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Trauma, surgery and pre-historic events

Introduction

The perception of the Minoans as a peaceful people originated with Sir Arthur Evans. He deduced this from their artistic creations which, in contrast with gory and grisly themes in Near Eastern art, show so sensitive an appreciation of the beauties of nature that to associate their creators with strife and violence seemed impossible. In the past three decades papers by various authors, Alexiou (1979, 1981), Evely (1996), Driessen (1999), Nowicki (1999), Alusik (2006), have re-examined evidence for fortifications, arms, armour and attitudes which contradict Evans' romantic view.

The continuous existence of defence architecture from the Final Neolithic throughout the Bronze Age was documented by Alusik (2006). Logic tells us that there must have been a reason for the massive fortifications of Pre- and Proto-palatial sites. The increase in guard houses in the MMII period was interpreted as measures against internal enemies. Nowicki suggests that there were "zones of conflict and tension between Proto-palatial states". Evely concluded that a thalassocracy could *not* have functioned without the implicit threat of warfare and that the Minoans quite probably were the premier arms producers of the Middle and start of the Late Bronze Age. Finally, reason tells us it is unlikely that the Minoans were an

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Pl. 1 : *Map of Lasithi showing location of Hagios Charalambos*

exception to the rest of the human race and never participated in warfare or resorted to physical violence to settle differences.

Today, I will show evidence from the anthropological remains excavated by Professors Davaras and Betancourt in the Hagios Charalambos cave ossuary, of discord amongst the inhabitants of the Lasithi Plain (Pl. 1). There are a startling number of head injuries indicating occasional outbreaks of violence.[1]

The Hagios Charalambos cave was used as an ossuary for the secondary burial of skeletal remains. The finds date from the Late Neolithic to the Late Minoan period. The number of burials (skulls)

1 Acknowledgements: My sincerest thanks to Professors P. Betancourt and C. Davaras for inviting me to study the material, to Dr V. Apostolakou for facilitating the study, to all the members of the excavation teams, the Directors and staff of INSTAP Study Centre East Crete and the Radiology Department at Ierapetra General Hospital for their invaluable help and, finally, to INSTAP for funding the project.

excavated so far exceeds 400. The excavators believe that the bones were transferred to this location on one or possibly two occasions separated by a short interval of time, from tombs in the vicinity and placed in the cave in MM II b period. Some stones intrusive to the context of the cave betray their origin from built tombs.

There are no discrete burials, so each bone is treated as a separate individual. 11,000 have been identified so far. The material includes many healed fractures of arms, legs, collar bones etc., some of which may be accidental but some may be due to force. However, there are 16 cases of cranial trauma, some of which are definitely deliberate injuries. The majority of cases involve men (11). The majority are on the frontal (10/15) or the left parietal (6/15), consistent with an instinctive rightward turn of the head to avoid a missile or to avoid a blow from a right-handed assailant. Three cases are trephinations; two more bear traces of what looks like scoring of the surgeon's knife delineating the injured area.

Frontal traumas

Case 8065: is male. He has an incision/ cut mark over the midline of the forehead below the hairline, caused by the tip of a blade, which probably only perforated the external surface of the bone (Pl. 2). There is limited osteitis of the surrounding bone tissue and no reaction on the internal surface (so the patient did not die from this wound). The wound may have been caused by a knife, tip of dagger or sword, or even an arrowhead from a distance which caught him a glancing blow from his left side. Presumably he was not wearing protective/ effective headgear.

Pl. 2 : *8065: blade wound on forehead*

The next **Case 1033:** is a female with a deep trauma on the midline of the frontal caused by a pointed object (sharp stone perhaps, arrow

Pl. 3 : *1033: wound above the left orbit*

Pl. 4 : *8121: frontal bone facture inflicted by blow to left side of forehead*

Pl. 5 : *8050: depression over the right eye and sinus area*

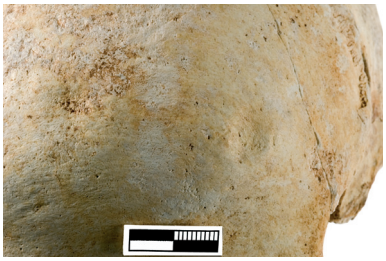
or possibly a lance) hurled from a distance (Pl. 3). There is osteitis around the perforation on the external surface, but no bone reaction on the internal surface.

