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Techno-functional studies on human bones


Étude techno-fonctionnelle appliquée aux
ossements humains



QP36MNHN / 3HPR 003 Paris-Nanterre - 2018

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Techno-functional analysis applied to human bones

Applications



Applications

To reconstruct :

- the treatment of the living
 - the way of using tools on human bodies
- the treatment of the dead (operations / technical sequences / processes)
 - the way of using tools on human bodies
 - the technical actions of thanatopraxy before deposition
 - the post-depositional actions after deposition
- the use of the human bone
 - manufacture
 - use

To interpret

- practical and ritual actions

Applications / History of medicine

- **Chirurgical technics during prehistoric times**
 - trephinations (Perrot 1969)
 - amputations (Buquet-Macon *et al.* 2012)
 - necropsy (Le Mort & Duday 1987)
 - obstetrics (feototomy, use of forceps for extraction - cases of Poundbury (Gourevitch & Malinas 1996) and Cagny (Corde *et al.* 2013))

- **Chirurgical technics and medical teaching during historic times**
 - comparison between text and remains (Benmoussa *et al.* 2016)
 - learning on body parts : Londres (Fowler *et al.* 2012) Newcastle (Chamberlin 2012)



Neolithic trepanation
Photograph : D. Kurin

Applications / Funerary practices

- Thanatopraxy = functional sequence
 - embalming

- Complex funerary handlings = functional and ritual sequence
 - momification
 - dismemberment / excarnation
 - scalding
 - understanding toward various actions : cannibalism, sky burials, *mos teutonicus*



Monk sky burial (Dari, Qinghai, China)

Cliché anonyme

Applications / Artefacts made of human bone

- Procurement on human
bodies

Cutmarks

- Manufacture


Sawing, carving by pressure,
drill, ...

- Using

Usewear analysis on the hole

Maya (?) *regalia* on human femora -
Ethnologische Museum (Berlin)
Photograph : P. Gaussin





Techno-functional analysis applied to human bones



Methods



Technological Approach with multiple facets

Thanato-archaeology study:

Bioarchaeological data

Funerary taphonomy

Taphonomic analysis:

Recognize unintentional alterations of the bones (ancient or modern ones)

Reconstruct events linked to Funeral Rites

Technological analysis:

Reconstruct the *modus operandi*, Recognize the tools

Experiments:

On faunal bones / data from ethnological observations

Technological Approach with multiple facets

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Thanato-archaeology / biological data

Thanato-archaeological methods (Duday *et al.* 1990) applied to Techno-functional studies on human bones :

Differentiate biological stigma linked to pathology / activity and anthropic modifications

tricky marks :

- some vascular imprints

Vascular imprints on a pelvis

Photograph : J. Kerner, MNHN, inv. 23691_B495



Thanato-archaeology / biological data

Differentiate biological stigma linked to
pathology / activity and anthropic
modifications

tricky marks :

- some vascular imprints
- muscle attachments imprints

Muscle attachments imprints on temporal bones
Photograph : J. Kerner, MNHN, inv. 23698



Thanato-archaeology / biological data

Thanato-archaeological methods (Duday *et al.* 1990) applied to Techno-functional studies on human bones :

Differentiate biological stigma linked to pathology / activity and anthropic modifications

tricky marks :

- some vascular imprints
- muscle attachments imprints (temporal bones)
- chirurgical interventions marks

Differentiate biological stigma linked to pathology /
activity and anthropic modifications

tricky marks :

- some vascular imprints
- muscle attachments imprints (temporal bones)
- chirurgical interventions marks
- some pathological alterations of the bones



Thanato-archaeology / biological data

Thanato-archaeological methods (Duday *et al.* 1990) applied to Techno-functional studies on human bones :

Differentiate biological stigma linked to pathology / activity and anthropic modifications

tricky marks :

- some vascular imprints
- muscle attachments imprints (temporal bones)
- chirurgical interventions marks
- some pathological alterations of the bones
- desiccation of articular cartilage



Desiccation of articular cartilage

Photograph : J. Kerner, MNHN, inv. 1926-B495

Technological Approach with multiple facets

Thanato-archaeology study:

Bioarchaeological data

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Thanato-archaeology / funerary taphonomy

Reconstruct the burial environment (empty/filled space ; shape of the pit ; formwork, etc.)

