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Bone measurements and body weights from some Australian feral pigs

A.J. Legge

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Grahame Clark Laboratory for Zooarchaeology, McDonald Institute for Archaeological Research, University of Cambridge.

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Introduction

A small sample of pig skulls and part-skeletons from Australian feral pigs is described below. The specimens were collected in the initial stage of a research project intended to look at the process of animal domestication when going in reverse, as with the feral pigs of Australia. However, this project was never completed. The data below is offered in the hope that it is sufficient to be useful to those with an interest in pig osteology, and perhaps to encourage further work.

The feral pigs of Australia were introduced there as domestic animals during the 19th Century, originating largely from British stock, possibly with some local admixture of breeds from South–East Asia. In earlier times, outback stations raised their own pigs on a free ranging system in which the animals were free to roam, but returned to their owners each night. The same system is operated now as a traditional right in the New Forest in England and this was a common husbandry system in earlier times, in both urban and rural environments. In 1842 the writer Charles Dickens saw free-ranging pigs in New York, swaggering home along Broadway (see his *American Notes*; many editions). Not that unusual—he would have seen the same in Cambridge, England, where the author's ancestors would have raised their pigs in New Square, as did all of the households there, to the despair of the local medical authorities. In Australia, the wide-ranging outback pigs gradually learned to live away from their human owners, to become the feral 'razorbacks'—now a virtual plague.

The specimens were collected during a brief trip to North-west New South Wales in the company of Professor James O'Connell, now of the University of Utah, USA. The pigs were collected at the Lower Lila Station, which lies north of the town of Bourke (Approximately 30° 15'N, 145° 56'E). The pigs lived along the Warrego River, a tributary of the River Darling. The region is arid, with 300–500 mm rainfall *per annum*, so that the Warrego is an ephemeral river, though capable of extensive flooding after heavy rainfall. The river was carrying water at the time of our visit in August 1977, but with little flow. The river banks had areas of thick cover, of the type generally known as 'mallee scrub', though this in itself is of variable nature. Sizeable swamp areas were intensively used by the pigs. Their diet thus consisted of a good deal of water vegetation, plus anything edible found by rooting up the drier ground. Carrion of all sorts was much favoured in the diet, and live sheep too if these could be caught. Recent Australian government evidence suggests that the feral pig population now might be 20–40 million, spread over all of Australia except for the dry centre. The pig population is thus something of an environmental disaster as their depredations cause very significant harm to the native flora and fauna.

The limited processing facilities that we had available at the time meant that only skulls and some limb bones were taken in this first sample. The specimens were buried near to Canberra for cleaning, and the bones were later kindly excavated by Betty Meehan, Rhys Jones and Mathew Spriggs. The project was much encouraged and assisted by the late Rhys Jones. The work was done

during the tenure of a fellowship held by the author at the Department of Prehistory, Research School of Pacific Studies, Australian National University, Canberra, Australia. This institution and its staff of that time are gratefully, if belatedly, acknowledged for their support and the provision of generous facilities. The holders of the Lower Lila Station were kind with permission to range over their land.

If anyone seeks to continue with such studies, allow me to repeat some sound advice that was given to me in a bar at Ford's Bridge, which is back of Bourke: 'Don't shoot at a pig unless you are near a tree that you can climb.'

The data

The pig measurement data given here are free for use as comparative examples in any published work concerned with non-profit teaching or research in any relevant field. Please acknowledge the collector (Professor A. J. Legge, Grahame Clark Laboratory, McDonald Institute for Archaeological Research, University of Cambridge) as the source of the data.

Limb bone and cranial measurements are based on the system of Von den Driesch (1976) ; for the cranial, see her figures 12a to f (pp 38–41 and 21 a and b (pp 58–9). Where a measurement is marked 'NP' this means not possible due to incomplete development or damage to the bone.

Recording tooth wear

The alphabetic pig tooth wear stages (marked by letters '**a**' to '**n**') are taken from the illustrations given by Grant (1982); see Figure 3 there for illustrations of pig tooth wear, showing successive wear states for the cheek teeth, P_4 to M_3. In the tabulations below, the wear states are also given for the upper teeth and the lower P_2 and P_3. These wear states are not illustrated by Grant, but are the best approximations based upon the wear states of lower P_4 to M_3. (See also Bull and Payne 1982, in the same volume.)

The '+' symbol after a Grant letter code means that the wear state is beyond that as illustrated by Grant 1982 (Figure 3), but has *not* reached the next stage as illustrated. Other codes used below: Cr = crypt of tooth is forming. V = tooth visible in crypt but not erupted. Er = tooth erupting through bone. So = empty socket, tooth loss *post-mortem*.

Desciptions and measurements

The right side is measured unless given otherwise.

Pig LL1

Adult female. Cranium and right front and hind limbs taken. Deadweight 60 kg. Body hair black all over, well developed on shoulders, front limbs and dorsal.

Mandible

The mandible is in full wear, and the M_3 is fully erupted and worn on all cusps. Both M_1 are heavily worn, that left side having the pulp cavity exposed on both cusps. The second cusps of right and left M_2 have marked oblique wear, the tooth being worn lower at the lingual margin. However, the second cusps of right and left M^2 do not show a peak of unworn enamel at this point when the mandible is articulated with the skull. The other older pigs in this collection (LL Pig 8 and LL Pig 9) do not show this oblique wear, although the M_1 and M_2 are heavily worn.

Table 1: Mandibular tooth wear (Grant numeric stages)

P_2=d	P_3=e	P_4=f	M_1=m*	M_2=k#	M_3=d	MWS
			TWS=17	TWS=16	TWS=9	42

Maxilla tooth wear

Development and wear accords with the mandible. M^3 fully erupted and worn to posterior cusp.

* pulp cavity exposed on left M_1 # - wear oblique on cusp 2 of M_2

Table 2: Cranial and mandibular measurements (LL Pig 1)

Skull measurement	
1a	287.0
1	271.0
2	266.0
3	257.0
8	129.0
9	110.0
10	162.0
11	91.0
12	180.0
21	30.9
22	20.2
25	107.3
27	97.6
28	56.9
29	40.0
30	29.1
31	18.5
40	24.5
43	139.5
44	66.3

Mandible measurement	
1	217.0
2	229.0
4	155.0
5	159.0
6	113.9
7a	91.5
8	60.8
9a	42.6
16a	42.5
16b	40.5
16c	40.0

M3 length=31.8 B=15.5

Bone measurements. (right side)

Scapula: fused. HS=163.0 GLP=33.6 BG=22.0 SLC=22.6

Humerus. Fusing proximal, fused distal. GLI=166.0 GLC=150.0 DP=53.7 Bp=45.3 SD=14.4 Bd=38.7 BT=32.6 HT=28.1E (estimated to allow for some degree of exostosis on medial margin of trochlea; see remark on radius above)

Radius: fused proximal, late fusing distal (fusion line partly closed).The proximal radius has an exostosis on its medial margin which prevents measurement. GL=127.0 Bp=NP SD=18.5 Bd=31.7 BFd=26.3

