

## APPENDIX J

### RECORDING PROTOCOL FOR ANIMAL BONES AND TEETH

The system is based on two main database structures, one for **teeth** and one for **bones**.

Remains are recorded using a “diagnostic zone” recording system. This involves the recording of a predefined set of skeletal parts, defined as ‘countable’, which are then used in the quantification of species and body parts. Zones followed those laid out by Bertini Vacca (2012). The following discusses the parts of the skeleton that were recorded; 50% of each zone is needed for it to be recordable. A list of element and taxon codes used are provided in Tables J1 and J2.

*J1: element codes used in Appendix K.*

Code	Description of element
U	unknown
X	maxilla
N	mandible
CR	cranium (zygomaticus)
AT	atlas
AX	axis
SC	scapula
CO	coracoid
HU	humerus
RA	radius
UL	ulna
C3	carpal 3 or 2+3 (=carpal 2+3 - i.e. capit-trapez.- in bovids and cervids; carpal 3, distal row - i.e. capit. - in equids, pig and carnivores)
MC1	metacarpal (=carpometacarpus in birds)
MC2	1/2 metacarpal
MCI	third metacarpal (pigs/carnivores)
MCIIV	fourth metacarpal (pigs/carnivores)
PE	pelvis
FE	femur
TI	tibia (=tibiotalus in birds)
AS	astragalus
CA	calcaneum
SCU	scafocuboid (bovids & cervids) or scafoid (equids) or cuboid (pigs and carnivores)
MT1	metatarsal (=tarsometatarsus in birds)
MT2	1/2 metatarsal
MTIII	third metatarsal (pigs/carnivores)
MTIV	fourth metatarsal (pigs/carnivores)
MP1	metapodial
MP2	1/2 metapodial
P1	Phalanx 1
P2	Phalanx 2
P3	Phalanx 3
HC	Horncore or antler
OTH	Others (element specified in comment if possible)

*J2: taxon codes used in Appendix K.*

Code	Taxon
B	<i>Bos</i>
O	<i>Ovis/Capra</i>
OVA	<i>Ovis aries</i>
CAH	<i>Capra hircus</i>
S	<i>Sus</i>
CEE	<i>Cervus elaphus</i>
DAD	<i>Dama dama</i>
CAC	<i>Capreolus capreolus</i>
EQ	<i>Equus</i>
EQC	<i>Equus caballus</i>
EQA	<i>Equus asinus</i>
CAF	<i>Canis familiaris</i>
VUV	<i>Vulpes vulpes</i>
FEC	<i>Felis catus</i>
MUN	<i>Mustela nivalis</i>
MUP	<i>Mustela putorius</i>
MUE	<i>Mustela erminea</i>
MUX	<i>Mustela erminea/nivalis</i>
LE	<i>Lepus</i>
LEE	<i>Lepus europaeus</i>
ORC	<i>Oryctolagus cuniculus</i>
LAG	<i>Lagomorphs</i>
CAS	<i>Castor</i>
RA	<i>Rattus</i>
RAR	<i>Rattus rattus</i>
RAV	<i>Rattus/Arvicola</i>
APO	<i>Apodemus</i>
MUM	<i>Mus musculus</i>
SMU	Small Murinae
ART	<i>Arvicola terrestris</i>
CLG	<i>Clethrionomys glareolus</i>
SRO	Small rodent
LRO	Large rodent
ERE	<i>Erinaceus europaeus</i>
TAL	<i>Talpa</i>
SOA	<i>Sorex araneus</i>
SMI	Small Microtinae
CD	<i>Cervus/Dama</i>
DC	<i>Dama/Capreolus</i>
CB	<i>Cervus/Bos</i>
CV	<i>Canis/Vulpes</i>
OCC	<i>Ovis/Capra/Capreolus</i>
GNP	<i>Gallus/Numida/Phasianus</i>
GP	<i>Gallus/Phasianus</i>
GN	<i>Gallus/Numida</i>
GAG	<i>Gallus gallus</i>
GAL	Galliform
ANA	<i>Anas</i>
ANS	<i>Anser</i>
ANPS	<i>Anas platyrhynchos sized duck</i>
SCR	<i>Scolopax rusticola</i>
PEP	<i>Perdix perdix</i>
PUP	<i>Puffinus puffinus</i>

Code	Taxon
PHC	<i>Phalacrocorax carbo</i>
BUB	<i>Buteo buteo</i>
MIM	<i>Milvus milvus</i>
FAL	<i>Falco</i>
ACN	<i>Accipiter nisus</i>
PL	<i>Pluvialis</i>
PLA	<i>Pluvialis apricaria</i>
PLS	<i>Pluvialis squatarola</i>
VAV	<i>Vanellus vanellus</i>
GAN	<i>Gallinago gallinago</i>
COL	<i>Columba</i>
TU	<i>Turdus/Sturnus</i>
CO	<i>Corvus</i>
COM	<i>Corvus monedula</i>
COF	<i>Corvus frugilegus/corone</i>
COC	<i>Corvus corax</i>
PIP	<i>Pica pica</i>
GAR	<i>Garrulus glandarius</i>
PSF	<i>Passeriformes</i>
AMP	<i>Amphibia</i>
RAN	<i>Rana</i>
BUF	<i>Bufo bufo</i>
LM	Large mammal
MM	Medium mammal
When the identification is uncertain there is a question mark at the end (e.g. CEE? B?)	