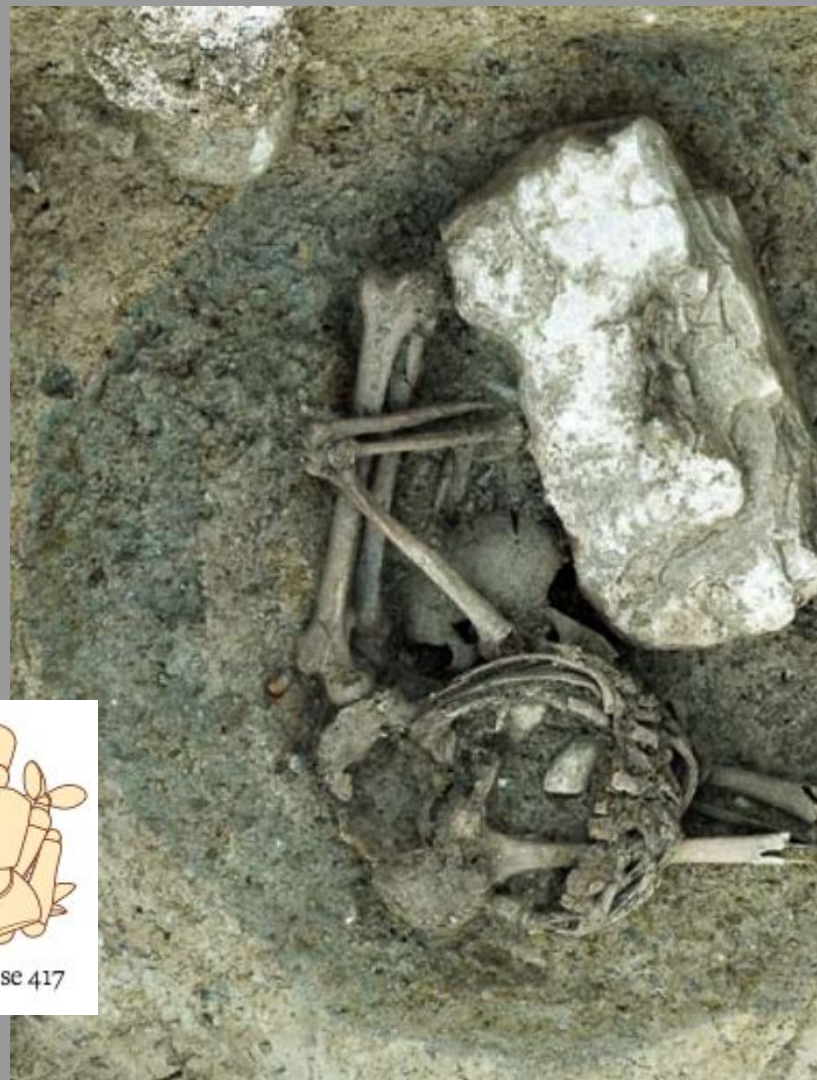
- Observation of preserved labile osteological articulations

The grasp of the stage of decay of cadavers at the moment of the deposit and analysis of the way bones are moving into the grave after the deposit

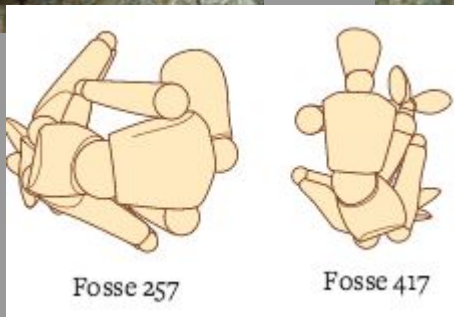
Differentiate natural drops / disturbance from anthropic post-depositional manipulations



Le Mormont / 100 BC
Photograph and drawings : P. Moinat



Decapitation VS sitting position in an empty space
Photograph and drawings : P. Moinat



Fosse 257

Fosse 417

Technological Approach with multiple facets

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Taphonomical Analysis

'Preparator's marks' (Shipman 1981:366)
Natural crushing
Alterations linked to storage in storerooms,
etc.

Differentiate anthropic and
natural alterations from
anthropic modifications



'Preparator's marks' on pelvis from MNHN collections
Photograph : J. Kerner

Technological Approach with multiple facets

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Technological Analysis

Cut marks, scraping marks, sawing marks, snatching, etc.