Ulna: fused proximal. Very late fusion distal (trace of fusion line). GL=173.0 LO=52.2 DPA=36.7 SDO=24.8

Femur: fused proximal, very late fusing distal (anterior line only visible). GL=186.5 GLC=181.0 Bp=48.4 DC=21.9 SD=17.4 BD=42.1

Tibia: late fusing proximal, fused distal. GL=GL=169.0 SD=18.4 Bd=27.5 Dd=24.5 (maximum measurement at right angles to Bd)

Calcaneum, fused. GL=68.8

Astragalus. GLl=37.9 GLm=34.3 BD=22.8

Metacarpal III: GL=65.3 Bp=17.1 B=12.5 Bd=16.0

Metacarpal IV: GL=66.4 Bp=14.1 B=11.1 Bd=16.3

Metatarsal III: GL=70.0 Bp=14.0 B=11.0 Bd=15.4

Metatarsal IV: GL=74.6 BP=15.2 B=12.8 Bd=16.3

Phalanx 1 (front lateral): Bp=15.2 GL=30.4 Bd=14.5

Phalanx 1 (front medial) Bp=15.3 GL=30.0 Bd=14.8

Phalanx 1 (hind lateral) BP=15.5 GL=32.1 Bd=14.2

Phalanx 1 (hind medial) lost

Phalanx 2 (front lateral) BP=14.9 GL=21.8 Bd=13.5

Phalanx 2 (front medial) BP=15.5 GL=20.3 Bd=13.8

Phalanx 2 (hind lateral) BP=15.1 GL=20.1 Bd=14.1

Phalanx 2 (hind medial) BP=14.7 GL=21.6 Bd=12.5

Phalanx 3: GL=27.5, 27.5, 26.4, 26.9

Atlas vertebra: fused GL=40.4 GB=73.4 BFcr=50.4

Axis vertebra. fused. BFcr=40.5

Pig LL2

Juvenile male. Cranium, right front and hind legs taken. Deadweight 25 kg. Body hair sandy brown, black dorsal and ventral. Pronounced dorsal hair ridge.

Mandible

The M_3 is not erupted, this tooth showing early crypt formation. The P_2 was lost *post mortem* in both right and left mandibles. Central incisors erupted, medial and lateral incisors erupting but not yet through bone.

Table 3: Mandibular tooth wear (Grant numeric stages):

P_2=Er	P_3=so	P_4=a	M_1=h+	M_2=c	M_3=Cr	MWS
			TWS=13	TWS=8	TWS=1	22

Maxilla tooth wear

Development and wear accords with the mandible. M^3 unerupted, crypt in formation, enamel crown in formation. Both P^3 were lost *post mortem*.

Table 4: Cranial and mandibular measurements. (LL Pig 2)

Skull measurement	
1a	210.0
1	211.0
2	NP
3	NP
8	NP
9	100.0
10	113.0
11	79.01
12	135.0
21	32.4
22	22.7
25	102.30
27	NP
28	NP
29	NP
30	NP
31	NP
40	24.5
43	105.0
44	52.4 (at M^2)

Mandible measurement	
1	167.0
2	176.0
4	NP0
5	125.0
6	NP
7a	NP
8	NP
9a	30.0
16a	NP
16b	27.2
16c	25.6

Atlas: body unfused.

Humerus, radius, ulna, femur, tibia: all unfused proximal and distal Metacarpal and metatarsal: unfused distal

Phalanx 1 and 2: unfused proximal

Limb bones: All limb bones are unfused, including proximal radius and distal humerus.

Pig LL4

Adult female. Cranium only taken. Body hair all black, marked dorsal hair ridge. Body length tip of snout to root of tail=104 cm. Deadweight=39 kg.

Mandible

The M_3 is fully erupted, but with no wear on the posterior enamel pillar.

Table 5: Mandibular tooth wear (Grant numeric stages)

P_2=d	P_3=d	P_4=f	M_1=n	M_2=j	M_3=d	MWS
			TWS=18	TWS=14	TWS=9	41

Maxillae

Wear accord with the mandible, M^3 fully erupted, but with no wear on the posterior pillar. The dentition is notable for the extreme wear on the 1st permanent molar and heavy wear on the second permanent molar, occurring soon after the full eruption of the third permanent molar.

Table 6: Skull and mandible measurements. (LL Pig 4)

Skull measurement	
1a	246.5
1	244.0
2	2450
3	235.0
8	114.0
9	112.0
10	142.0
11	83.1
12	161.5
21	37.0
22	26.7
25	102.30
27	97.1
28	56.3
29	40.4
30	27.8
31	17.7
40	26.5
43	121.5
44	62.4

Mandible measurement	
1	199.0
2	206.0
4	144.0
5	150.0
6	111.0
7a	95.0
8	64.5
9a	28.0
16a	40.0
16b	Bk
16c	32.3

M_3 L=34.5 B=14.2

Atlas: fused.

GB=71.2 GL=36.5 BFcr=49.7

Pig LL7

Young adult female. Cranium only taken. Body hair all black, marked dorsal hair. Body length tip of snout to root of tail = 108 cm. Deadweight = 42 kg.

Mandible

The M_3 is not fully erupted, with no wear on the 3 posterior pillars.

Table 7: Mandibular tooth wear (Grant numeric stages)

P_2=c	P_3=e	P_4=f	M_1=n	M_2=j	M_3=c	MWS
			TWS=18	TWS=14	TWS=9	40

Maxilla tooth wear

Wear accord with the mandible, M^3 not fully erupted, with no wear on the posterior part of the tooth. The dentition is notable for the extreme wear on the 1st permanent molars even before the full eruption of the third permanent molar

Table 8: Cranial and mandibular measurements. (LL Pig 7)

Skull measurement	
1a	247.0
1	245.0
2	234.0
3	243.0
8	114.0
9	110.0
10	140.5
11	90.0
12	162.0
21	37.6
22	25.9
25	104.0
27	97.8
28	61.1
29	38.1
30	30.3
31	18.6
40	28.2
43	127.0
44	62.9

Mandible measurement	
1	205.5
2	215.0
4	147.5
5	155.0
6	102.6
7a	95.0
8	64.5
9a	31.4
16a	45.8
16b	37.2
16c	39.1

M3 L=34.5 B=14.8

Atlas: fused.

GB=70.6 GL=40.0 BFcr=50.3

Pig LL8

Adult male. Cranium only taken. Body hair all black, marked hair growth dorsal ridge and on shoulders. Skin thickness on shoulders ±1 cm. Body length tip of snout to root of tail = 140 cm. Deadweight = 75 kg.

Mandible

The dentition is fully developed, with the M_3 fully erupted, but without wear on the posterior pillar.

