her must have fed her, given her water and protected her from predators whilst she was ill (Walker et al. 1982; Walker & Shipman 1997; Tilley 2015, p.15). The second is even earlier, at 1.8 million years ago and from Dmanisi in Georgia. Here an individual who had lost all but one of their teeth (figure 2), and survived for probably months in this condition as the surrounding bone had reabsorbed (Lordkipanidze et al. 2005). It has been argued that they too must have been looked after by others (Lordkipanidze et al. 2005; Tilley 2015).

< FIGURE 1 HERE >

< FIGURE 2 HERE >

What is distinctive in these early populations is not compassion per se, as compassion and a capacity to nurture are not unique to humans. Chimpanzees and bonobos, sharing a common ancestor with humans around 6-8 million years ago, are capable of a certain

compassion. Chimpanzees console each other after a fight for example, and sometimes provide fleeting momentary care or assistance (de Waal 2008). However altruism in primates is limited (Silk & House 2011). Their willingness to engage in extended care is limited to infants, and support for their closest allies is limited to moments of help and consolation structured by a reciprocal return of favours, albeit remembered over many months (Schino & Aureli 2010). What is remarkable about examples of evidence for care in early humans is that care is provided to adults, and for extended periods.

This earliest cases of extended care also notably co-incide with other evidence for different and perhaps closer emotional bonds than we see in other species. Evidence for attention to individuals at death is also emerging by this time for example. Pettitt has argued that the collection of thirteen australopithecines at Hadar site AL-333 may be a case of deliberate deposition in a certain ritual location (Pettitt 2013, p.44). Moreover the remains of potential contemporaneous individuals of Homo Naledi appear to represent some kind of mortuary location (Berger et al. 2015). Chimpanzees appear to grieve for the death of infants, with cases of mothers carrying around corpses for several weeks, but reactions to dead adults are fleeting, without the sense of a shared ritual we begin to see in human ancestors. Shared mortuary practice suggests the extent of grief felt at the passing of a loved one and perhaps even more significantly shared ritual practice implies shared feeling, and a shared drive to appease emotional suffering.

It seems to be no coincidence that at the same time as we see care for the ill or injured, and attention to the diseased, we also see evidence for extended 'care' in other ways. The most unusual is that of additional care and attention taken over stone tools. Artefacts created by early humans begin to mean more than merely functional items at around this time. Whilst earlier tools were merely functional, the appearance of handaxes show elements not only of aesthetics but also a certain generosity in making a tool pleasing to use, as well as emotional self control in their production (Spikins 2012), see figure 3. Moreover handaxes made of elephant bone ivory, a far less practical material than stone, have been interpreted as implying some kind of close connection to these highly empathetic animals that goes beyond seeing them as merely food (Zutovski & Barkai 2015).

< FIGURE 3 HERE >

What drove these changes? From an evolutionary perspective there must have distinct selection pressures.

The most obvious of the evolutionary pressures acting on human ancestors dates back at least 4 million years. Occupying more open ecological conditions exposed early human ancestors to unstable and unpredictable environments and numerous predators, and it is clear from the tell tale marks on their bones that hominins were often prey. The first stages in the development of new ways of collaboration may thus have involved collaboratively defending themselves against predators, perhaps using tactics such as throwing stones as a group (Rose & Marshall 1996). These abilities then opened up opportunities to scavenge meat from carcasses, and quite possibly to begin to share food, with evidence from the earliest stone tools use to cut meat appearing over 3 million years ago.

From these first collaborations however we see the development of strong selective pressures to be pro-social, and to collaborative in new, uniquely human ways. The context of early care lies within the timing of an important ecological transition occurring as early humans faced uniquely variable and unpredictable environments (Potts & Faith 2015) as well as moving into a new niche of collaborative hunting (Domínguez-Rodrigo et al. 2014) actively competing with large predators. Social collaboration solved the problems that these challenges posed by allowing them to buffer risks through hunting, finding food, and caring of infants *collaboratively*. Despite the challenges this is a time when the length of dependency of offspring increases, brain sizes increase and body shapes become larger.

To a great extent early human collaboration depended on evolving emotional capacities. Collaborative hunting, food sharing and shared parenting demanding an ability not only to invest in another's wellbeing above one's own, but also the self control (and tolerance to emotional distress) need to risk one's wellbeing when facing predators or dangerous prey on behalf of others, or in forgoing immediate gratification in saving and sharing food. These new emotional capacities and commitments transformed human society (Nesse 2001) changing a group of individuals into a 'unique and highly competitive predatory organism' (Whiten & Erdal 2012, p.2119).