- Observations carried out at macro and microscopic scales
- Analysis of morphology, orientation and localisation of the marks
- Adaptation of the technique to empirical knowledge on human anatomy

Identification of intentional VS accidental anthropic modifications

Technological Approach with multiple facets

Thanato-archaeology study:

Bioarchaeological data

Funerary taphonomy

Taphonomical analysis:

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Technological analysis:

Reconstruct the *modus operandi*, Recognize the tools

Experiments:

On faunal bones / data from ethnological observations

Experiments

anthropic marks linked to
precise gestures

video / photograph
recording

comparison with
archaeological data

possible future works : usewear analysis on lithic tools

Validation of hypothesis about operational sequences



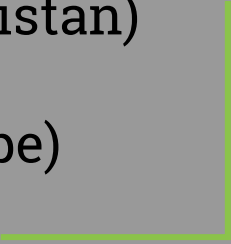
Archaeological case studies



History of medicine

Neolithic dentistry at Merghargh (Pakistan)

Surgery on the XIXth century (Europe)



Neolithic dental care

Context: site of Mehrgarh (Pakistan) Early neolithic
11 cases of *in vivo* dental perforations

Localisation: occlusal surface of a second inferior molar

Marks: size : 2,5 mm (diam) / 1,5 mm (deep)
bow drill with lithic spike (same tool for jewellery)

Action: Abrasive technique : Coring

Medical purpose: Care of a tooth decay?



© L. Bondioli (Musée L. Pigorini, Rome) & R. Macchiarelli (Univ. Poitiers)

Early maxillectomy techniques



Jean Marie Vericel first maxillectomy by Gensoul: before-after surgery
Courtesy of French National Academy of Medicine and BIU santé-Paris



Dupuytren museum skull (1842),
donation from Dr Pigné.

Photograph : J. Kerner

Early maxillectomy techniques by Joseph Gensoul

Marks and localisation :