Table 9: Mandibular tooth wear (Grant numeric stages)

P_2=b	P_3=d	P_4=f	M_1=n	M_2=j	M_3=d+	MWS
			TWS=18	TWS=14	TWS=9	41

Maxilla tooth wear

Wear accord with the mandible. M^3 not quite fully erupted, with no wear on the posterior part of the tooth. The dentition is notable for the extreme wear on the 1st permanent molars even before the full eruption of the third permanent molar

Table 10: Cranial and mandibular measurements. (LL Pig 8)

Skull measurement	
1a	264.0
1	282.0
2	262.0
3	253.0
8	121.0
9	126.0
10	152.0
11	105.0
12	175.0
21	37.8
22	25.0
25	101.6
27	97.0
28	57.0
29	39.1
30	29.6
31	19.0
40	24.1
43	147.0
44	68.6

Mandible measurement	
1	230.0
2	235.50
4	155.0
5	164.0
6	117.6
7a	93.5
8	63.4
9a	30.0
16a	53.0
16b	44.8
16c	46.6

M_3: L=35.5 B=15.0

Atlas: fused.

GB=83.5 GL=44.5 BFcr=58.0

Axis vertebra: unfused distal

Vertebrae C3 and C4: fusing proximal, unfused distal:

Pig LL9

A very large male. Cranium, right front and hind legs taken. Body hair all black, marked dorsal hair growth. Recovered in swamp; very problematic to handle. Body weight exceeded maximum of weighing machine; deadweight estimated 90–100 kg.

Mandible

The dentition is fully developed, with the M_3 fully erupted, but without wear on the posterior pillar.

Table 11: Mandibular tooth wear (Grant numeric stages)

P_2=d	P_3=f	P_4=f	M_1=n	M_2=k	M_3=d+	MWS
			TWS=18	TWS=16	TWS=9	43

Maxilla tooth wear

Wear accord with the mandible. M^3 not quite fully erupted, with no wear on the posterior part of the tooth. The dentition is notable for the extreme wear on the 1st permanent molars even before the full eruption of the third permanent molar

Table 12: Cranial and mandibular measurements (LL Pig 9)

Skull measurement	
1a	301.0
1	311.0
2	285.0
3	275.0
8	122.0
9	130.0
10	170.0
11	106.0
12	193.0
21	42.8
22	29.7
25	111.6
27	101.0
28	60.8
29	41.1
30	30.2
31	18.0
40	28.5
43	142.3
44	64.0

Mandible measurement	
1	243.0
2	247.0
4	166.0
5	170.0
6	124.6
7a	114.5
8	63.3
9a	31.4
16a	53.0
16b	44.5
16c	45.7

M_3: L=35.4 B=15.3

Atlas: fused.

GB=86.5E GL=48.0 BFcr=58.2

Bone measurements (right side)

Scapula (broken blade): GLP=37.6BG=23.8

Humerus: Unfused proximal, fused distal. GL=167.4 (including unfused epiphysis) SD=16.2 BD=40.7 BT=29.7 HT=29.6 The measurement 'HT' is taken on medial surface of articulation, parallel to long axis of bone. This is illustrated in A. J. Legge 1981, in (R. Mercer) Excavations at Grimes Graves 1971-872. London, HMSO. See p102, measurement 'T').

Radius: Unfused distal. GL=133.6 Bp=27.8 SD=18.3 Bd=32.7 (at fusion line) BFd=28.7

Femur: Broken. Fusing distal. Bd=42.9

Ulna: Early fusing proximal and distal. GL=183.5 LO=53.1 SDO=27.9 DPA=38.1

Tibia: Fusing proximal, fused distal. Fibula: unfused distal. GL=178.4 BP=45.2 SD=19.0 Bd=29.8 Dd=26.5

Calcaneum. Unfused process.

Astragalus. GLI=41.1 GLm=38.5 BD=24.9

Metacarpal III. Fusing distal. GL=69.7 BP=18.0 B=13.9 Bd=15.5

Metacarpal IV Fusing distal. GL=70.0 BP=14.7 B=12.4 Bd=17.6 (at fusion line)

Metatarsal III. Fusing distal. GL=76.2 BP=15.2 B=12.5 Bd=16.0

Metatarsal IV. Fusing distal. GL=79.2 BP=15.2 B=13.3 Bd=17.2 (at fusion line)

Phalanges: all 1st and 2nd phalanges are fused proximal.

Phalanx 1 (front lateral) GL=31.5 Bp=16.8 Bd=15.7

Phalanx 1 (front medial) GL=31.3 Bp=16.5 Bd=15.2

Phalanx 1 (hind medial) GL=33.8 Bp=15.3 Bd=15.0

Phalanx 1 (hind lateral) GL=33.0 Bp=15.8 Bd=14.9

Discussion

As noted above, the feral pigs of Australia are descended largely from British domestic stock. Recent evidence from mitochondrial DNA shows that the domestic pigs of Britain and northern Europe originated largely, if not entirely, from the local wild populations, while in northern India, China and South-east Asia, there were independent centres of pig domestication from the local wild (Larson et al. 2005, Chen et al. 2007). Further work on modern and ancient DNA will elucidate more fully the relationship between the various sub-species of *Sus scrofa*. Zeuner (1963) commented on the form of the lachrymal bone in the skull of pigs, saying that this is long in *Sus scrofa*, the wild pig of Europe and western Asia, but is short in the wild pig of south-east Asia, *Sus vitattus*. He further stated that this bone is of intermediate form in Mediterranean wild pigs, though not citing the source of metrical data to show that this is indeed so, saying only that 'Much has been written about the significance of the shape of this bone in the pig.' (Zeuner 1963, 256). However, this proposition may be questionable.

Clutton-Brock (1999) illustrates the difference in the form of the lachrymal bone in the European boar *Sus scrofa scrofa* and the Indian form, *Sus scrofa cristatus*, though the source of the specimens illustrated there is not given. Her diagram (pp 91–93 and Figure 8.3) shows the lachrymal bone of *Sus scrofa scrofa* as being relatively longer than it is high, while in *Sus scrofa cristatus* the two measurements of this bone are more nearly equal (the measurements used here based upon Von den Driesch, measurements 21 and 22, Figure 12b and 12c, 39).

This difference was also described by McFadyean in 1888:

> In the wild pig and the coarser races the lachrymo-frontal suture is much longer than the lachrymo-maxillary suture, but in the finer breeds the latter suture may equal or exceed the former in length.
>
> (p. 98)

The margins of the lachrymal bone in both wild and domestic pigs are of highly variable form so that this cannot be a very exact measurement. However, this small sample of Australian feral pigs have lachrymal bones in which the length is an average of 1.44 times the height measurement, while in the sample of wild pigs (5 European and 4 Indian) the length measurement is on average twice that of the height (see Figure 1 below. Note that the right and left lachrymal bones may show some degree of difference in the same skull). While McFadyean might have considered the Australian feral pigs to be of 'coarse' breeding, they none-the-less are quite separate from the wild pigs, both European and Indian, on this measurement. The wild pigs from the Indian sub-continent are not notably different from the European wild boars, contrary to Clutton-Brock's suggestion.

