DOG REMAINS IN ITALY FROM THE NEOLITHIC TO THE ROMAN PERIOD

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Summary

The goal of this paper is to demonstrate the development and the variability of the morphology and size of dogs from the early Neolithic until the Roman period. During the Bronze Age, in addition to a strong variablity observed for the limbs, the selection of particular characters on the skull suggests the existence of true races. During the Iron Age, this morphological variation is less obvious because of the lack of information. However, the increase in size is obvious. Some races have proper characteristics only at the Roman period. Beside the use for hunting, dog was, at times, eaten between the Neolithic and the Iron Age. For all the periods considered, we have evidence of ritual and funeral uses of the dog.

Résumé

Les ossements de chien en Italie du Néolithique à l'époque romaine.

Le but de ce travail est de mettre en évidence le développement et la variabilité de la morphologie et des dimensions des chiens du Néolithique ancien à la fin de l'Époque romaine. À l'Âge du Bronze, en plus d'une forte variabilité observée pour les membres, la sélection de certains caractères sur le crâne semble attester la présence de véritables races. À l'Âge du Fer, en raison de l'insuffisance des informations, cette variabilité morphologique ne semble pas être aussi claire. Par contre, l'augmentation de la taille est évidente. Certaines races n'ont des caractéristiques propres qu'à l'Époque romaine. En dehors de l'utilisation pour la chasse, le chien a été parfois consommé à partir du Néolithique et jusqu'à l'Âge du Fer. Il existe des témoignages de l'utilisation rituelle et funéraire du chien pour toutes les périodes étudiées.

Zusammenfassung

Überreste des Hundes vom Neolithikum bis zur Römerzeit in Italien.

Ziel dieser Arbeit ist, Entwicklungen und Veränderungen von Morphologie und Größe der Hunde vom Neolithikum bis an das Ende der römischen Epoche zu verdeutlichen. Es konnte beobachtet werden, daß in der Bronzezeit - abgesehen von einer großen Variabilität der Knochenmaße - eine gewisse Auslese bezüglich Kopf- und Unterkieferform stattgefunden hat. Dies könnte auf das Vorhandensein von Rassen hindeuten.

In der Eisenzeit sind diese Tendenzen aufgrund der geringen Materialbasis nicht so deutlich festzustellen. Gut zu belegen ist hingegen die Zunahme der durchschnittlichen Körpergröße. Klar definierte Rassen mit fest angelegten Merkmalen können einzig in römischer Zeit ausgemacht werden.

Abgesehen von einer möglichen Verwendung als Jagd-, Wach- und Arbeitstier kann vom Neolithikum bis zur Eisenzeit auch von einer sporadischen Nutzung als Nahrungsmittel ausgegangen werden. Allen Zeiten gemeinsam ist die Bedeutung des Hundes im rituellen Bereich.

Key Words

Dog, Italy, Osteometry, Ritual, Butchery.

Mots clés

Chien, Italie, Ostéométrie, Rituel, Boucherie.

Schlüsselworte

Hund, Italien, Osteometrie, Ritus, Schlachtung.

The scope of this work is to examine the evolution of the domesticated dog in Italy from the Neolithic to the end of the Roman Period and to explore the economic and ritual use of the dog as documented by archaeological research. At this time, the problem of the dog's origin and diffusion will not be dealt with.

Its aim is to evaluate whether, in the period under examination, the development and changes in the morphology and size of canine remains reflect the emergence of different breeds and varieties of *Canis familiaris* and if so, where and when these new strains have occurred. It is not our intent, however, to compare our findings with actual breeds which are of recent selection, nor with the various species, subspecies and varieties often cited in the old archaeozoological literature (*C. f. palustris*, *C. f. intermedius*, *C. f. matris optimae*, *C. f. spalletti*, etc.) which,

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upon closer examination, are neither statistically or morphologically well-defined.

The results presented involve the preliminary analysis of data from over 1500 specimens of skeletal dog remains taken from approximately 200 archaeological excavations. This osteological sample, while numerically relevant, demonstrates a series of apparent limits that influence the general consideration of the results. First, only a small part of the remains were studied directly by the authors and the majority of the data was obtained from findings cited in numerous publications, many of which were quite difficult to find. Also publications pertaining to many of the samples, even those from the most important sites (excavations) lack metrical data and describe samples with subjective descriptions such as "dog of small (medium or large) build, or long (short or broad) muzzle."

Even when metrical information is present, it has often been gathered using different methodologies, making it impossible to use numerous findings. In addition, research on old collections was often fruitless since materials have been lost or are being stored away by the Italian museums they belong to and were thus unavailable for study.