Case 8121: is a woman with a fractured frontal bone. The woman sustained a very forceful blow to the left side of the forehead above the orbit, inflicted perhaps with a wooden club causing distortion of the shape of the frontal bone and the bone to fracture adjacent (Pl. 4). One can trace the course of the fracture line descending from the left coronal suture, horizontally above the left and right orbits terminating on the right side of the frontal bone. The jagged edges of the fracture had partially healed, so she survived the attack at least for a short time. There is a lytic area in the sinuses which is evidence of an infection, which may or may not be a result of the trauma.

Case 8050: is a middle-aged male with large mastoids and prominent brow ridges. Trauma on the frontal consists of a depression over the right sinus area (Pl. 5), which was seen to be enlarged

in the x-ray, and above the right eye there is slight depression and osteitis on the external surface of the bone. The patient survived this incident.

Case 1032: is an adult female with two shallow depressions/traumas on the left side of the frontal bone (Pl. 6). One is elliptical implying a blow at close range with an offensive weapon that probably had a handle (causing the elliptical shape of the trauma). There is some limited osteitis (bone reaction) within the circular depressions.



Pl. 6 : *1032: two shallow depressions on the left side of the frontal bone*

Case 8136: is a male with trauma on the frontal bone which can be seen in (Pl. 7).

Pl. 7 : *8136: trauma on the frontal bone*

Case 6000 is a male with a deep circular depression fracture on the right frontal bone and corresponding inward displacement of the cranial table which healed apparently without splintering (Pl. 8). The break is post-mortem as you can tell from the arrangement of the trabeculae between the inner and outer cranial table. Keep this image in mind for later.

Trephination

Finally, the most remarkable case of the frontal traumas is **Case 8083**. There is a shallow circular depression on the right side of the frontal bone and next to it a trephination (Pl. 9). A part of the frontal

Pl. 8 : *6000: deep circular depression on the right frontal bone*

Pl. 9 : *8083: trephination on the right side of the frontal bone*

bone is missing so we do not have the complete outline of the trephination, but the hole has a diameter of over 10 mm. Its beautifully smooth bevelled edges show a remarkable technique of cutting. Amazingly, there is no evidence of infection. — Presumably patients developed a resistance to infections, producing their own antibodies, enabling them to survive.

The logic of doctors of that time was different from today when technology allows you to look inside the patient. If treatment was not undertaken within three days the patient was at risk. Hippocrates' "On Surgery" sets down the approach for dealing with head trauma.

It was three-day procedure. On the first day the wound was cleaned and then closed. If necessary a poultice of finely ground barley flour mixed with boiled water might be applied. In general the necessity of keeping a wound as dry as possible and avoiding bandaging/ gauzes is stressed because of the increased possibility of infection. If pus appeared it was only a matter of time before the patient's demise: a week in summer, two weeks in winter. The following day the surgeon would open the wound and probe to see whether the wound was over a suture. He might use a dye substance of copper dust and water which he would spread on the bone and leave for a day. If the colour remained the next day when the wound was re-exam-

Pl. 10 : *1027: circular depression on the left parietal boss area*

Pl. 11 : *8084: elliptical depression near the left parietal boss*

ined then it would indicate where the bone was broken or fissured. In this case, in order to deal with a haematoma, the surgeon might then decide to proceed with trephination using a bow drill which needed to be wetted from time to time to prevent over-heating. The bone would be drilled up to a point: it was important not to perforate the meningeal laminae. The surgeon would leave the flap of bone in place, allowing it to dry out and exfoliate, or peel away by itself, rather like a dead nail. — Knowledge of this protocol is vividly illustrated by a patient with a trephination in Mycenae Grave Γ 51, who did not survive the operation. — The wound was to be kept dry and bandaging avoided.

This patient **8083** obviously received a high standard of care — there is no evidence of infection — and survived long after the operation, dying of unrelated causes. One wonders about the social status of the patient and who the highly skilled surgeon who performed this operation was.

Parietal traumas

Case 1027 is a mature male with a circular depression (ca 8.3 mm in diameter) on the left parietal boss area (Pl. 10).

Case 8084 is a mature male with a shallow elliptical depression near the left parietal boss with dense osteitis (bone reaction) on the surface within the depression, with a max. diameter of 16.5 mm and min. diameter of 9.5 mm (Pl. 11). The blow may have come from

Pl. 12 : *8123: child with trephination anterior to the left parietal boss*

Pl. 13 : *AX15/13: lesion on the parietal behind the coronal suture*

behind, as the victim was fleeing.

Case 8123 is a thin, fragile, slightly warped cranium of a child. There is a trephination anterior to the left parietal boss (with a max. diameter of 8.5 mm), which has smooth edges showing that it had partially healed (Pl. 12). There is a post-mortem break across the trephination. As the cranium is incomplete, it is possible that there was a trauma which preceded and necessitated this operation.