The measurements on which this scatter diagram is based are given below. Three of the European wild boar (#336 juvenile and adult #323 and #500) are from the reference collection at the Clark Laboratory, McDonald Institute of

Archaeological Research, University of Cambridge. These skulls are from animals raised under farm conditions).

The Australian pigs are well grown, with two adult males (LL8 and LL 9) equalling or exceeding the weight for two free-living populations of European male wild boar. An older female (LL1) is also larger than European wild females, while two young adult females (LL4 and LL7) are somewhat smaller. It is well known that body size in pigs is highly dependent on food supply; see for example Mattioli and Pedone (1995), who found that enclosed wild boar, living at high density (160/km^2) and with no supplemental feeding, were little more than half the body weight of the free-living population in the same region.

Some additional specimens of wild boar

A female wild boar from Spain (author's collection)

This specimen was shot in Zaragossa Province, Spain, in 1984 and the cranium was later given to the author. The precise place and date of killing is not known except that, from the information given, this was in Aragon. The specimen is included as an interesting comparison for the wear shown by LL Pig 2, which shows very much faster tooth wear than the Spanish specimen, presumably reflecting different sedimentary conditions in each environment.

Table 13: Spanish wild pig: mandibular tooth wear (Grant numeric stages)

P_2=Er	P_3=a	P_4=a	M_1=b	M_2=a	M_3=Cr	MWS
			TWS=7	TWS=6	TWS=1	14

Maxilla

The maxilla has the adult tooth row P^2 to M^2. However, all of the cheek teeth are in wear state; that is, with slight enamel wear only or no visible wear.

Table 14: Cranial and mandibular measurements (sub-adult female, Spain)

Skull measurement	
1a	310.0
1	304.0
2	274.0
3	262.0
8	124.0
9	145.0
10	158.0
11	113.0
12	195.0
21	51.6
22	24.5
25	NP
27	NP
28	NP
29	46.4
30	NP
31	NP
40	27.2
43	117.0
44	59.0*

Mandible measurement	
1	213.0
2	231.0
4	NP
5	158.0E
6	NP
7a	NP
8	NP
9a	40.5E
16a	NP
16b	34.6
16c	37.1

* Across M^2

A large wild male from Jhansi, India

This specimen was killed in India, the victim of a pig sticking expedition, in which wild pigs were killed by spear thrust from horseback. The specimen was donated to the Clark Laboratory, Department of Archaeology, University of Cambridge, by Miss Mary Cra'ster, a former member of the museum curatorial staff there. Miss Cra'ster has informed me that the pig was killed by her father about the year 1930, in Jhansi province, Northern India. An account of this activity is given in *Pig Sticking or Hog Hunting*. Robert Baden-Powell, London, Harrison, 1889. 18 years later Baden-Powell established the Scouting Movement.

Indian boar: Mandible

The M_3 is fully erupted, with wear on all pillars. The M_1 is heavily worn, but not to the extent found in the feral pigs described above (see LL9, where extreme wear on the M_1 was reached before M_3 was fully erupted). The jaw has large canines, reaching about 75 mm above the bone.

Table 15: Mandibular tooth wear (Grant numeric stages)

P_2=b	P_3=d	P_4=e	M_1=j	M_2=f	M_3=d	MWS
			TWS=14	TWS=11	TWS=9	34

Maxilla

The maxilla has the adult tooth row P^2 to M^3. All of the cheek teeth are in wear. Wear on the M^3 is present to the posterior cusp.

Table 16: Cranial and mandibular measurements

Skull measurement	
1a	396.0
1	321.0
2	334.0
3	320.0
8	155.0
9	192.0
10	204.0
11	145.0
12	251.0
21	52.0 (left side)
22	27.0 (estimated*)
25	126.6
27	115.3
28	78.0
29	44.2
30	43.5
31	22.8
40	46.5
43	152.8
44	75.6

Mandible measurement	
1	288.0
2	302.0
4	195.0
5	206.0
6	144.0
7a	115.3
8	79.5
9a	34.8
16a	53.7
16b	49.3
16c	50.0

* suture eliminated

M3 L=44.9 B=18.0

A comparison of mandibular tooth eruption and wear

Tooth wear states are recorded as above. Data for specimens designated 'BIAA' and 'SP' are from Bull and Payne 1982, Figs 2–5.

Number	Age (mo.)	P2	P3	P4	M1	M2	M3	MWS
BIAA 29	19-23 F	a	b	b	d	b	Cr	17
SP352	31-35 F	b	d	e	h	e	b+	30
SP344	Adult F	e	e+	f	h	g	d	34
SP350	Adult M	e	f	f	L	j	f	41*
Spain	Sub-adult F.	Er	a	a	b	a	Cr	13
India	Adult male	b	d	e	j	f	d	34
LL1	Adult F	e	f	m	m	k	d	39
LL2	Juv M	Er	So	a	h+	c	Cr	22
LL4	Adult F.	d	d	f	n	j	d	41
LL7	Adult F.	c	e	f	n	j	d	40
LL8	Adult M.	b	d	f	n	j	d+	41
LL9	Adult M	d	f	f	n	k	d+	42

Er=tooth in eruption So=empty socket, post mortem tooth loss. Cr=crypt formation. For Grant's stage 'L' the upper case letter is used to avoid confusion. *the values for stages L and k appear to be reversed in Grant 1982 table 1. The values taken here are the *opposite* to those as quoted: k=15, L=16.

Feral pig references

An Internet search on "feral pigs Australia" will bring up numerous informative web sites. For a highly recommended account of the disastrous introductions of alien species into Australia, see:

1. Eric Rolls (1969, revised 1984.) *They all Ran Wild; the Animals that Plague Australia*. London, Angus and Robertson.
2. *The Feral Pig*. Department of the Environment and Water Resources, The Australian Government.
   (http://www.environment.gov.au/biodiversity/invasive/publications/pig/index.htm)
3. Ian Parsonson 2000. *The Australian ark: A history of domestic animals in Australia*. CSIRO.
4. An extensive reading list on wild and feral pigs at a very good British web site: http://www.britishwildboar.org.uk/research.htm

This web site also chronicles the welcome return of wild boar to the British fauna, which has resulted from farm escapes where wild boars are farm-raised for the delicatessen trade.

Additional references

Bull, G. and Payne, S. (1982) Tooth eruption and epiphyseal fusion in pigs and wild boar. in: *Ageing and Sexing Animal Bones from Archaeological Sites*. (Eds. B. Wilson, C. Grigson and S. Payne) Oxford, British Archaeological Reports British Series 109, pp 55–71.

Chen, K., et al. (2007) Genetic resources, genome mapping and evolutionary genomics of the pig, (*Sus scrofa*). *International Journal of Biological Science*, 3 (3) 153–165.

Clutton Brock, J. (1999) *The Natural History of Domesticated Mammals*. Cambridge.