## ***MAMMALS***

**Upper teeth** (occlusal surface, with exception of pig canines, which are recorded whenever a complete transverse section is present); **Lower teeth** (occlusal surface, with exception of pig canines, which are recorded whenever a complete transverse section is present); **Cranium** (1 zone—complete or sub-complete zygomaticus); **Atlas** (2 zones); **Axis** (2 zones); **Scapula** (1 zone); **Humerus** (6 zones); **Radius** (6 zones); **Ulna** (3 zones); **Carpal3** (or C2+3); **Metacarpal** (4 or 6 zones, species dependent); **Pelvis** (3 zones); **Femur** (6 zones); **Tibia** (6 zones); **Astragalus** (4 zones); **Calcaneum** (2 zones); **Scafocuboid**; **Metatarsal** (4 or 6 zones, species dependent); **Metapodial** (4 or 6 zones, species dependent); **Phalanges 1 and 2** (2 zones); **Phalanx 3** (1 zone). Codes used in the recording of teeth are provided in Table J3.

*Table J3: codes used in the recording of mammalian teeth, as used in Appendix K.*

Code	Description
<b>I1, I2, I3, I, dl1, dl2, dl3, dl, C (other than pig), dC, P1, P2, P3, P, dP2, dP3, P/M, M</b>	
P	present, but wear stage not recordable (or not recorded)
"blank"	absent
<b>C (pig only)</b>	
M	male
F	female
AM	male alveolus
AF	female alveolus
P	present
blank	absent

<b>P4, dP4, M1, M2, M3, M12(=M1 or M2)</b>	
Wear stage according to Grant 1982, or Payne 1973	
P	present, but wear stage not recordable (or not recorded)
blank	absent
<b>P4we, dP4we, M1we, M2we, M3we, M12we (=M1we or M2we) (only used for pigs)</b>	
Wear stage according to Wright <i>et al.</i> 2014	
P	present, but wear stage not recordable (or not recorded)
blank	absent

## ***BIRDS***

Scapula glenoid cavity/articular end; coracoid (proximal and distal); radius (proximal and distal); humerus (proximal and distal); ulna (proximal and distal); carpometacarpus (proximal and distal); femur (proximal and distal); tibiotarsus (proximal and distal); tarsometatarsus (proximal and distal).

## ***AMPHIBIANS***

Amphibian bones are recorded when either end of the following bones is present: humerus, radioulna, femur and tibiofibula, as well as the pelvis acetabulum.

Side is recorded for the following elements: jaws; scapula; pelvis; humerus; radius; femur; tibia; astragalus; calcaneum (excluding the non-countable parts).

Vertebrae and ribs are recorded in a separate table into size groups (large, medium and small); only presence is recorded.

"Non-countable" elements are those that are not used for any quantitative analysis and include horncores and antlers (with a complete transverse section) and all other elements or parts of elements that are not included in the list of regularly recorded teeth and bones (see below), but are worth recording (e.g. rarer species, anomalous size, interesting butchery marks or abnormalities). All "non-countable" elements are recorded as "OTH" and the part of the body (if known) is specified in 'comments'. The one exception to this is horncores and antlers (at least a full circumference present), which are recorded as HC rather than OTH.

In this project, when dealing with likely placed 'grave goods', all specimens were recorded and any that fell outside of the elements or zones specified by the recording protocol were recorded as 'other' and not included in quantifications.

## ***CAPRINE DISTINCTION***

Sheep/goat distinction was attempted for the following elements:

Horncore (non-countable); dP<sub>3</sub> & dP<sub>4</sub>; distal humerus; proximal radius; distal metacarpal; distal tibia; astragalus; calcaneum; distal metatarsal.

The criteria of Schmid (1972) and Clutton-Brock *et al.* (1990) were used for horncores, Payne (1985) and Halstead *et al.* (2002) for teeth, and Boessneck (1969), Kratochvil (1969) and Zeder and Lapham (2010) for postcranial remains.

## **PRESERVATION**

Bone surface preservation is recorded using the categories ‘excellent’, ‘good’, ‘medium’, ‘bad’ or ‘awful’. Definitions of these categories are provided in Table J4.

*Table J4: bone preservation categories.*

Code	Description
A	awful (>90% of cortical surface degraded and/or surface beginning to flake away)
B	bad (>60% of cortical surface degraded)
M	medium (40-50% of cortical surface degraded)
G	good (20-30% of cortical surface degraded)
E	excellent (preservation equivalent to a modern specimen)

## **MEASUREMENTS**

For a description of how measurements are taken see von den Driesch (1976), Payne and Bull (1988), Davis (1992), Albarella and Davis (1994) and Albarella and Payne (2005). Some additional measurements were also taken on caprine remains in order to attempt sheep/goat distinction according to Salvagno and Albarella (2017). The list of measurements taken on both bones and teeth can be found in Tables J5 and J6. All measurements are in millimetres to one decimal point, with the exception of those taken in a measuring box, which will have no decimal point (i.e. approximated to the millimetre).