Frontal & parietal fracture

Case AX15/13 is a mature male with heavy brow ridges. He had multiple traumas (Pl. 13). Above the corner of the left orbit, there are two separate depressions, one deeper than the other. On the left frontal about 2 cm. from bregma, there is a small circular lesion (8.1 mm diameter), and another on the anterior *right* parietal behind the coronal suture. The blows may have come from above. An area of the right parietal bone, near bregma, is displaced inwards and the internal bone surface is anomalous. The head wound may have become infected, judging from bone reaction on both the external and internal surface of the cranium.

Peri-mortem fracture

The next, **Case AX 16**, is a young adult male with open sutures. He has what appears to be a trans-sutural, peri-mortem fracture (Pl. 14). Hippocrates' prognosis for such cases is bleak. He states that when the sutures are open, patients have no chance of survival due to

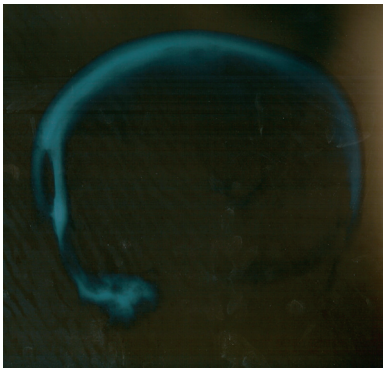
Pl. 14 : *AX 16: possible trans-sutural peri-mortem fracture*

the impossibility of limiting infection and damage to the meninges.

Temporal-parietal fracture

Case AX 14/18, is a middle-aged male with a severe head wound: a healed right temporal-parietal fracture, caused by a severe trauma to the right side of the head, which displaced the bone inwards (Pl. 15). This would have caused pressure on the brain and possible spasms of limbs on the left side of the body. The displacement of the bone can be seen very clearly in the x-ray (Pl. 16). In ancient times, doctors did not of course have such means at their disposal but Hippocrates knew that such traumas to the area of the temporal bone cause spasms and advised against trephination in such cases. Indeed, there is no evidence of attempted trephination on this specimen. The area of the wound appears to be encircled by a residual line, scored by the surgeon's knife (?),

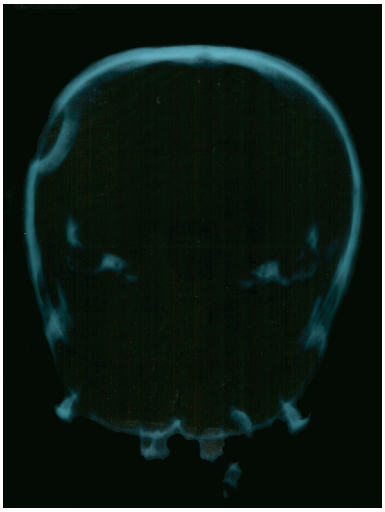
Pl. 15 : *AX 14/18: right temporal-parietal fracture*



Pl. 16 : *AX 14/18: XR showing inward displacement of bone*

Pl. 17 : *1012: three traumas on the left side of the head*

Pl. 18 : *1012: trauma near the left parietal boss*



Pl. 19 : *1012: XR showing inward displacement of bone*

perhaps when tending the wound and investigating the damage.

Deliberate trauma

Case 1012: is a male with three traumas on the left side of the head (Pl. 17). There is a deep healed depression fracture on the left parietal boss and osteitis within this area (Pl. 18). The inward displacement of cranial table is very clear in the x-ray (Pl. 19). The damage must have been caused by considerable force such as a small rounded pebble or sling-stone. According to Betancourt and Frangakis (1998: 123), in the hands of a trained marksman the sling-stone is a formidable weapon which can be propelled in excess of 100 miles per hour with pin point accuracy, while according to Prof. Korfmann (1973: 37): small pebbles, apparently, can be cast in excess of 200 metres.

A second depression fracture lies next to the coronal suture. Again it is outlined by what looks like scoring of the surgeon's knife (Pl. 20). Finally, there is another deep trauma to the frontal bone just above the left frontal crest, caused by narrow pointed imple-

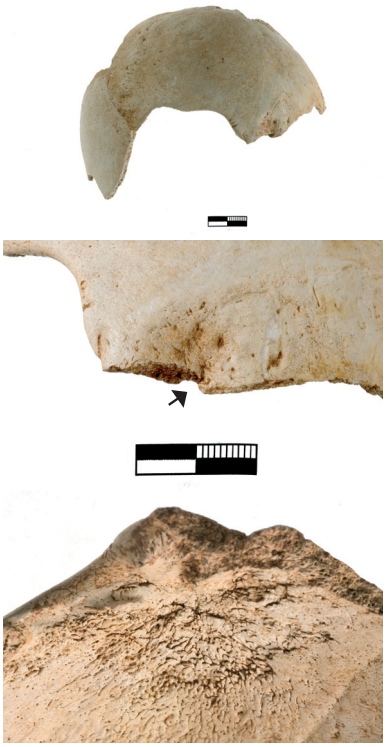
Pl. 20 : *1012: depression fracture next to coronal suture*