Gallo Orsi U., Macchi E., Perrone A. and Durio P. (1992) Biometric Data and Growth Rates of an Alpine Population of Wild Boar (Sus scrofa) *Ongules/Ungulates 91* S.F.E.P.M., Paris-Toulouse, 427–429

Grant, A. (1982) The use of tooth wear as a guide to the age of domestic ungulates. In: (eds. B. Wilson, C. Grigson and S. Payne) *Ageing and Sexing Animal Bones from Archaeological Sites*. Oxford, British Archaeological Reports British Series 109, pp 91–108.

Larson, G. et al. (2005) Worldwide phylogeography of the wild boar reveals multiple centres of domestication. *Science,* 307, No. 5715, 1618–1621.

Mattioli, S and Pedone, P (1995) Body growth in a confined wild boar population. *Ibex: Journal of Mountain Ecology*. 3, 64–65.

McFadyean, J. (1888) *Comparative Anatomy of the Domestic Animals; Osteology and Arthrology*. Edinburgh, Johnston. (1st Edition, not dated; library stamp gives 1888)

Moretti, M (1995) Biometric data and growth rates of a mountain population of wild boar (*Sus scrofa*), Ticino, Switzerland. *Ibex: Journal of Mountain Ecology*. 3, 56–59.

von den Driesch, A. (1976) *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Harvard, Peabody Museum, Bulletin 1.

Wilson, G., Dexter, N., O'Brien, P. and Bomford, M. 1993. Pest Animals in Australia: A Survey of Introduced Wild Mammals. Sydney, Kangaroo Press.

Figures

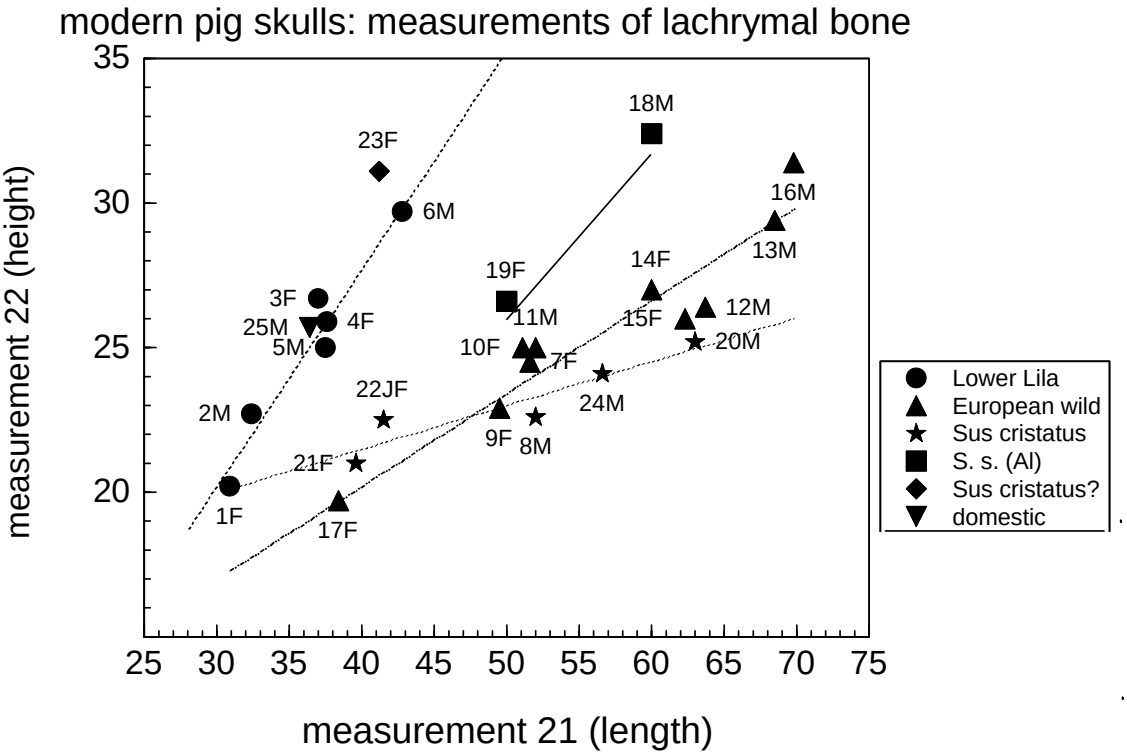

Figure 1. Modern pig skulls: Measurements of lachrymal bone.

For the data points in all figures: F=female M=male J=juvenile. Specimens 1–5 author's collection. Specimens 6 to 11 held at Clark Laboratory, Department of Archaeology, University of Cambridge. Specimens 12 to 24 held at Zoology Museum, University of Cambridge. (All H.12 series: see on-line museum catalogue at: http://www.zoo.cam.ac.uk/museum/). With the exception of specimens 14, 15 and 17, all specimens are of recent origin. Linear trend lines shown.

1 - LL1. **2** - LL2. **3** - LL4. **4** - LL7. **5** - LL8. **6** - LL9. **7** - Spanish wild. **8** - Indian wild, presumably *S. s. cristatus*. **9** - #336 captive wild. **10** - #323 captive wild. **11** - P500 captive wild. **12** - H.12.271 wild. **13** - H.12.302 wild. **14** - H.12.303 Prehistoric wild, England. **15** - H.12.386-7 Prehistoric wild, England. **16** – H.12.333, wild. **17** - H.12.375 prehistoric wild, England. **18** - H.12.341 wild, Algiers. **19** - H.12.342 wild, Algiers. **20** - H.12.551 *S. s. cristatus,* origin not known. **21** - H.12.552 *S. s. cristatus,* India. **22** - H.12.553 *Sus s. cristatus*, India. **23** - H.12.555 *S. s. cristatus,* India. **24** - H.12.556 *S. s. cristatus,* Ceylon.