The role of social reputation

It isn't difficult to see how any individual benefits from being part of a highly cohesive collaborative group. However *how* new emotional capacities evolved is different issue. How would people *become* motivated to give up time or energy or take risks for others? Why not avoid potentially life threatening confrontations with predators or prey, or keep food to oneself? Most particularly why care about people too ill to ever repay one's care, or even the dead or even objects? Motivations to be concerned about the treatment of the dead, to identify with objects (take for example tendencies to infer motivations and feelings to moving shapes, (Heider & Simmel 1944)) are part of our complex human emotional minds, yet hardly seem to make sense in functional terms.

There is of course, much debate. However the material record provides a key explanation in the significance of tangible signals of *social or moral reputation* to early human selective success.

A positive social reputation plays a noticeable, if minor, role in the social dynamics of our nearest relatives. Chimpanzees don't need to collaborate to survive, nonetheless their understanding of fairness, and complex social dynamics based on remembered favours means that it *sometimes* pays in chimpanzee society to put others first. Even though chimpanzees mostly compete those alpha males who intervene to break up conflicts and behave 'fairly' will stay dominant for longer. Overly aggressive dominant males have even been known to be excluded by combined action of the other group members (Flack & De Waal 2000). Our common ancestor with chimpanzees, living around 6-8 million years ago is likely to have shared important cognitive and moral capacities to remember behaviours and make moral judgements of others.

Where collaboration is key to survival selection pressures change. Rather than the most powerful, it is the *best collaborators* who are selected as allies and mates, willingly helped and trusted to help out in turn, and whose genes are most likely to be passed on.

Judgements of how likeable (Gilbert 2015) or how trustworthy any individuals are to act in the interests of others (Nesse 2001) become the major currency of selection. Selection pressures on the best collaborators are however much more complex than pressures on physical abilities. Whereas it may be easy to judge who is the strongest or most powerful (or for this to be evident through physical conflicts) judging who is the best collaborator is complex. It is not behaviour per se, but *motivations*, which are at stake. After all a shrewd and self orientated individual might pretend to care deeply about the wellbeing of their ally or mate, and so elicit their support when they need it by *behaving* altruistically, but in reality be prepared to abandon them (as do chimpanzees) if they are no longer convenient. Detecting a genuine sensitivity to pro-social emotions is essential to the evolution of altruism and compassion, and in turn judgments of moral reputation need to use all the clues available and are built over many observations. Detecting and punishing cheats is also critically important, however doing so is cognitively demanding - if we see someone punishing someone else how do we know if there are being aggressive, or punishing an offender? Both making reliable signals of one's genuine motivations and trustworthy nature *and* being vigilant to such signals in others become all important (Nowak & Sigmund 2005; Hoffman et al. 2015).

Selection pressures to be seen to be genuinely emotionally motivated by the wellbeing of others can be seen operating amongst hunter-gatherers in modern contexts. Amongst the Ache of Paraguay for example those who are judged to be most genuinely generous are looked after more willingly and extensively when ill or elderly (Gurven et al. 2000). Even adult males, the least dependant element of society, depend on this support, with hunters spending a third of their time too ill or injured to hunt. Amongst the Martu, those who are most generous are favoured as partners in collaborative hunts, and Bliege Bird and Power comment that 'prosocial generosity produces benefits indirectly, through the formation of trusting, cooperative partnerships' (Bliege Bird & Power 2015, p.389). Experiments show that even in modern societies a reputation for caring about group wellbeing can have similar payoffs (Hardy & Van Vugt 2006).