Pl. 21 : *1012: deep trauma to frontal bone above the left frontal crest*

ment which is square in section (Pl. 21). It is inconceivable that these injuries are accidental. This is certainly a case of a deliberate attack.

Third & final case of trephination

Case 8124: is a male, a large area of whose skull had been removed by surgery (Pl. 22). The point of the weapon's impact is indicated by an arrow (Pl. 23). A blow or several blows perhaps shattered the cranium (left parietal) causing an inward displacement of the fractured bone. The cranium had been cut at right angles to the relatively smooth remodelled edge of the bone; remodelling had begun sealing the trabeculae (Pl. 24, compare it with Pl. 9 post-mortem break). This edge of the bone had evidently been sawn through in a later phase



Pl. 22 : *8124: large area of the left parietal removed*
Pl. 23 : *8124: showing point of weapon's impact and cut marks*
Pl. 24 : *8124: remodelling of the edge had begun sealing trabeculae*

of surgery, perhaps intended to "tidy up" after a large area of the parietal had initially been removed — perhaps following extensive shattering/splintering. The bone had healed extremely well judging from amazingly neat, smooth edges of the bone, around the part which had been removed. These otherwise smooth edges of the trephination have *three incisions* at right angles and a fourth incision (Pl. 23) along the well-healed edge and must be cut marks from the intrepid surgeon's knife! Changes on the internal surface of the parietal bone show there was irritation from infection which led to the creation of new bone tissue (Pl. 24).

Conclusion

To summarize, there are a remarkable number of head injuries in this series (: 15-16 so far), proving that the Minoans were indeed capable of violent behaviour. We cannot know the precise nature or scale of the discord, if clashes took place on one or many occasions, if they were quarrels between individuals or larger-scale, regional conflicts, but we have incontestable evidence from these head injuries that violence took place.

The casualties are mostly men, presumably not wearing adequate head protection. Women and children are under-represented. Most traumas are on the left side of the skull. Some of these traumas are certainly deliberate, not accidental. In the case of multiple wounds there can be no doubt that the trauma is deliberate. The lesions were caused by various weapons: a blade wound sustained perhaps in hand to hand combat (**8065**). Another caused by a pointed object: sharp stone, arrowhead or lancet (**1033**). A fracture caused by a blow from a wooden club (**8121**). Some circular depressions could have been caused by sling stones, highly efficient missiles flung from a distance.

The finds from Hagios Charalambos also have implications for the history of medicine. As far as I am aware, this is now the earliest evidence on Crete and in Greece for the practice of trephining skulls. These cases are earlier than the example at Mycenae. The

warrior from Grave Γ 51 reported by Angel (1973: 380-81) is in my opinion an amazing example of *verbatim adherence* to a procedure handed down and recorded centuries later in the Hippocratic corpus! Following a head wound, trephination was performed on the left frontal and the flaps of bone left to exfoliate; unfortunately, the patient did not survive. But the patients from Lasithi did survive their operations, two of them for a considerable time, and judging from the beautiful healing of the bone, their operations seem to have been performed by a highly skilled surgeon/s. So it appears that surgeons were already practising in the 18/19th century B.C. protocols that were transmitted to Hippocrates and written down in the treatises which date from the 5th and 4th centuries!

The prehistoric surgeons at Lasithi knew that they had to avoid invasive surgery in the case of injuries to the temporal bone (e.g. AX 14/18), which can cause spasms. They would have known that the brain floated in liquid and that it was important not to damage the meninges. Trephinations were probably more commonplace than we imagine as the physician/surgeon had none of the diagnostic technology that we have today. He was obliged to investigate directly; delay could be fatal. Symptoms from head injuries could range from simple head-aches, blurred vision to paralysis of the limbs or the entire side of the body opposite to whichever brain-hemisphere sustained the pressure of a sub-dural haematoma caused by the injury, which it was imperative to relieve by trephination. So we can conclude from this new evidence that many generations of practice and accumulated observation preceded Hippocrates' description of these surgical procedures. How did this expertise come to exist in Lasithi? Perhaps war was the catalyst, as has often been observed, for the acquisition, development and dissemination of surgical techniques and knowledge.