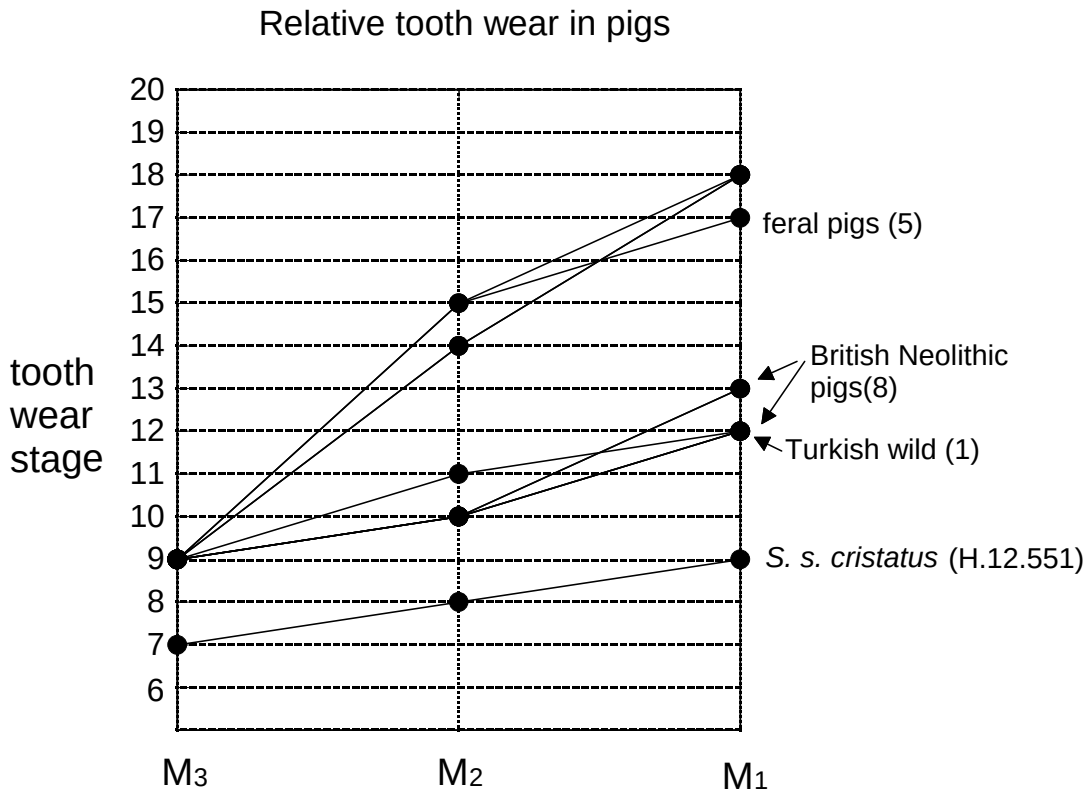

Figure 2. Relative tooth wear in pigs.

The Australian feral pigs show a very high rate of wear, doubtless associated with the sandy terrain in which these animals lived. British Neolithic and modern Turkish wild (Bull and Payne show lower rates of wear, and *Sus s. cristatus* has the lowest wear rate of all, presumably reflecting a soft diet, free from abrasive particles. Specimens chosen with early wear on the third permanent molar (Grant 1982, p.94, stages b-d, TWS 7-9).

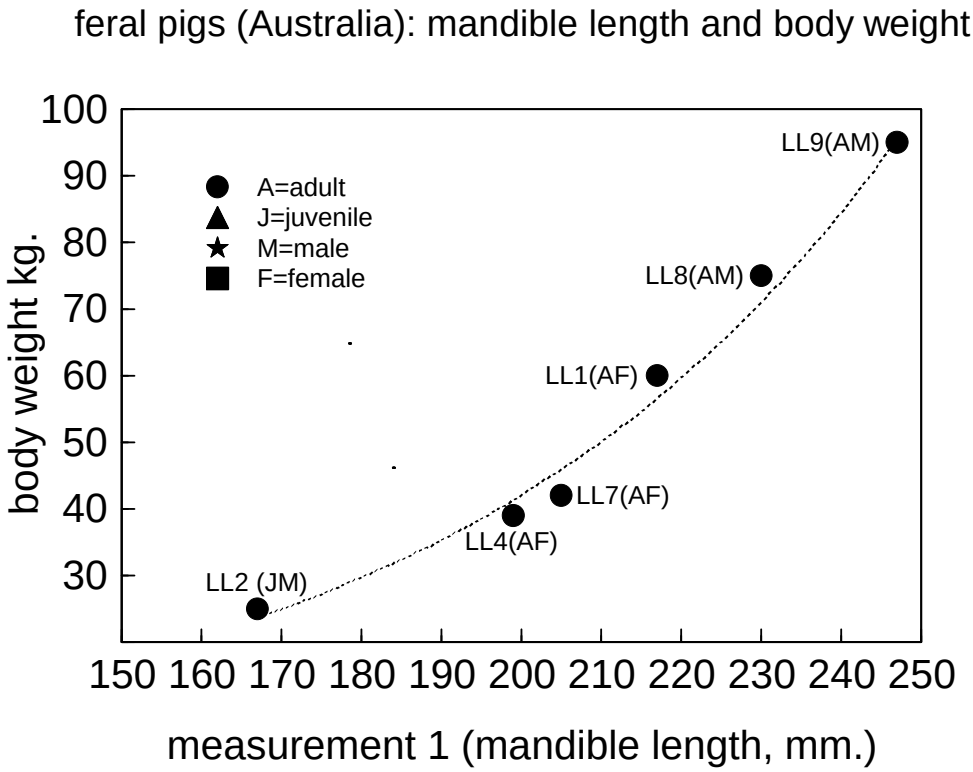

Figure 3. Feral pigs (Australia): Mandible length and body weight.

Mandible length and body weight shows a consistent relationship, at least in this small sample. Further data from Gallo Orsi at al. (1992) suggests that the relationship between jaw length and body weight is somewhat different in males and females as these become fully adult.

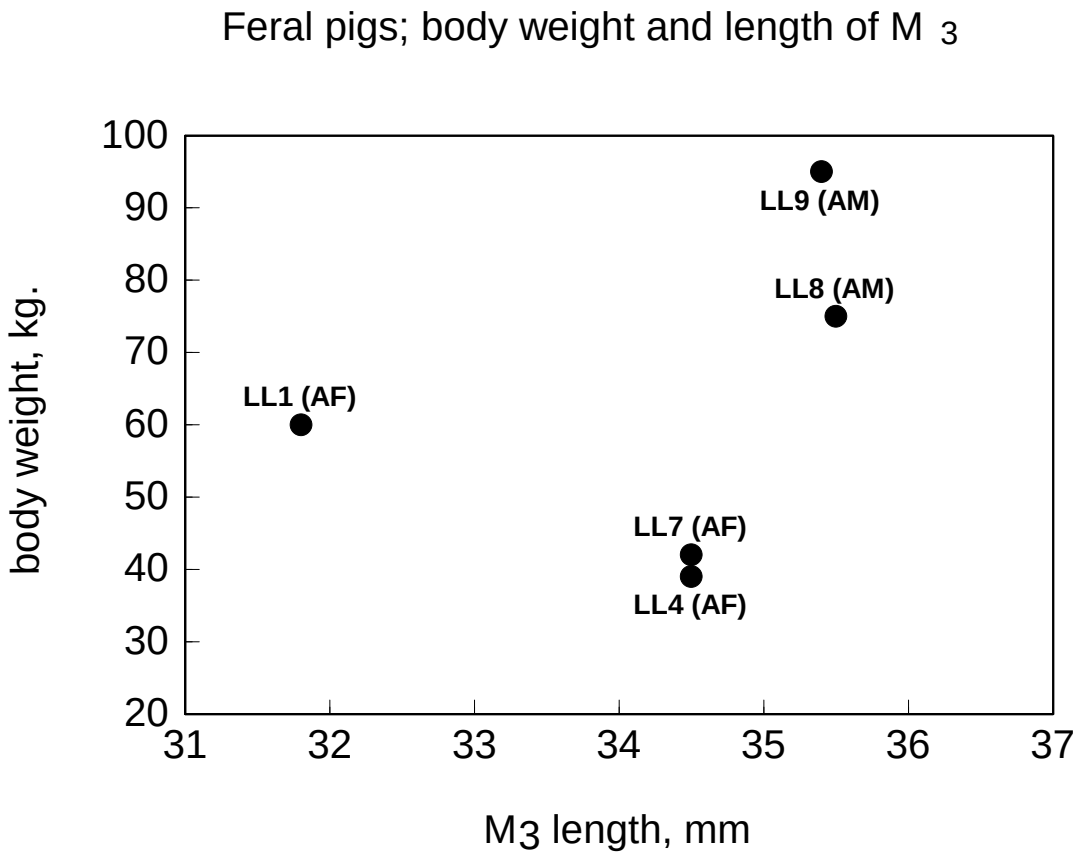

Figure 4. Feral pigs: Body weight and length of M_3.