cut marks on the face

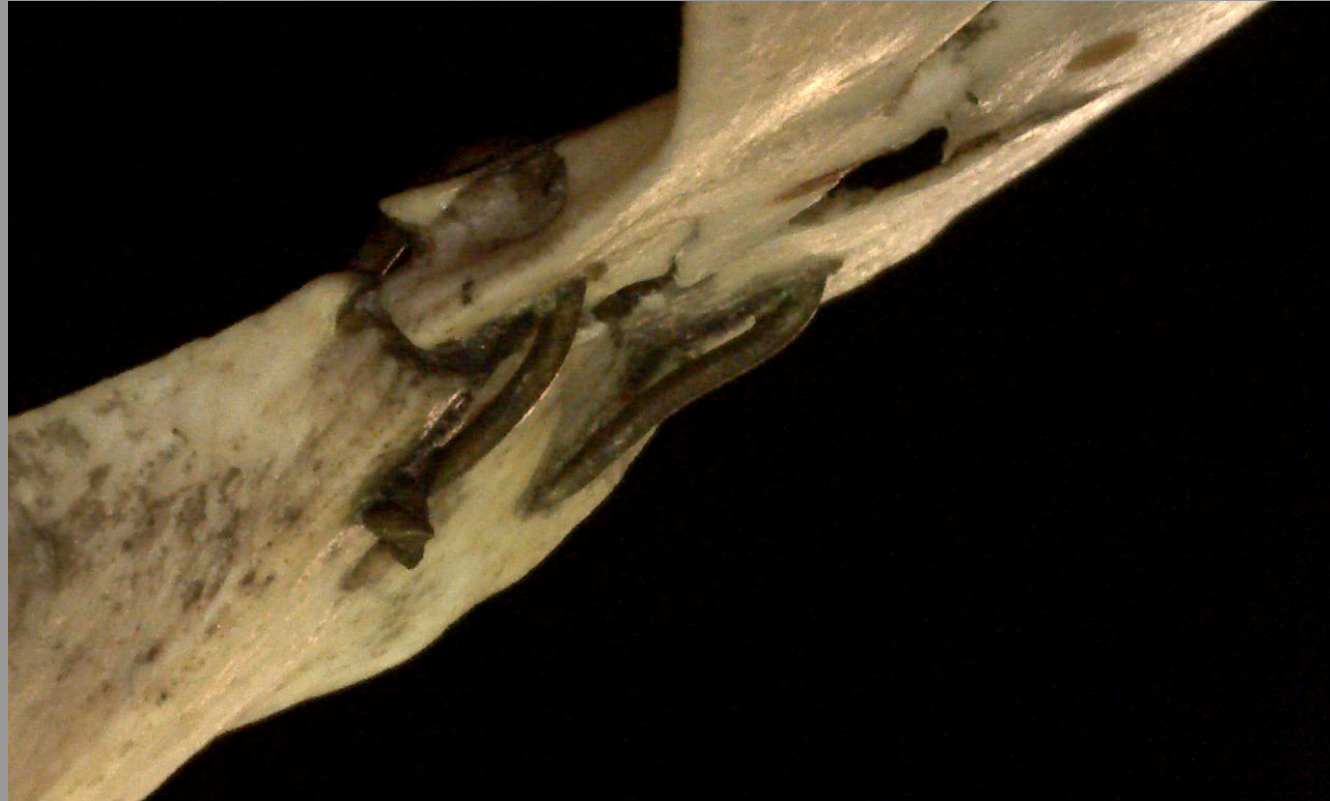
sawing of zygomatic arcade

Actions:

removal of epidermis

excision and removal of the tumor


Medical purpose: cancer treatment





Identification of Post-funerals Gestures

Between Devotion and Opportunism



Gestures of devotion and “lustres”

Context : *Capela dos Ossos*, Évora
(Portugal)

ossuary chapel - XVIIIth century AD

Marks : lustres

Action : touching of payers

Photograph : J. Kerner



Gestures of devotion and “lustres”

Context : Catacombs of Napoli,
Cemetery of Fontanelle (Italy)

Skull of Donna Carmela

Marks : lustres

Action : touching of payers



Creation of royal relics

Context : Basilique
Saint-Denis / reliquary

mandible of Saint Louis

Marks : sawing marks

Photograph : N. Benmoussa



Creation of royal relics

Tool : modern tool

Action : unknown... for now

Photograph : N. Benmoussa



Neolithic tooth pendant

Context : Çatal Höyük (Turkey)
Neolithic

Marks : abrasion on the root
lustres on the hole (usewear)

Use : Tooth pendant



Ice or Salt Skates from Marsal (Iron Age)

Context :
Site of “La
Digue”, Marsal
(France) (Olivier 2005)

Salt craftshop

Iron Age



Photograph: J. Arteta

Ice or Salt Skates from Marsal (Iron Age) / Taphonomy

Marks : Rodent tooth marks

Archaeological fact :
unprotected storage of the
artefacts



Photograph: J. Kerner

Ice or Salt Skates from Marsal (Iron Age) / Manufacture

Marks : abrasion
: filing
(intentional)

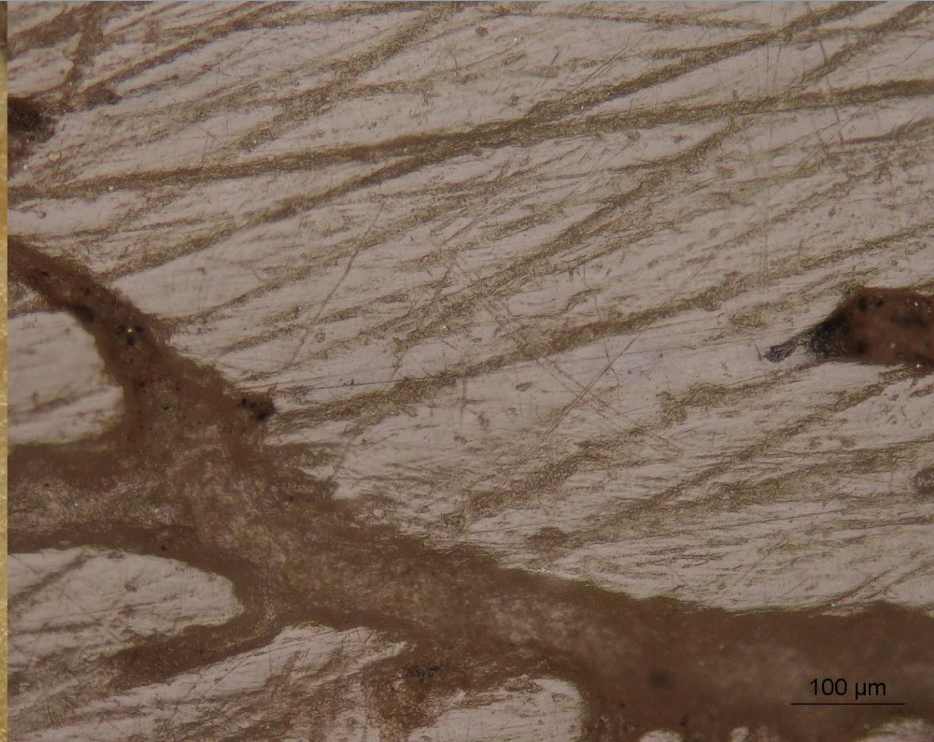
sawing
(intentional) and
snatching
(accidental)

