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Some comparative features of the skulls of Wolves (*Canis lupus* Linn.) and Pariah Dogs (*Canis familiaris* Linn.) from the Arabian Peninsula and neighbouring lands

By

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Dedicated to Dr. H. Kumerloeve on the event of his seventieth birthday

Summary

A series of crania of Pariah Dogs *(Canis familiaris)* from the Batinah Coast of Oman are compared with the available material of *Canis lupus arabs* and *Canis lupus pallipes* from Arabia and neighbouring lands. Although the teeth of the wolves average larger, the only consistent difference is in the size of the tympanic bullae. The differences that have evolved between the skulls of larger domesticated dogs and wolves during some 7—8,000 years in the Middle East are thus comparatively slight.

Zusammenfassung

Beim Vergleich einer Schädelserie des Pariahundes von der Batinah-Küste Omans mit Schädelmaterial von *Canis lupus arabs* und *Canis lupus pallipes* aus verschiedenen Teilen Arabiens und benachbarten Gebieten ergab sich: Abgesehen davon, daß beim Wolf die Zähne durchschnittlich größer sind, zeigt sich nur in der Form der Bullae tympanicae ein auffälliger Unterschied. Er wird im einzelnen beschrieben. Demnach haben sich im Mittleren Orient im Verlauf von etwa 7000 bis 8000 Jahren im Schädelbau der größeren domestizierten Hunde einerseits und des Wolfes anderseits nur relativ begrenzte Verschiedenheiten herausgebildet.

In the Arabian Peninsula, the races of the Wolf *(Canis lupus)* are smaller than in northern Eurasia and in consequence difficulty has been experienced by mammalogists in distinguishing them from the larger varieties of domestic dog *(C. familiaris)* found in the region. As noted by Lawrence (1956) this difficulty is particularly marked when cranial material alone is available for determination. Although there has been some doubt in the past regarding the racial determination of Arabian wolves it now seems clear (Harrison, 1968) that a larger race, *C. l. pallipes* Sykes, 1831, occurs in Iraq and intergrades in Kuwait and northern Arabia with the smaller *C. l. arabs* of the southern and eastern Arabian Peninsula, many individuals of which have in fact smaller skulls than those of large Arabian Pariah Dogs *(C. familiaris)*.

One of the main difficulties in the past in the determination of doubtful Canid skulls in Arabia has been the virtual absence of authentic material of Pariah Dog crania from the region. This difficulty has been to some extent overcome by the recent acquisition of a series of Pariah skulls from

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Oman, mainly from the Batinah Coast. I have already commented briefly on this material in the Harrison Zoological Museum (Harrison loc. cit. p. 205) noting that the whole series of *C. familiaris* skulls available from Oman can be readily distinguished from all the *C. l. arabs* skulls from the same region by means of the striking difference in size of the tympanic bullae, while the relatively larger teeth of the wolf are also generally helpful.

It has seemed useful here to examine this new Arabian Canid material in greater detail, in view of the particular difficulties experienced by Lawrence (loc. cit.) in the hope of drawing some conclusions that may be helpful to Arabian mammalogists and archaeologists confronted with the same problem in the future.

Lawrence (loc. cit.) listed the cranial characters customarily found reliable in separating the northern races of *lupus* from *familiaris*. Those most widespread and typical of dog are:

1. An elevated forehead and accompanying changes in shape of the orbit.
2. Small teeth, which do not increase in size with the increased palatal length found in large dogs.
3. A tendency to flattening of the tympanic bullae, which are thick-walled.

Lawrence (loc. cit.) found a bewildering variability in these characters in the Canid material from Iraq examined by her, noting that "the typical combinations of characters that are usually diagnostic of either group often do not occur here. That is to say, in a single skull a wolf-like development of one feature may be balanced by a dog-like development of another, so that the evidence instead of being cumulative may point in different directions." The Canid material now available to me from the Arabian Peninsula and neighbouring countries, which has been included in this study, is listed below.