Reliance is often placed upon the length of M_3 as an indicator of gross body size in adult pigs. This small sample suggests that this relationship is at best weak, and that it should be explored further.

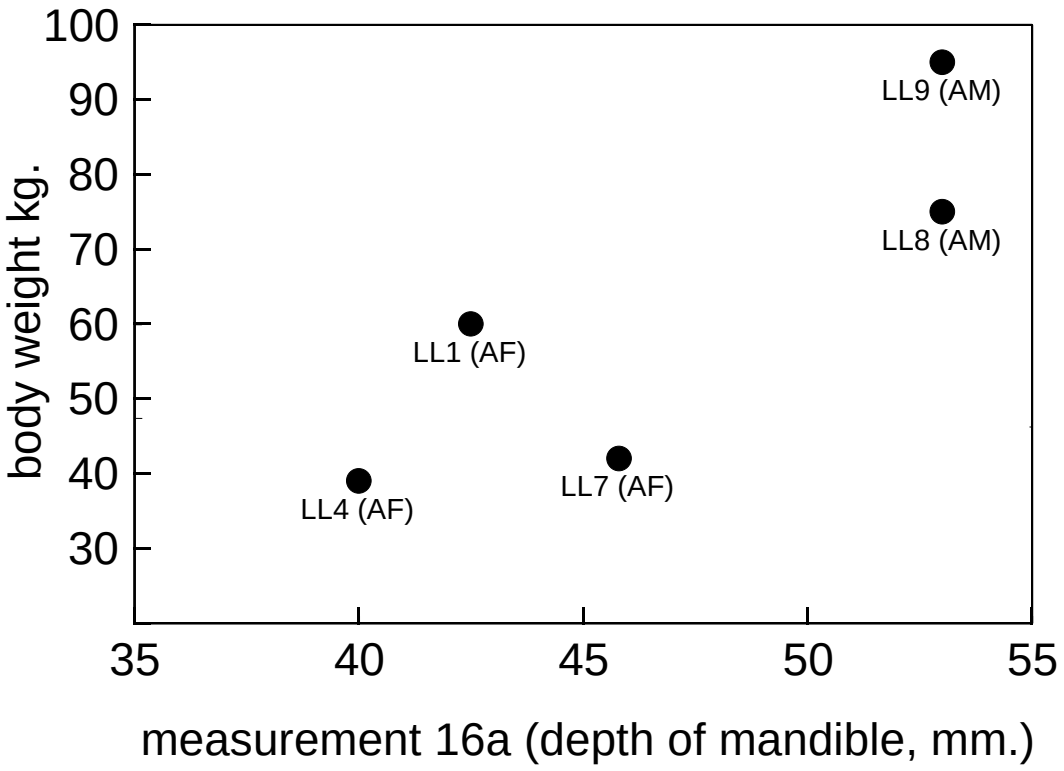

Figure 5. Depth of mandible (measurement 16a).

The relationship between the depth of the mandible (measurement 16a) and body weight is moderately good, indicating that this measurement that would provide useful data from samples of fragmentary mandibles.

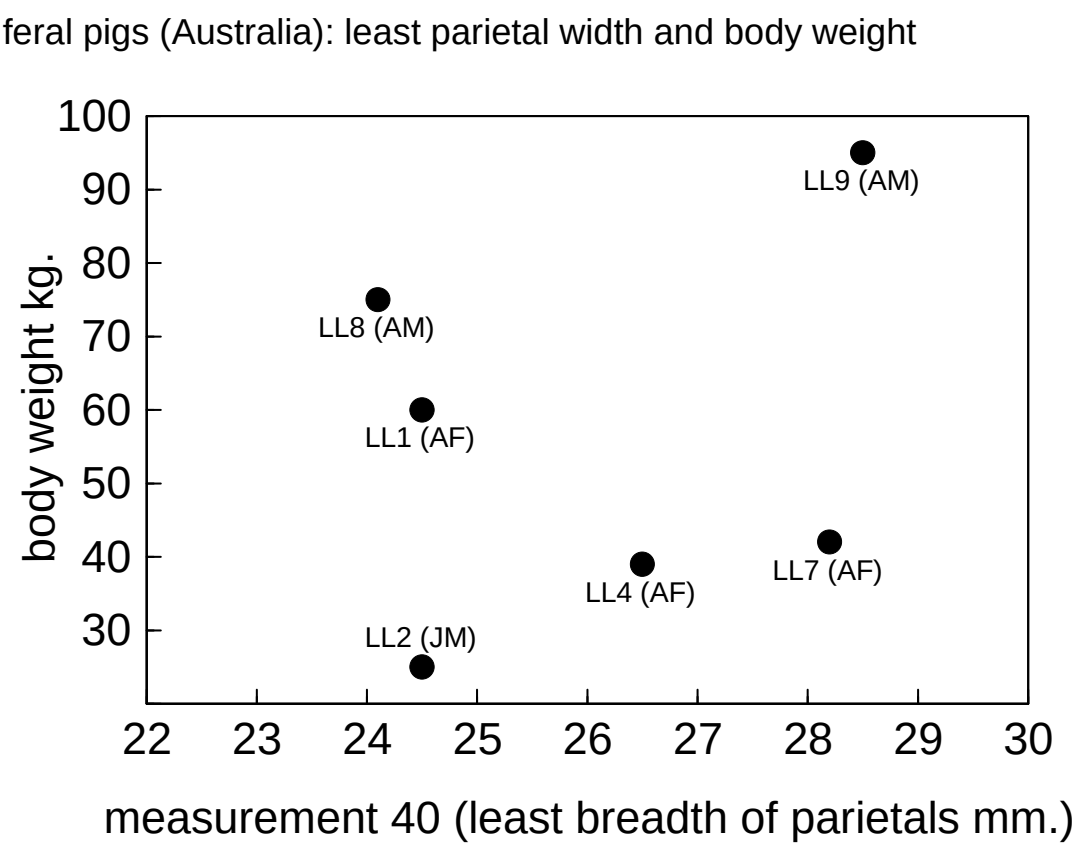

Figure 6. Feral pigs (Australia): Least parietal width and body weight.