We would like to take the opportunity to thank all of our colleagues who gave us access to data they have yet to publish and that helped up to provide a rich bibliography. This collaboration among scholars has most certainly been encouraged by the birth, also in Italy, of an archaeozoological association which has among its aims the development of such forms of cooperation and information exchange.

Another problem that became clear in the course of the research was the disparity of information both because of the different chronological periods analyzed and the distribution of the various sites throughout Italy. The majority of the data is from prehistoric sites in north-central Italy, in particular the Bronze Age (cranial and mandibular remains from this period represent more than 50% of the sample), while data from Neolithic and Roman excavations is quite limited. While the rarity of data from the Neolithic is due to the limited number of sites and finds recovered, this is certainly not true for material from more recent excavations. The scarce data in this case is fundamentally attributable to the lack of interest on the part of numerous archaeologists paid to naturalist findings and the scarce interest of paleontologists in studying such recent periods.

Method

The method used in this research was to gather and computerize all available data on the dimensions of the samples under investigation applying the methodology used by von den Driesch (1976) and, when possible, also measurements taken using other methods. Quantitative and statistical analysis were also carried out on the main bone measurement. At present an extensive multivariated analysis, the only method able to thoroughly evaluate the validity of differences noted among single measurements, has not been carried out. This work took as a model the analogous research conducted by Harcourt (1974) on dogs in Great Britain.

Data have been divided into the following chronological periods: Neolithic, Bronze Age (XIX-Xth centuries BC), Iron Age (IX-IIIrd centuries BC), early Roman period (IIIrd century BC- IInd century AD), late Roman period (III-VIth centuries AD). Initially cranial dimensions was determined using von den Driesch system of 40 measurements but later 10 specific measurements were selected, based in part on the experience of Harcourt's research, which were able to express with precision the real size of the skulls. This substantially reduced the quantity of the osteological sample but at the same time allowed for more valid comparisons. Following the numbering system established by von den Driesch, the measurements selected are:

(1) - Total length
(8) - Viscerocranium length
(13) - Median palatal length
(15) - Length of cheektooth row (P1 - M2)
(18) - Length of the carnassial
(29) - Greatest neurocranium breadth
(30) - Zygomatic breadth
(32) - Frontal breadth
(34) - Greatest palatal breadth
(36) - Breadth at the canine alveoli

In addition to absolute size, others characteristics able to shed light on the morphological character of the specimen are the shape of the skull, the zygomatic breadth, the length of the muzzle and the width of the snout. Indexes representing the relationship between several of the above-mentioned measurements as a percentage were determined to represent the relationship between the separate parts of the cranium. In addition to the three indexes used by Harcourt (1974), another five were applied in our research to be adapted to incomplete specimens on which it was not always possible to take all the measurements.

Ind. 1 - Cephalic index (30) * 100 / (1)
Ind. 2 - Cephalic index (29) * 100 / (1)
Ind. 3 - Snout index (8) * 100 / (1)

Ind. 4 - Snout index (15) * 100 / (1)

Ind. 5 - Snout width index (36) * 100 / (8)

Ind. 6 - Snout width index (34) * 100 / (8)

Ind. 7 - Snout width index (34) * 100 / (15)

Ind. 8 - Snout width index (36) * 100 / (34)

The same method was used for the mandible where seven measurements were selected and six indexes calculated.

(1) - Total length

(6) - Length: angular process - aboral border of the canine alveolus

(8) - Length of cheektooth row (P1 - M3)

(10) - Length of the molar row

(13) - Length of the carnassial

(18) - Heigth of the vertical ramus

(19) - Heigth of the mandible behind M1

Ind. 1 - (18) * 100 / (1)

Ind. 2 - (18) * 100 / (8)

Ind. 3 - (19) * 100 / (1)

Ind. 4 - (19) * 100 / (8)

Ind. 5 - (10) * 100 / (18)

Ind. 6 - (19) * 100 / (10)

Regarding skeletal measurements, factors selected as relevant for consideration were the dimensions of the long bones of the limbs (humerus, radius, femur and tibia). Measurements taken were generally the total length of the bones, the proximal, shaft and distal breadth, and at time also the antero-posterior diameters of the proximal and distal end.

Analysis of the data

The sample of skulls for which data was available on at least one of the ten selected measurements totalled 98 of which 14 were Neolithic, 37 Bronze Age, 23 Iron Age, 14 from early Roman period and 10 from late Roman period. The sample was drawn from 46 separate sites.

Analyzing the skull lengths, the smallest specimen (115 mm) came from the late Roman period and was discover in a sewage drain in the port of Classe near Ravenna, where three other skulls of less than 150 mm were also unearthed. Small skulls of less than 150 mm from the Bronze Age were also found at Cetona (132 mm), Bagno di Rubiera (142 mm), and Barche di Solferino (147.5 mm). The largest skull of the sample was found at Cetona (194.2 mm) but large skulls that exceed 180 mm were present in all of the periods analyzed (fig. 1). Since skull length was not always available, as skulls uncovered are often only fragments, we have used the length of the mandibular cheek tooth row which partially confirmed previous findings but illustrated an increase in skull size in the Iron Age over previous periods (fig. 2).