Action :
manufacture

failed repairing

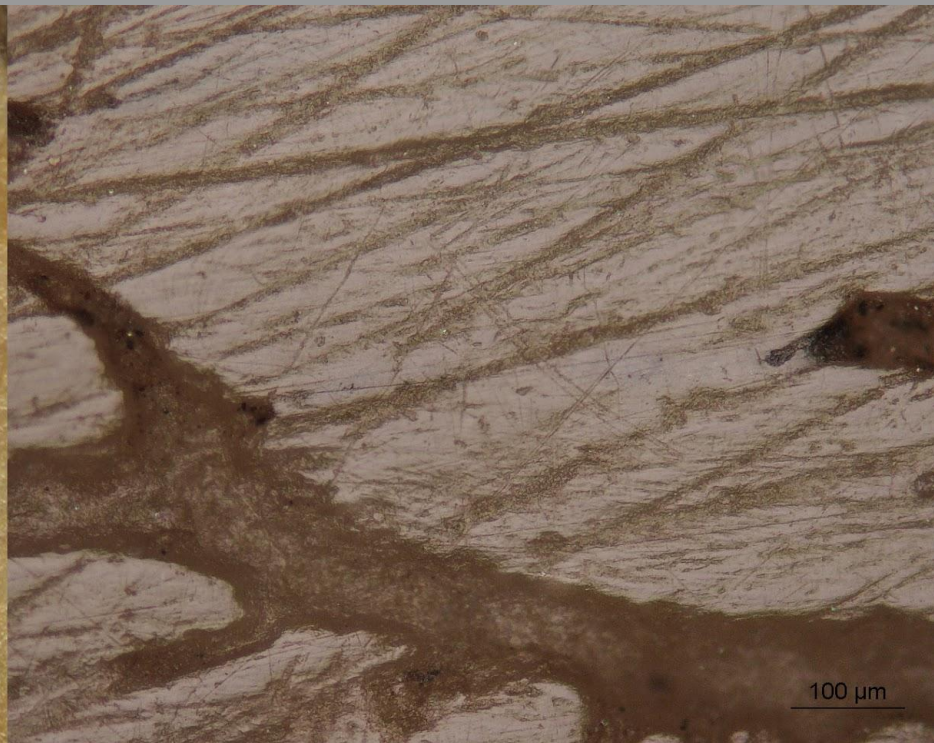
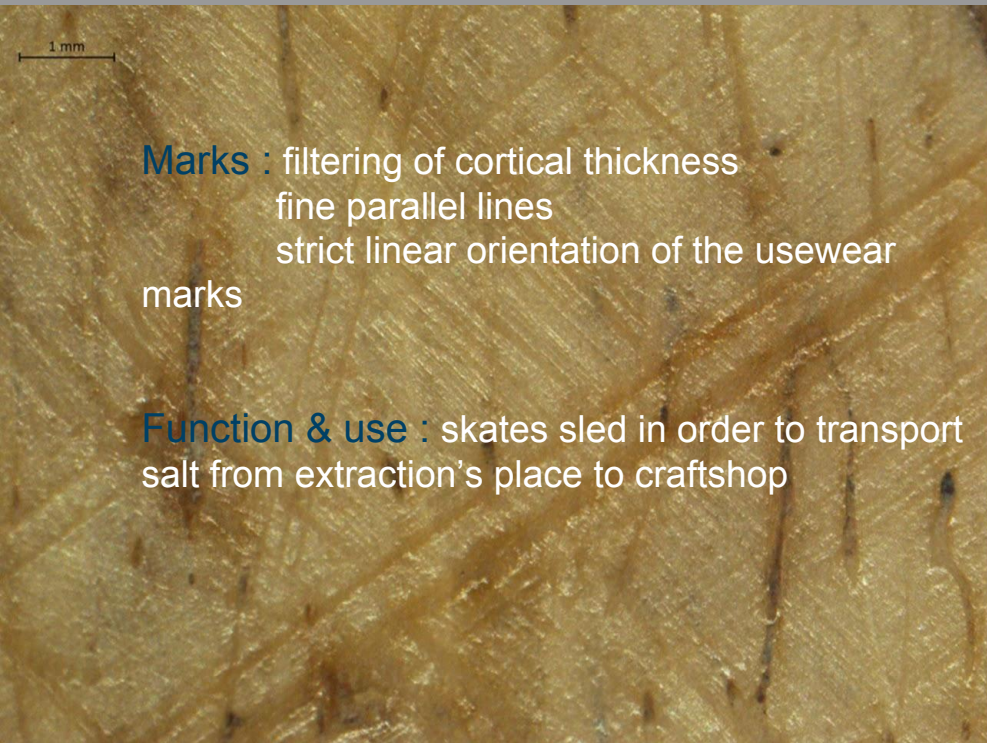