Evidently the measurement of the least parietal width of the skull has a very weak relationship with body weight.

Figure 7. LL Pig 1 cranium.

Figure 8. LL Pig 1 mandible.

Figure 9. LL Pig 1 maxilla.

Figure 10. LL Pig 4 mandible.

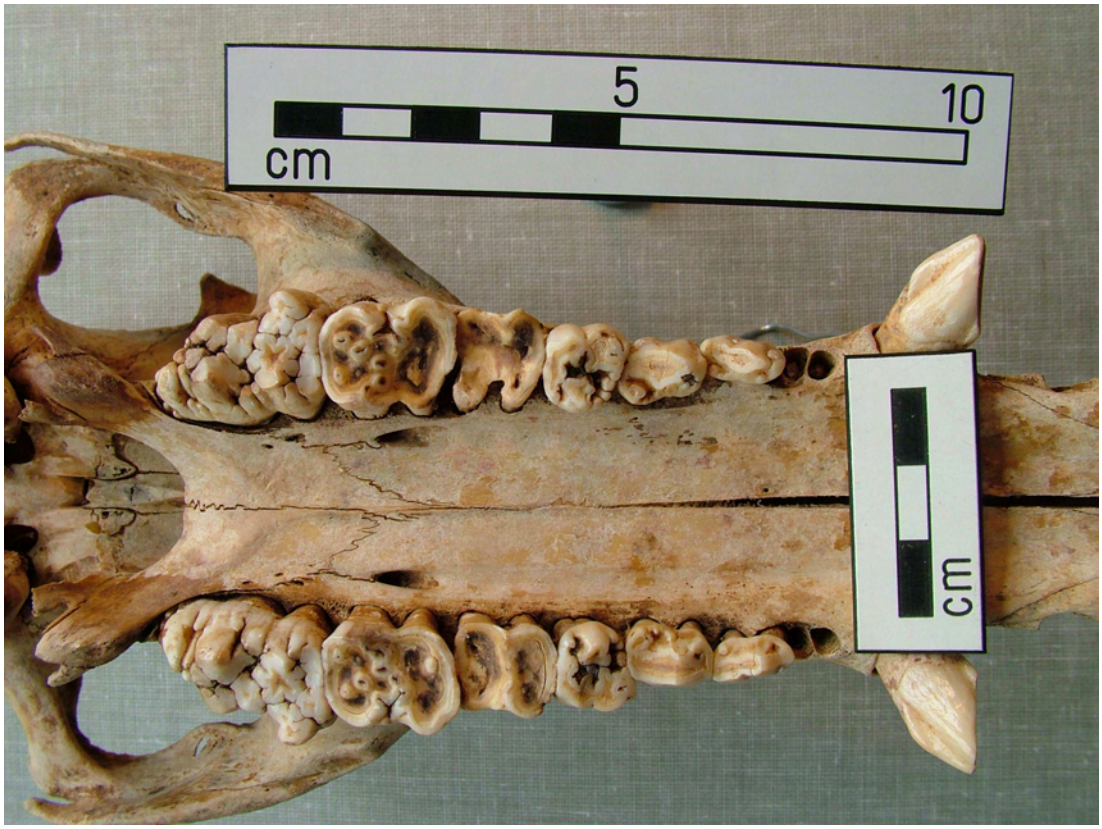

Figure 11. LL Pig 4 maxilla.

Figure 12. LL Pig 7 mandible.

Figure 13. LL Pig 7 maxilla.

Figure 14. LL Pig 8 cranium.

Figure 15. LL Pig 8 mandible.

Figure 16. LL Pig 8 maxilla.

Figure 17. LL Pig 9 cranium.

Figure 18. LL Pig 9 mandible.

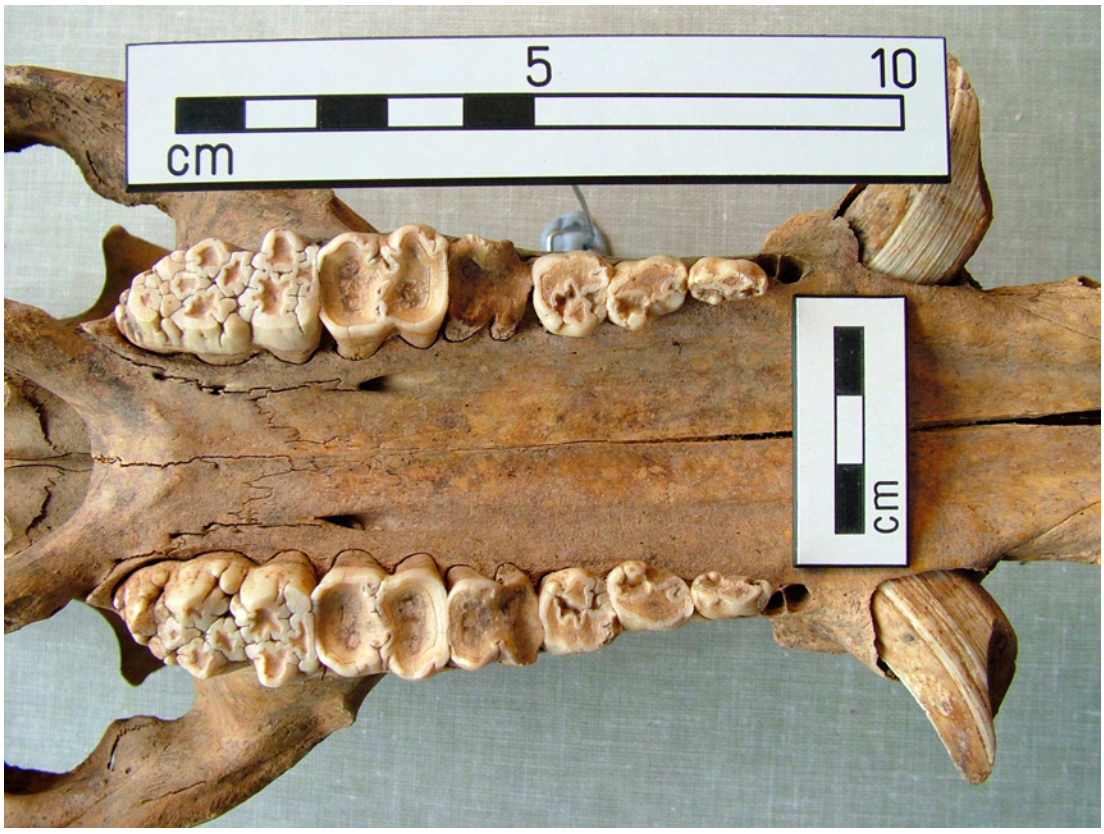

Figure 19. LL Pig 9 maxilla.

Figure 20. *Sus scrofa cristatus* lachrymal.

Figure 21. Wild Indian adult male.

Figure 22. Wild Spanish sub-adult female.