The most complete skulls which allowed the application of at least one index are listed in table 1.

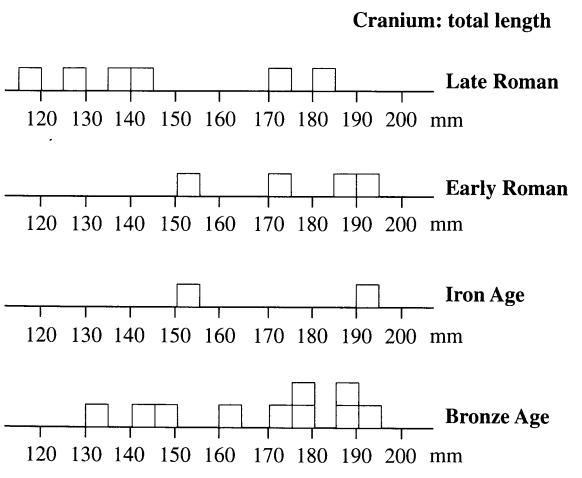

Fig. 1: Dog cranium: total length (mm).

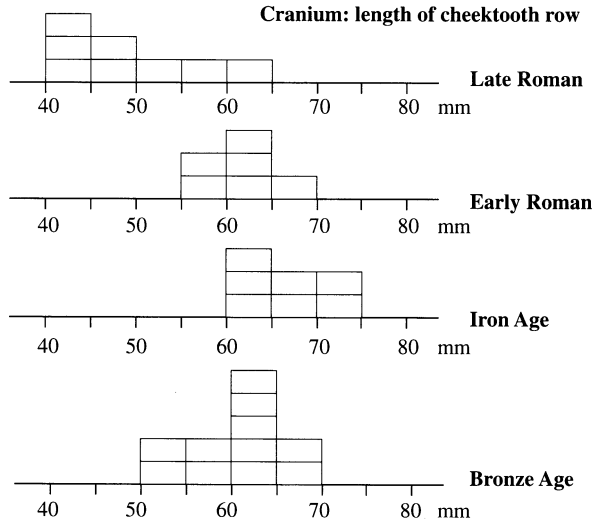

Fig. 2: Dog cranium: length of cheektooth (mm).

Table 1: Measurements of dog's skull (N = Neolithic, BA = Bronze Age, IA = Iron Age, ER = early Roman, LR = late Roman).

Site	date	(1)	(8)	(13)	(15)	(29)	(30)	(34)	(36)	Ind.1	Ind.2	Ind.3	Ind.4	Ind.5	Ind.6	Ind.7	Ind.8
S. Maria	N				63.3	58	90.2	61.7								97.5	
Ancona	BA	179.2	86.8		63.1	57.2		62.6	37.4		31.9	48.4	35.2	43.1		99.2	59.7
Cetona	BA	132.6		63.9		48.7		50.8	30.5		36.8				79.4		60.1
Cetona	BA	161.8		77.8		50.3		57.1	32.7		31.1				73.5		57.2
Cetona	BA	176		89		48.3		56.6	33.4		27.5				63.6		59
Cetona	BA	194.2		102.5		51.7		60.4	34.9		26.6				58.9		57.8
M. Castell.	BA	186	92	90.4	65	57.2		58.9	33.9		30.8	49.4	34.9	36.8	65.2	90.6	57.5
Rubiera	BA	142	68.2	75.4	51.8	52.8		48.6			37.2	48	36.5		64.4	93.8	
S. Ambrogio	BA	170	66.8	82.4	51.5	53		57.5	30		31.2	39.3	30.3	44.9	69.8	111.6	52.2
Terramare	BA	189	95	93	64.5	51			37.7		26.9	50.2	34.1	39.7			
Terramare	BA			91.5	58.5			66	40						72.1	112.8	60.6
C. Vandelli	IA	191	101.2		68.3	58					30.4	52.9	35.8				
Ost. Osa	IA				69			60	36.5							86.9	60.8
Veroli	IA	153			63				32				41.2				
Padova	ER	152.8	76	78	55.1	55.4	91.6		30.7	59.9	36.3	49.7	36.1	40.4			
Padova	ER	172.3	84.5		57.7	58.5	96.5	65.7	36.5	56	33.9	49	33.5	43.1		113.8	55.5
Padova	ER	186.7	89.2	97	60.8	57		60	37		30.5	47.7	32.6	41.4	61.9	98.6	61.6
Padova	ER	192		96	64	58					30.2		33.3				
Classe	LR	115	51	59	43.3	45.8	69.1	42.6	22.8	60	39.8	44.3	37.7	44.7	72.2	98.3	53.5
Classe	LR	128	61	62.2	44.5	50.3	84.6	48.5	25.5	66	39.3	47.6	34.8	41.8	77.9	108.9	52.6
Classe	LR	135	65	66	46	44.5	81.4	47.8	24.2	60.3	32.9	48.1	34.1	37.2	72.4	103.9	50.6
Classe	LR	143	69	67	49	47.4	85.5	50.7	28.4	59.8	33.1	48.2	34.3	41.1	75.7	103.4	56
Classe	LR	170	80	87.2	59.4	54.3	90	57.8	31.2	52.9	31.9	47	34.9	39	66.3	97.3	53.9
Classe	LR	184	93	90.7	61.1	52.1	101.2	60.3	33.3	55	28.3	50.5	33.2	35.8	66.5	98.7	55.2
Classe	LR				44.6	52	75.5	52.8	28.1							118.3	53.2
Classe	LR				50.5	51.5	81.8	54	31.4							106.9	58.1