The importance of a good social or moral reputation will have driven much of human emotional and cognitive transformations. Firstly the complexities of making judgements of motivations prompted pressures on brain expansion and social understanding (Nowak & Sigmund 2005). Secondly we evolved to feel and signal our motivations in many different ways. Caring for the vulnerable is one way of displaying one's emotional credentials as a trustworthy ally, i.e. one that is that one is both motivated to help others in need, and has the emotional self control to do so. However the same capacities can also be signalled in other ways, such as how we treat the bodies of the dead or or even objects, as well as through evolved physical signs such as blushing or crying. Our material world plays a particular role - a finely made handaxe or other aesthetically pleasing object demonstrates a certain skill (ie social value), generosity and self control in its production which has a repeated effect, with each use reminding others of the qualities of its maker. Lastly we become highly sensitive to small signals of genuine intent, vigilant to tiny facial expressions which might indicate genuine emotions, alert to how ways in which people express themselves might indicate that they are *on our side*, and equally vigilant to what they think about us. As consciousness allows us to reflect upon ourselves, and collaborative morality (Tomasello & Vaish 2013) brings selection pressures from combined group opinion, vigilance of our *social value* becomes ever prominent.

Group support for the vulnerable

Failing to be moved by the needs of others or unwilling to help them is likely to have been damaging to one's moral reputation, perhaps even risking exclusion, against which the economic costs of assistance appear minor. As mortuary practices involving larger collections of individuals appear after half a million years ago we tend to find a variety of debilitating conditions which must have been supported not only by individual allies but by the shared moral imperative of the group as a whole.

The earliest example comes from the site of Sima de los Huesos in northern Spain dating to around 400,000 years ago. Here at least 28 individuals, closely related to *Homo heidelbergensis*, were deposited in a natural cavity as some form of mortuary ritual. Several of these suffered from conditions which will have required support. One elderly man had a damaged pelvis and would only have been able to walk slowly and with a stick (Bonmatí et al. 2011). One individual has ear hyperostosis, that probably caused deafness, and another a severe dental abscess (Pérez et al. 1997). A child mostly likely aged between 5 and 8 years old at death suffered from craniosyntosis (Gracia et al. 2009).

A similar range of vulnerabilities amongst Neanderthals is found at the later site of Shanidar Cave in Iraq. Here ten individuals were buried within a cave between 60,000 and 45,000 years ago. Of these the most famous is an old man, aged around 35-45 years old who had multiple pathologies which appeared to have occurred in childhood and made any mobility very difficult. These included damage to his left eye and probable blindness (as well as damage to the left cerebral cortex), right arm paralysis, fractures of right humerus, osteomyelitis of the right clavicle, fracture to the right foot, and degenerative joint disease of the right knee and ankle (Solecki 1971; Trinkaus & Zimmerman 1982; Tilley 2015, p.16). His care must have involved the whole group, over at least a decade. Another male, aged 35-50, suffered from severe osteoarthritis of the right foot, which is also likely to have much limited his mobility. He also survived injury to left lung which must have involved having been immobilised for several weeks (Tilley 2015, p.16)

Far from being unusual, care for illness and injury is so common that many authors conclude that amongst Neanderthals those who were vulnerable must have been routinely cared for (Solecki 1971; Hublin 2009; Spikins et al. 2010; Spikins 2015a), see (Tilley 2015) for a detailed review). Other cases include that of an adult woman from Salé, in Morocco with congenital torticollis from birth, leading to cranial distortion and muscular trauma, as well possible limitations on limb movement, hip displacement and club foot (Hublin 2009); that of a man from La Chapelle aux Saints in France with significant disability relating to degenerative joint disease in the back, shoulder, hip and foot (Tilley 2015); and also an individual from La Ferrassie who recovered from a severe leg fracture, as well as being cared for for a substantial time whilst suffering from a severe systemic disease, most likely a pulmonary infection (Tilley 2015). Such care can never have been easy, with skeletal records showing frequent famines as well as demanding lifestyles, yet most remains of Neanderthals show signs of healed pathologies.

Similar evidence continues to be found in ice age Europe after the arrival of our own species. Cases include those such as a man with dwarfism from Romito in Italy (Fruyer et al. 1987; Tilley 2015), and an individual from Dolni Vestonice in the Czech Republic with

chondrodysplasia calcificans punctata, causing severe developmental abnormalities (Trinkaus et al. 2001).

Responses to mental and emotional suffering

Part and parcel of the way that emotions evolve to foster collaboration is a certain sensitivity, even a *vulnerability* to our social emotions, alongside a greater vigilance of others, and greater anxieties over what individuals and the whole group feel about us or perceive our social value to be (see (Gilbert 2015) re Old Brain and New Brain mentalities). In consequence mental and emotional suffering, and a drive to alleviate it, seems to also have been part of the human condition as much as were physical stresses and caring responses.