Ice or Salt Skates from Marsal (Iron Age) / Use



Photograph: J. Kerner


Ice or Salt Skates from Marsal (Iron Age) / Use





Funerary Practices

Embalming processes /
Ptolemaic mummies (Egypt)
Funeral dismemberment /
Ding si shan bodies (China)



Evisceration on Ptolemaic Times

Marks : juddering marks =
“traces de broutements”

(Dauvois 1974:80)

Localisation : On
endothoracic 23 709
mummy's rib

(MNHN collections)

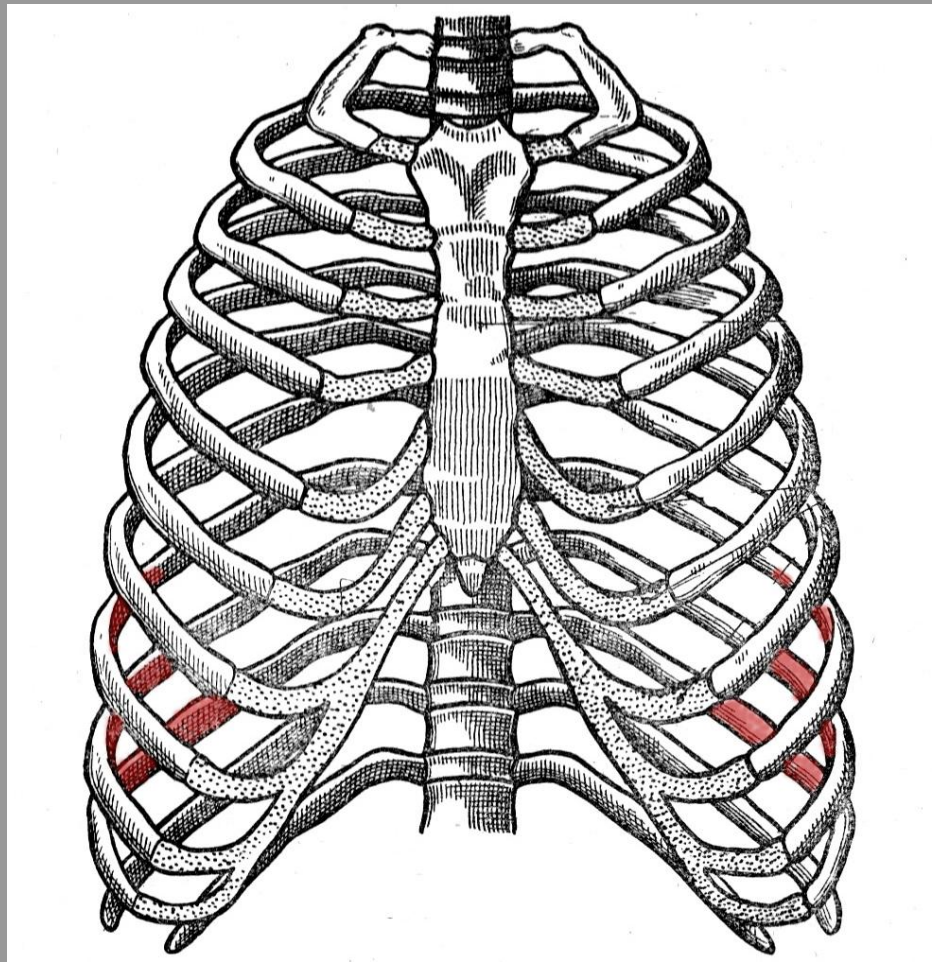


Evisceration on Ptolemaic Times

Marks : cutting and scraping

Repartition : regular pattern of scraping marks on several rib cages following the layout hereafter

Action : Extraction of lungs from the inside of thoracic cavity / difficulty linked to pathology (pleural plaque diag. Ph. Charlier)



Dismemberment at Ding si shan

The original lecture includes 18 other slides about dismemberment at Ding si shan (China, Neolithic times)

These slides cannot be published because of copyright issues.