*Table J5: bone measurements by element according to animal.*

Element	Measurements according to animal
<b>Horncores and antlers</b>	Bovids = min and max diameter of the base; greatest length,
	Caprines (in addition to above) = E, F
<b>Atlas</b>	Mammals = H
	Pig (in addition to above) = BFcr
<b>Scapula</b>	Mammals = SLC
<b>Humerus</b>	Mammals = GLC, BT (ungulates), Bd (all other mammals), HTC, SD
	Birds = GL, SC, Bd
<b>Radius</b>	Mammals = GL, SD (when GL is taken), Bp, BFp, Dp (caprines only)
<b>Metacarpal</b>	Cattle = GL, SD, BatF, Bd, a, b, 3, 6.
	Caprines = GL, SD, BFd, a, b, 1, 2, 3, 4, 5, 6.
	Pig = GL
	Cervids = GL, SD, Bd, 3
	Horse = GL, SD, Bd, Dd
<b>Pelvis</b>	Mammals = LAR (LA)
<b>Femur</b>	Mammals = GL, SD (when GL is taken), DC
	Birds = GL, Lm, SC, Bd, Dd
<b>Tibia</b>	Mammals = GL, Bd, Dd, SD (ant-post, when GL is taken)
	Birds = GL, La, SC, Bd, Dd.
<b>Astragalus</b>	Bovids and cervids = GLL, GLm, Bd, DI
	Caprines (in addition to above) = H
	Pig = GLL, GLm
	Carnivores = GL
	Equids = GH, GB, BFd, LmT
<b>Calcaneum</b>	Mammals = GL, GD
	Caprines (in addition to above) = c, d, B, DS
<b>Metatarsal</b>	Cattle = GL, SD, BatF, Bd, a, b, 3, 6.
	Caprines and cervids = GL, SD, BFd, a, b, 1, 2, 3, 4, 5, 6.
	Pig = GL

Element	Measurements according to animal
	Cervids = GL, SD, Bd, 3
	Horse = GL, SD, Bd, Dd
	Birds = GL, SC, Bd.
<b>Phalanx 1</b>	Equids = GL, Bp, Dp, SD, Bd, Dd.

Table J6: tooth measurements according to animal.

Animal	Teeth measurements taken
<b>Equids</b>	L1, Wa and Wd (as in Davis 2002) (only teeth which can be positioned, i.e. we know which tooth it is)(Wd is only taken on molars)
<b>Cattle</b>	dP4 W, dP4 W, M1W, M2W, M3W, M1W, M2W, M3L, M3W, M12L and M12W (all maximum widths and lengths)
<b>Caprines and Cervids</b>	dP4W, M1W, M2W, M3L and M3W
<b>Pig</b>	dP4 (L,WP), M1, M2 & M12 (L, WA,WP), M3 (L,WA,WC), dP4 (L,WP), M1, M2 and M12 (L,WA,WP), M3 (L,WA,WC, WP), H.
<b>Carnivores</b>	P4, M1 (L & W), P1-M3L (canids), P3-M1L(felids), P2-M3L (canids), P1-P4 L (canids), P2-P4L (canids), M1-M3L (canids), H.

## **AGEING**

Age information is recorded using bone epiphyseal fusion and tooth eruption and wear. The fusion of post-cranial bones is recorded as 'fused', 'fusing' or 'unfused' (Albarella and Davis 1994) and the codes used for recording these can be found in the accompanying Excel spreadsheet. Methods for recording tooth eruption and wear are described in Grant (1982) for cattle and pigs, Wright *et al.* (2014) for pigs, and Payne (1973) for sheep/goat.

## **BONE MODIFICATIONS**

Evidence of bone modifications, including butchery, pathology, gnawing and burning, is also recorded. Butchery, burning and gnawing have designated columns in the database and codes are described in the accompanying spreadsheet. Information about pathology is included in the comments column

A description of all database fields and definitions for database codes is provided in Tables J7–J9.

Table J7: butchery codes used in Appendix K.

Code	Description
P	chopped
T	cut(s) (TT is also used for multiple cuts)
S	sawn
PT	chopped + cut(s)
SP	sawn + chopped
TS	cut(s) + sawn
blank	absent or not recordable
<b>Specific Roman butchery codes:</b>	
CS	scapula with typical chops around the neck and/or removed spine
HS	scapula with hook damage
HCS	scapula with typical chopping and hook damage

Table J8: codes for level of burning present as used in Appendix K.

Code	Description
S	singed
B	burnt
C	calcined
BC	burnt and calcined

Table J9: codes for presence of gnawing as used in Appendix K.

Code	Description
C	gnawed by carnivores
D	partially digested
R	gnawed by rodents
CR	gnawed by carnivores and rodents
blank	absent or not recordable

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