Emotional suffering and mental disorder is, of course, harder to identify archaeologically than physical illnesses and injuries. Nonetheless we can identify an early willingness to accommodate those who were cognitively different, and who struggled with that difference. Cognitive disabilities were likely to be part of the symptoms of the 450,000bp child with craniosynostosis found at Atapuerca (Gracia et al. 2009). Equally a 90-100,000bp child found at Quafzeh, who had suffered a traumatic brain injury leading to reduced brain volume also probably suffered neurological problems (Coqueugniot et al. 2014). Both were clearly cared for. Difference can at times confer a certain status. A woman, likely to have suffered epilepsy due to a malformation at the base of her skull received a rare elaborate burial in Mesolithic Germany, and has been interpreted as a shaman (Porr & Alt 2006). Equally the ethnographic record highlights that modern hunter-gatherers tend to be very accommodating of difference or emotional distress. Whitley describes how those with bipolar disorder and other conditions, particularly those suffering from terrifying hallucinations, tend to take on roles as shaman in hunter-gatherer societies for example (Whitley 2009). The unique talents of those with autism can be also be appreciated and socially valued, compensating for any lack of social understanding (Spikins 2009).

Sometimes we can identify particular practices designed to alleviate emotional and mental suffering. An increasingly attention to shared mortuary practices from interments in natural pits or crevices to burials themselves seems to a response to a need to validate or alleviate feelings of grief through shared expressions (Pettitt 2013). We can however also see the emergence of specific treatments which appear to be a response to severe mental or emotional distress. Practices such as trepanation, are recorded from 12,000bp. Given how widespread trepanation is in later prehistory (found in between 2-8% of individuals in some regions of Neolithic Europe, (Robb 2002)) this seems likely to be not only a response to physical ailments of the brain (such as hydrocephaly) but also likely to be an attempt to treat other kinds of mental suffering or disorder. Tilley speculates that trepanation involves great deal with trust between the surgeon and the individual being treated (Tilley 2015, p.34).

When written texts appear we see recorded description of mental suffering and attempts to find ways to alleviate such suffering. Whilst the Babylonians lacked full understanding of the neurological basis of disorders, they constructed careful study of symptoms and attempt to classify and treat mental disorders. Treatments for depression, involving creating an image made of clay, imagining it as themselves and wishing themselves happiness are even evocative of compassion focused imagery exercises (Reynolds & Wilson 2013, pp.478–9). Barre discusses symptoms of depression in 3rd centry AD of the Far East (Barre 2001),

Kruger describes depression in the Hebrew Bible (Kruger 2005) and Greaves discusses post-natal depression in Ancient Greece (Greaves 2009).

That being cared for, and responding to emotional, mental and physical suffering, has been part of the human condition since the earliest remotely 'human' species explains why these responses are so integral to our neurological make-up. Far from an impediment to efficiency, widespread collaborative care is part of survival - only through a visible willingness to care *come what may* would the emotional context be created which prompted uniquely human collaboration.

Complex emotional minds

We can see in the archaeological record a trajectory of increasing motivations to care for and support other group members and also to unconsciously display one's emotional credentials in different ways. However beyond this general direction of change many of cognitive-emotional transformations which have taken place are more challenging to fully understand.

Trust in other's emotional commitments is complex (Nesse 2001). We may *trust* those who are *compassionate to the vulnerable* to have our interests and those of the whole group at heart. However trust is also placed in individuals who *punish* those who appear to be dominators or cheats, risk their lives to *kill prey* to provide food, and even to be willing to take risks to *defend us against outsiders*. Relationships based on emotional commitments thus create complex conflicting motivations and have a darker side. Potential conflict between being compassionate to the vulnerable and protecting one's loved ones when faced with outsiders may explain why tolerance towards outgroups appears very late in human evolution.

It is only after around 100,000 years ago, beginning in Africa, and in broad association with the emergence of *Homo sapiens* that we see good evidence for sustained inter-group collaboration. Raw materials are more regularly sourced from what must have been well outside the usual ranges of groups, and non-functional items, such as shell beads like those found in north Africa over 80,000 years (Bouzougar et al. 2007) are created and moved around in what seem to be large scale networks of gift-giving. Similar networks are seen in modern hunter-gatherers such as the Jo-huansi, and play a key role in survival through providing distant friends in times of need. Weissner notes for example that in a time of food shortages following high winds and destruction of the mongongo nuts in /Xai/xai for example half of the population moved in with distant exchange partners, and would not have survived if this social support was not possible (Weissner 2002). Collaborations between groups make modern human populations more resilient to fluctuations in resources than archaics. At the same time human populations disperse, rapidly occupying the whole globe, where previous species stayed within familiar ecological contexts (Spikins 2015b).