Photograph : Pr. X. Fu



Thanks for your
attention

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References

ARTETA J., KERNER J., CHARLIER Ph. & LAURENT O.. Étude techno-fonctionnelle sur les objets en os humain de l'atelier saunier de Marsal (Moselle) : résultats préliminaires. In: CHARLIER Ph. (dir.). *Actes du colloque du 6ème Congrès International de Pathographie*. Paris : De Broccard (sous presse).

BENMOUSSA N., KERNER J., JOSSET P., RUTALI C. & CHARLIER P., « A 1842 skull from Dupuytren's museum of Paris: an original artifact of Joseph Gensoul first maxillectomy technique », *International Journal of Osteoarchaeology* (soumis).

BUQUET-MACON C., CHARLIER Ph. & SAMZUN A., 2007. The oldest amputation on a Neolithic skeleton in France. *Nature Precedings* (<http://hdl.handle.net/10101/npre.2007.1278.1>).

CHAMBERLIN A. T., 2012. Morbid Osteology: Evidence for autopsies, Dissection and Surgical Training from the Newcastle Infirmary Burial Ground (1753-1845). In : Mitchell P., (Ed.). *Anatomical dissection in Enlightenment England and beyond : autopsy, pathology and display*. coll. The history of medicine in context, Farnham ; Burlington: Ashgate. p. 11-23

CHARLIER P., AUGIAS A., KERNER J., RAINSARD P., FROMENT A. & PRADES L. The mandible of Saint-Louis: a dental reappraisal. *American Journal of Forensic Medicine and Pathology* (soumis).

CHARLIER P., HUYNH I., PANNIER F. & BAZIN N., 2007. Paléolapthologie au Tibet et en Asie Centrale. In : CHARLIER P. (dir.). *Actes du premier colloque international de pathographie*. Paris : de Broccard, p. 243-257

COPPA A., BONDIOLI L., CUCINA A., FRAYER D.W., JARRIGE C., JARRIGE J.-F., QUIVRON G., ROSSI M., VIDALE M. & MACCHIARELLI R., 2006. Early Neolithic tradition of dentistry. *NATURE* 440. p. 755-756

CORDE D., LaAQUAY L., AUGIAS A., POUPON J., DEWITTE J. & CHARLIER Ph., 2013. Un cas ancien de Foetotomie. Cagny, 14, La Tène. *5ème colloque international de Pathographie*. Paris : De Broccard. p. 21-31

DAVID É., 2007. Technology on Bone and Antler industries: A Relevant Methodology for Characterizing Early Post-Glacial Societies (9th-8th Millenium BC). In : GATES Ch. St.-Pierre & R. Walker (Eds). *Bones as Tools; Current methods and interpretations in worked bone studies*

DAUVOIR M., 1974. Industrie préhistorique et expérimentation. In *1er colloque international sur l'industrie de l'os dans la préhistoire, Abbaye de Sénanque (Vaucluse), avril 1974*. Éditions de l'université de Provence.:73-84
DUDAY H., COURTAUD P., CRUBEZY E., TILLER A.-M., SELLIER P., 1990. L'Anthropologie « de terrain » : reconnaissance et interprétation des gestes funéraires. *BMSAP 2 (4)*. p. 29-49

DUDAY H., 1987. Contributions des observations ostéologiques à la chronologie des sépultures collectives. In : DUDAY H., MASSET C. (dir.) *Anthropologie Physique et archéologie. Méthodes d'étude des sépultures*. Paris : CNRS. p. 89-104

DUDAY H. & GUILLON M., 2006. Understanding the circumstances of decomposition when the body is skeletonized. In : SCHMITT A., CUNHA E. & PINHEURI J., 2006. *Forensic Anthropology and Medicine: Complementary Sciences From Recovery to Cause of Death*. Totowa NJ: Humana Press Inc. p. 117-157

DUDAY D. & SELLIER P., 1990. L'archéologie des gestes funéraires et la taphonomie. *Les Nouvelles de l'Archéologie 40*. p. 12-14

DUDAY H., COURTAUD P., CRUBEZY E., SELLIER P. & TILLIER A.-M., 1990. L'Anthropologie « de terrain » : reconnaissance et interprétation des gestes funéraires. *Bulletins et Mémoires de la Société d'Anthropologie de Paris 2 (3)*. p. 29-49

FOWLER L., POWERS N. & WALKER D., 2012. Patients, anatomists and resurrection men: archaeological evidence for anatomy teaching at the London Hospital in the Early Nineteenth Century. In : Mitchell P., (Ed.). *Anatomical dissection in Enlightenment England and beyond : autopsy, pathology and display*. coll. The history of medicine in context, Farnham ; Burlington: Ashgate. p. 77-95

FU X., 2002. The Ding Si Shan site and the Prehistory of Guangxi, South China. *Indo-Pacific Prehistory Association Bulletin* 22, 6.