Material Studied

Canis lupus pallipes

B M 44.80 Basra, Iraq
B M 35.1.14.1 Tanumah, Iraq
H Z M 8.6133 Main Kaleh Peninsula, Iran.
B M 11.7.26.1 Smyrna, Asia Minor

Canis lupus arabs

B M 97.1.14.4. Nr. Muscat, Oman
B M 34.8.4.12. Ain, Dhufar, Oman (type)
H Z M 1.3902 Jebel Hafit, Oman
H Z M 2.3903 Saham, Batinah Coast
H Z M 5.4416 Nizwa, Oman
H Z M 7. 4885 Fizz, Oman
B M 48.367 Buraida, Saudi Arabia
B M 24.8.13.1 N. of Lahej, S. Yemen
B M 95.19.8.1 Aden
B M 99.11.6.36 Lahej
B M 39.896 Kuwait
B M 46.890 Kuwait
B M 39.895 Kuwait
B M 48.368 „Arabia"
B M 91.2.5.1 Muscat, Oman.

Canis familiaris

H Z M 4.3956 N. of Mahab, Oman.
H Z M 6.4957 Nr. Sohar, Batinah
H Z M 7.5171 Salan, Batinah
H Z M 4.4610 Sohar, Batinah
H Z M 2.4542 Sohar, Batinah
H Z M 1.4541 Sohar, Batinah
H Z M 3.4543 Ibri, Oman.
H Z M 5.4611 Sohar, Oman
B M D 96 Constantinople, Turkey

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The cranial measurements taken for this study (see Table I), and the methods by which they have been taken are listed below, together with the abbreviations employed in Table I.

Greatest Length (Gt L): The greatest antero-posterior diameter of the skull, taken from the most projecting point at each extremity.

Condylobasal Length (CBL): From the exoccipital condyle to the anterior extremity of the premaxillary (at the alveolar margin of the most forwardly projecting upper incisor tooth.

Zygomatic Width (ZB): The greatest width of the skull across the zygomatic arches.

Breadth of the Braincase (BB): The width of the braincase at the posterior roots of the zygomatic arches.

Interorbital Constriction (IC): The narrowest width across the interorbital region.

Maxillary Cheekteeth (C-M^2): From the front of the upper canine to the back of the second molar.

TABLE I

Cranial measurements (mm.)