Transformations after 100,000 years ago clearly reflect significant changes in social relationships. An increasing social tolerance, perhaps influenced by neurological changes, may be part of developments. However other changes in emotional capacities must also be playing a role in allowing large scale networks to emerge. Gift giving suggests an emphasis on complex emotional responses, depending on high level of theory of mind ability, such as gratitude. Equally there may have been changes in emotional and cognitive responses to

objects, with gifts perhaps increasingly sparking social memories, provoking affiliative hormones and represent others *as if they were there*. The association of a new level of collaboration with risky dispersals argues that the darker side of human emotions, with intents to harm those who fail to honour commitments, may also play a role (Spikins 2015b). It is equally clear that cultural changes may be playing an important role. Certainly the widespread 'demand sharing' (giving to any who are in need), egalitarianism and extraordinary willingness to support others at their own costs seen in modern small scale hunter-gatherers is not merely a product of biology, but hard won through constant efforts to constrain ranked based mentalities and dominance (Boehm et al. 1993; Boehm 2012). In contrast to ingroup care and support we can almost see capacities to feel compassion for outgroups in an evolutionary sense as *only just evolving*.

The trajectory of the evolution of human social emotions has been complex in other ways besides. While it is tempting to see evolution as a simple progression towards ourselves, reality was evidently more complicated. It is clear that there is no *single human mind* but rather our genes code for *possible minds* depending on context. Sensitivity to social environments for example gives our minds a certain plasticity which seems to have been part of human success. By dropping back on self orientated strategies individuals in emotional harsh environments pay the psychological costs of a competitive mentality (Gilbert 2005) but avoid being exploited and are more likely to survive. We can see this in the archaeological and ethnographic record where there are times and places where, despite whatever cultural controls discourage ranked mentalities, competition and violence rise to the fore (Spikins 2008). Warfare is extremely rare in forager societies (Fry & Söderberg 2013) and conflicts usually lead to movement rather than violence (Lee 2014), however sometimes, changing environments or other causes lead to cultures of competition and aggression (Spikins 2015a).

Furthermore whilst we look back on the past and create a narrative of progression there has never been *a set direction* along which compassionate responses evolved. Far from the pinnacle of evolution we are, like other human species, an evolutionary experiment - a compromise between conflicting pressures which will have led in different directions in the past (and might equally in the future). Much as different primates show subtly different types of altruistic motivations (Silk & House 2011) the compassionate response of our branching set of distant ancestors will have varied. Spikins, Hitchens and Needham argue for example that the highly internally supportive contexts of Neanderthals reflects a much more internally focused compassion (2014). Our capacity for cruelty and inability to care for the environment calls in question in what sense we as a species can really be seen as *better* than alternatives.

The more material evidence improves our understanding of how human compassion evolved, the more questions we raise.

Conclusions

We think of our ancestors as strong and invulnerable. However the material record illustrates that they were vulnerable to injury, illness, famine and even emotional distress. Rather than independence it was a uniquely human emotional *interdependence*, based on compassionate responses and emotional commitments to each other, which was part of human evolutionary success. Widespread emotional commitments set in place

transformations which included a widening of compassionate responses and increasingly complex social understanding as well as a greater *vulnerability* to our emotional motivations and greater vigilance of subtle signals of emotional competencies, expressed everywhere from personal interactions to treatment of objects. To be motivated to care for others, to respond to being cared for and to be somewhat anxious about one's social value made us human.

Whilst we are able to consider in analytical terms the large scale evolutionary processes underlying the emergence of human compassion, our human capacities also allow us to reflect that the material evidence for the widespread willingness to care for others, despite the cost, in our far distant past, is nothing short of awe-inspiring.

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Figure Captions



Figure 1. *KNM-ER 1808 showing abnormal layer of bone on the femur (author's own drawing)*



Figure 2. *The 'toothless' Dmanisi hominin (author's own drawing)*



Figure 3. *Olduvai handaxe, Lower Palaeolithic, about 1.2 million years old, Olduvai Gorge, Tanzania (source: Wikimedia Commons).*