GOUREVITCH D. & MALINAS Y., 1996. Expertise d'un squelette de fœtus à terme découvert dans une nécropole du IV^e siècle à Poundbury (Dorset-UK). *Revue française de gynécologie et d'obstétrique* 91 (6): 291-303

KERNER J., DAVID É., CHARLIER P. & QUÉTEL É., 2015. (poster) Apport de l'analyse technologique des "momies squelettisées" à la compréhension des procédés d'embaumement. *1840 ème journées de la Société d'Anthropologie de Paris*.

KERNER J. & DAVID É. Étude de restes humains inédits provenant de la grotte du Mas d'Azil (Ariège). *Antiquités Nationales* (soumis).

KERNER J. & DAVID É. Apport de l'analyse techno-fonctionnelle à la compréhension du dépôt mortuaire azilien du Maz d'Azil. *Antiquités Nationales* (soumis).

KERNER J., 2015. Étude techno-fonctionnelle des fémurs humains du site de la digue à Marsal (Âge du Fer). Rapport d'activité

KÜECHELMANN H. C. & ZIDAROV P., 2005. 'Let's skate together!'. In : H. Liuk, A. M. Choyke, C. E. Batey & L. Lougas (Eds.). *From Hooves to Horns, from Mollusc to Mammoth, Manufacture and Use of Bone Artefacts from Prehistory Times to the Present, proceedings of the 4th Meeting of the ICAZ Worked Bone Research Group*. Tallinn : Icaz. p. 425-445

LE MORT F. & DUDAY H., 1987. Traces de décharnement sur un humérus dysmorphique néolithique. *Bulletins et Mémoires de la Société d'Anthropologie de Paris* 4 (1). p. 17-23

LI F.-J., WANGM.-H., FU X.-G, DOBNEY K., LI Z., CHEN B.-Y. & CHONG Y., 2013. Dismembered Neolithic Burial at the Ding Si Shan site in Guangxi southern China. *Antiquity* 087, 337.

MOINAT O. (Dir.), 2009. *Le mormont : Un sanctuaire des Helvètes en terre vaudoise vers 100 avant J.-C.* Lausanne.

OLIVIER L. (dir.), 2005. *Le « Briquetage de la Seille » (Moselle) - Prospection thématique et sondages de vérification des anomalies géomagnétiques, Campagne 2005.* Saint-Germain-en-Laye : Musée d'Archéologie Nationale

OLIVIER L., 2014. L'exploitation du sel à l'Âge du Fer dans la vallée de la Seille, L'exemple de l'atelier de "la Digue" à Marsal (Moselle). *Le Pays lorrain* 84. p. 7-22

OLIVIER L., 2006. Le "briquetage de la Seille" (Moselle) : Bilan d'un programme de cinq années de recherche archéologique. *Le briquetage de la Seille* 1(2). p. 7-21

PARMA D., KALA J., NÝVLTOÁ FIŠÁKOVÁ M. & RAŠKOVÁ ZELINKOVÁ M., 2011. Netradiční materiál, neobvyklý předmět Opomíjený segment kostěné industrie mladší doby bronzové. *Archeologické rozhledy LXIII.* p.136-150 (Non-traditional material and a non-traditional object. A neglected sort of the Late Bronze Age bone industry)

PELEGRIN J., KARLIN C. & BODU P., 1988. "Chaînes opératoires" : un outil pour les préhistoriens. Dans : TIXIER J. (ed.). *Technologie Préhistorique.* Paris, C.N.R.S., p. 55-62 (Notes et Monographies Techniques 25).

PERROT R., 1969. À propos d'une trépanation orbitaire protohistorique. *Comptes Rendus de l'Association régionale de préhistoire et de Paléontologie et des amis du Muséum de Lyon.* p. 59

SHIPMAN P., 1981. Applications of Scanning Electron Microscopy to Taphonomic Problem. In : CANTWELL A. M., GRIFFING J. B. & ROTSCCHILD N. *The Research Potential of Anthropological Study Collections. Annals of the New York Academy of Science* 376. p. 357-385