COLL AND NO.	Gt L	CBL	ZB	BB	IC	C-M^2	BOW	PZW	TB	LC	WM^1
Canis lupus pallipes											
BM 44.80	237	211.5	133	70.6	44	93.6	18	75.6	28	23.2	17.7
BM 35.1.14.1	238	214	119	63.7	36	97	13.4	71.3	27.5	24.8	18.1
HZM 8.6133	242	223.5	139.4	75.2	46.9	—	16.6	78.7	30.6	25.4	20
BM 11.7.26.1	223.2	210.6	118	72.1	41.2	93.6	15.8	71.9	26.7	23.2	18.9
Canis lupus arabs											
BM 97.1.14.4	192	—	106	59.2	35.5	84	—	59.9	—	22	18.2
BM 34.8.4.12	198.8	181.8	107.8	58.5	33.8	85.4	13.5	61.4	23.9	20.7	17.1
HZM 1.3902	208	198	109	65.4	36.8	91.7	13.8	64.9	24	—	—
HZM 2.3903	189.9	—	101.3	58.6	35	82.3	—	58.2	—	20.5	17.2
HZM 5.4416	187	174	90.2	58.1	31.1	83.3	12.4	59.3	22.8	22.2	18.1
HZM 7.4885	184.5	169	91.1	60.2	31.6	81.2	12.4	60.2	23.7	19.6	17.2
BM 48.367	208	190.2	107	61	35.8	87	13.9	64.2	24.4	21.7	17.1
BM 24.8.13.1	199	—	—	—	35.8	82.3	—	—	—	22.2	17.9
BM 95.10.8.1	207	189	104.7	57.6	34.5	86	13.3	59.2	22.5	22.5	18.0
BM 99.11.6.36	202	184	100	58	31.8	84.3	12.2	61.7	22.5	21.7	17.8
BM 39.896	201	188.9	115.5	63.2	36.6	86.6	11.7	65.5	27	21	18.2
BM 46.890	216	194	109	61.2	40.3	89	9.3	62.2	28.1	22	17.3
BM 39.895	220	206	130	65.8	44.2	93	12.2	68.1	28.4	21.8	18.6
BM 48.368	205.4	192.6	106.2	61.3	40	90.6	11.3	62.6	25.7	22.9	17.3
BM 91.2.5.1	193	182.2	96.2	61.1	33.2	85.2	12.8	62.4	23.6	21.7	18.5
Cranis familiaris											
HZM 4.3957	190	177	102.7	60.2	39.1	79.8	15.6	61.2	21.4	19.7	16.8
HZM 6.4957	185.5	170.8	96.6	60.9	—	79.5	16.5	61.9	21.4	18.5	16.9
HZM 7.5171	208.4	193	109.3	63	42.3	87	18.3	66.6	24.4	20.8	17.7
HZM 4.4610	198.3	179.3	—	59.2	36.1	81.1	16.6	60.9	21.9	18.2	15.9
HZM 2.4542	190.9	178.2	93.5	58.2	36.8	—	16.0	60.9	20.5	18.8	16.2
HZM 1.4541	192.2	181.2	98.1	63.4	35	—	18.1	69.5	22.3	19.7	16.4
HZM 3.4543	201.8	188	—	62.2	37.2	84.3	—	62.8	—	19.3	15.9
HZM 5.4611	200.8	181.1	99.7	63.1	37	85.3	18.2	64.2	20.4	19.5	17.2
BM D 96	194.2	181.2	106.6	62.3	33.8	78	19.5	64.9	23.2	18	16

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Width of Tympanic Bulla (TB): The greatest width of the bulla, from the posterior margin of the meatus to the suture between the bulla and the basioccipital.

Basioccipital Width (BOW): The narrowest width of the basioccipital between the bullae, measured from the sutures between the basioccipital abd the bullae.

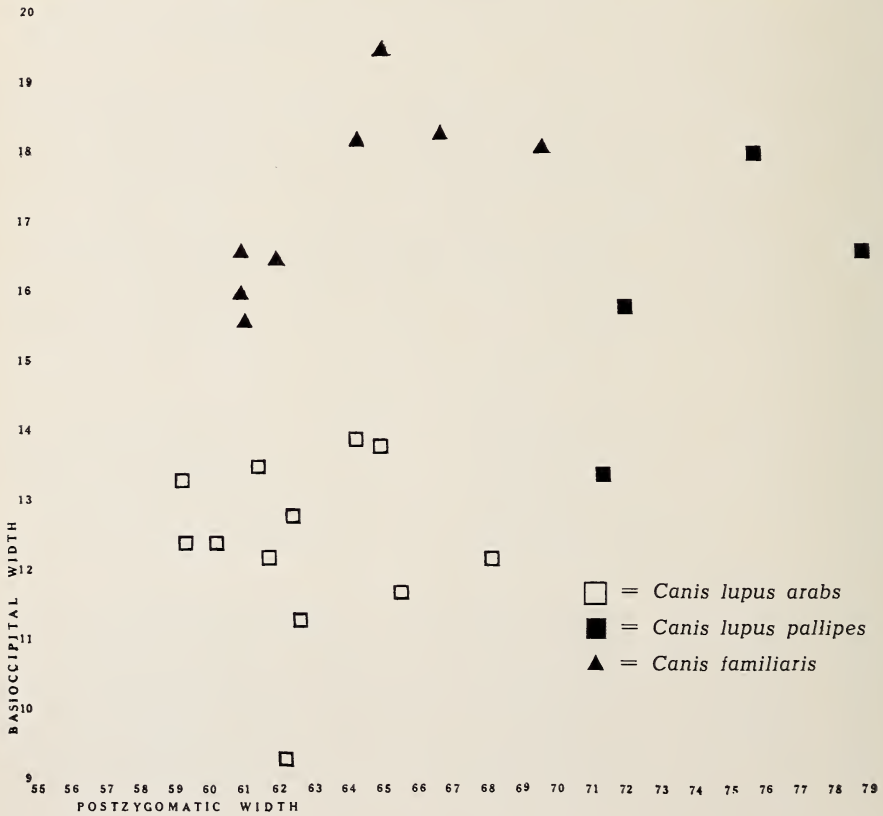
Post-Zygomatic Width (PZW): The width of the braincase taken across the squamosal ridges behind the zygomatic arches, at the level of the auditory meati.