Why was the cave used for the secondary burial? We know that secondary burial was practised from the Early Minoan period, but the origin of the material from built tombs was betrayed by the inclusion of intrusive stones transported to the new burial site. According

to one hypothesis, the motivation for the disinterment and re-deposition of these burials, a huge undertaking, could have been to safeguard the ancestors' remains from hostile intruders. The evidence of violence seen in the crania seems to provide internal proof of the plausibility of this explanation.

What could have been the cause of the conflict or reason for the presence of hostile intruders? The pottery analysis has recognised changing patterns of regional "orientation" or loyalties. Prior to EMIII the pottery was mainly Messara oriented; in EMIII-MMIa loyalties switched to East Crete, though seals continued to come from the Messara; from MMIb-MMII there is an orientation to Malia and at the end of MMIIb-MMIII there are Knossian incursions. Why? — Nowicki has suggested that Lasithi was an important source of wood, but it may also have had other desirable commodities (food products, livestock), to give in exchange for those luxury items, which Susan Ferrence (2006) presented in her paper. The evidence of violence may reflect a local resistance to outside interference and coercion, though due to the nature of secondary burials these casualties of violence cannot be related to specific chronological horizons.

The skeletal evidence for violence in Lasithi destroys the myth of the "peaceful" Minoans and reinforces hypotheses of tensions and territorial conflicts.

BIBLIOGRAPHICAL REFERENCES

Alexiou 1979 : S. Alexiou, "Τείχη και ακροπόλεις στη Μινωική Κρήτη," *Κρητολογία* 8: 41-56.

Alexiou 1981 : S. Alexiou, "Προανακτορικές ακροπόλεις της Κρήτης," in *Πεπραγμένα Δ΄ Διεθνούς Κρητολογικού Συνεδρίου (Heraklion, 29 Aug. - 3 Sept. 1976)*, A1, Athens, 9-22.

Alusik 2006 : T. Alusik, "Cretan Prehistoric defensive architecture: First results," in *Ι΄ Διεθνές Κρητολογικό Συνέδριο (Khania 1-8 October 2006), Περιλήψεις (Summaries)*, Khania [paper published in Vol. A2 (Khania 2011) of *Πεπραγμένα*].

Angel 1973 : L. Angel, "Human Skeletons from Grave Circles at Mycenae," in G.E. Mylonas (ed.), *Ταφικός Κύκλος Β των Μυκηνών*, Athens, 380 -381, Pl. 244,249.

Betancourt – Frangakis 1998 : P.B. Betancourt – I. Frangakis, "The Sling-stones," in C.R. Floyd (ed.): *Pseria III. The Plateia Building,* Philadelphia, University of Pennsylvania, 117-124.

Driessen 1999 : J. Driessen, "The Archaeology of Aegean Warfare," in R. Laffineur (ed.), *POLEMOS. Le contexte guerrier en Égée à l'âge du Bronze. (Actes de la 7e Rencontre égéenne internationale, Université de Liège, 14-17 avril 1998)*, (Aegaeum 19), Liège/Austin, 11-20.

Evely 1996 : D. Evely, "The Neo-Palatial Minoan Warrior: Fact or Fiction?," in D. Evely – I.S. Lemos – S. Sherratt (eds), *Minotaur and Centaur: Studies in the archaeology of Crete and Euboea presented to Mervyn Popham*, (BAR International Series 638), Oxford, 59-69.

Ferrence 2006 : S. Ferrence, "Variety is the spice of life: figurines from the cave of Haghios Charalambos," in *Ι΄ Διεθνές Κρητολογικό Συνέδριο (Khania 1-8 October 2006), Περιλήψεις (Summaries)*, Khania [paper published in Vol. A4 (Khania 2011) of *Πεπραγμένα*].

Hippocrates 1992 : Ιπποκράτης, "*Χειρουργική: Περί των εν Κεφαλήι Τρωμάτων*," *Άπαντα*, τόμ.11, (Αρχαία Ελληνική Γραμματεία), Athens, 29-69.

Korfmann 1973 : M. Korfmann, "The Sling as a Weapon," *Scientific American* 229(4): 34-42.

Nowicki 1999 : K. Nowicki, "The Historical Background of Defensible Sites on Crete: Late Minoan IIIC versus Protopalatial," in R. Laffineur (ed.), *POLEMOS. Le contexte guerrier en Égée à l'âge du Bronze. (Actes de la 7e Rencontre égéenne internationale, Université de Liège, 14-17 avril 1998)*, (Aegaeum 19), Liège/Austin, 191-195.