Length of Upper Carnassial (LC): From the front of the crown antero-internally to the most posterior point of the crown.

Width of m^1 (WM^1): Taken from the centre of the crown medially to its widest point outside the paracone laterally.

Examination of the distinguishing characters listed by Lawrence in these Middle Eastern Canids gives some interesting conclusions.

Fig. 1. Scatter diagram. Basioccipital Width plotted against Postzygomatic Width.



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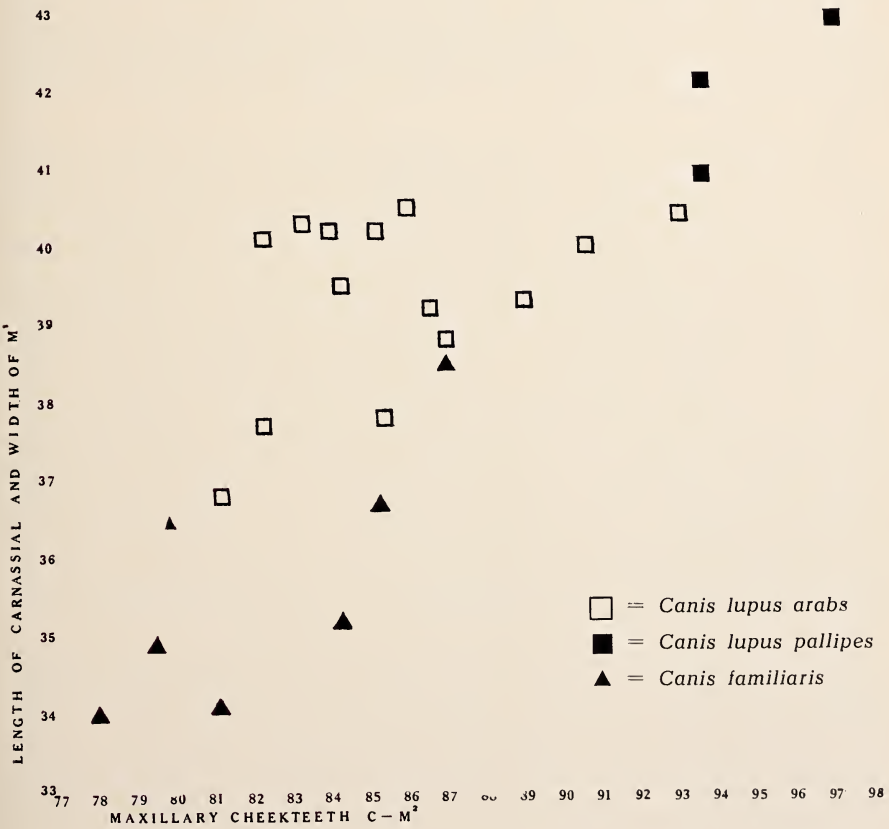
The height of the forehead and profile of the braincase are extremely variable in the two groups, and although it is in general true that wolves tend to be "low-browed" and dogs "high-browed", there is certainly a good deal of overlap between the two groups, nor is there any distinctive feature in the orbital shape of the two groups. The braincase profile is, of course, much affected by age, and it is the adult wolves that show a rather characteristic combination of low brow, with heavy development of the sagittal crest, producing an almost horizontal braincase profile. The angle formed between the preorbital frontal plane and the basifacial axis varies from 32°—38° (average 34°) in these wolves, while in the dogs it varies from 36°—40° (average 37°).

A similar situation exists in respect of the size of the teeth, which are generally strikingly larger in wolves than in dogs, especially when the

Fig. 2. Scatter diagram. Length of Carnassial and width of m^1 plotted against maxillary cheekteeth c—m^2.



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upper carnassials and first molars are compared. However, when a scatter diagram is prepared, in which the combined greatest length of the upper carnassial and greatest width of the first molar are plotted against the length of the upper toothrow (C-M^2) as in Fig. 2, it becomes clear that even this time-honoured distinction between dogs and wolves is not absolute, a narrow but definite zone of overlap existing between the two groups.

It is interesting however that in this Middle Eastern material at least all available wolf skulls may be readily distinguished from the pariah dog series by the relative size and inflation of the tympanic bullae, which are strikingly larger in the wolves. Associated with this there is a marked narrowing of the basioccipital between the bullae.

The clear distinction is demonstrated in the scatter diagram (Fig. 1) in which the basioccipital width between the bullae is plotted against the post-zygomatic width (i. e. the width of the braincase opposite the bullae). This figure also shows that this distinction is equally valid for the larger *C. l. pallipes* of northern Arabia, Persia and Asia Minor, as it is for the smaller *C. l. arabs*. This difference in bulla size and inflation is even clearly apparent in a very young *C. l. arabs* (HZM 6.4612) in which the permanent dentition had not yet erupted.

It only remains to state that there appears to be no other reliable cranial distinction between the skulls of these Middle Eastern Canids. In view of the comparatively recent domestication in dogs, (Lawrence, 1967, 1968, reports *C. familiaris* remains with a Carbon 14 dating of 8,400 B. C. in Idaho and in South Central Turkey dating from about 7,000 B. C. and even as long ago as 10th millennium B. C.), now generally agreed to have arisen from one or more of the races of *Canis lupus*, it is hardly to be expected that any absolutely distinctive differences between skulls of wolves and dogs will be found, especially on a world-wide basis. It is, however, of interest to find that in the Arabian Peninsula at least the difference in size of the tympanic bullae is a more clearly demonstrable difference than the relative size of the teeth, which has formerly been considered the most reliable distinction. It is tempting to speculate that the enlarged bullae in Arabian wolves may be correlated with their generally solitary hunting habits and the need to hear each other's cries over great distances. A similar explanation has been proposed for the enlarged bullae of desert rodents.

Berry (1969) has pointed out the possible fallacies in assuming domestication in archaeological material, and certainly this study indicates that extreme difficulty may be encountered in distinguishing wolf from dog skulls from archaeological sites in the Middle East, as has indeed been found by Lawrence (1956). More material is needed, especially of Middle Eastern Dogs, to test the reliability of this difference in bulla size, which,

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taken in conjunction with the generally larger teeth, appears to be the only means of distinguishing Arabian dog and wolf skulls.

Acknowledgements: The author is much indebted to Lt. Col. C. Seton-Browne, who has obtained invaluable material of Canids from Oman to facilitate this study, other specimens were obtained from Persia by Dr. J. G. Harrison, and from Arabia by Major Mark Legg.

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: Bonn zoological Bulletin - früher Bonner Zoologische Beiträge.

Jahr/Year: 1973

Band/Volume: 24

Autor(en)/Author(s): Harrison David L.

Artikel/Article: Some comparative features of the skulls of Wolves (Canis lupus Linn.) and Pariah Dogs (Canis familiaris Linn.) from the Arabian Peninsula and neighbouring lands 185-191