It was possible to apply the First Cephalic Index (tab. 1) to only two skulls from the early Roman period and six from the late Roman period with a relationship between skull length and breadth of between 55-62% while among the specimens uncovered at Classe, one skull was particularly broad (ind.1 = 66%) and another exceptionally narrow (ind.1 = 53%). By using the Second Cephalic Index, a larger number of applications to a larger number of skulls was possible, allowing also the examination of the morphology of dogs from the Bronze and Iron Age. This index shows the presence, already in the Bronze Age (Cetona and Rubiera), of short skulls with fairly broad neurocraniums and a relatively high index of 37%. Rounder skulls were found in Classe, having indexes of 39-40%. Using this index for the Bronze Age site of Cetona, we can already note two different morphologies in the breadth-length ratio, which varies from 26 to 36%.

The index 3 allows the evaluation of different morphologies using the ratio of facial length to total cranial length which, on the average, is equal to 50%. An example of a dog with a particularly short muzzle was the one found at the Bronze Age site of S. Ambrogio (ind.3 = 39%), while the dog of Case Vandelli had a particularly long muzzle as did the Veroli dog if we analyze the index 4.

Indexes 5-8, which are relative to the breadth of the muzzle, show that the previously mentioned dog from S. Ambrogio, aside from the strong shortening of the muzzle, also demonstrates a broadening of the muzzle. Skulls with broad muzzles were present in the Bronze Age at Cetona and Ancona, in the early Roman period in Padova, and in the late Roman period in a number of specimens from Classe. Cranial remains with tapered muzzles coexist in all the periods (Cetona, Padova e Classe).

In analyzing mandibular samples, 281 specimens allowed at least one of the seven measurements selected to be analyzed. Those which allowed at least one of the indexes to be used were 192. In table 3, data on the 41 mandibles which allowed the calculation of all six indexes are listed. The indexes used in the study of the mandibles allowed the evaluation of only the morphological changes tied to the shortening of the muzzle, measured in the relationship between the absolute length and the length of the mandibular cheek tooth row on the one side and the heigth of the body of the jaw and the vertical ramus on the other.

For the Neolithic period there is very little information on absolute mandibular length (fig. 3). At Grotta Continenza a mandible of medium-small size (total length = 114) and the relatively low ramus was found (h. vertical *ramus* = 41). The group of mandible from S. Maria in Selva showed a strong variability in index 6, in fact, even with the majority of the mandibles falling within a range of variability for medium sized mandibles (tab. 2; values between 58 and 72), there were also present mandibles with very high (ind.6 = 79.7) or low bodies (ind.6 = 54.5) with respect to the length of the molar series. At Grotta della Gallerie, however, a homogeneous group of mandibles of medium-large dimensions was present (total length between 128-138).

In the Bronze Age, a strong variability in the absolute size of the mandibles was present (total length between 109-148) even if those of medium (125-135) or medium-small (114-124) dimensions predominated (fig. 3). The analysis of the indexes already show the existence of different morphologies in mandibles of similar size, observable in particular in the five sites of this period that furnished the largest number of finds: Ledro, Frattesina, M. Castellaccio, Isolone and Cetona. Ledro and Cetona are the sites that showed the greatest variability both in the absolute length (Ledro = 111-141; Cetona = 112-148) and in the various relationships between different mandibular measurements which demonstrate the coexistence in these sites of different types of dogs. M. Castellaccio showed minor variability in size but strong morphological differences. Isolone and Frattesina showed minor differences in size and only rare elements that reflect morphological differentiation.

In the Iron Age, even with less data available, evidence of larger dimensions with regard to earlier periods

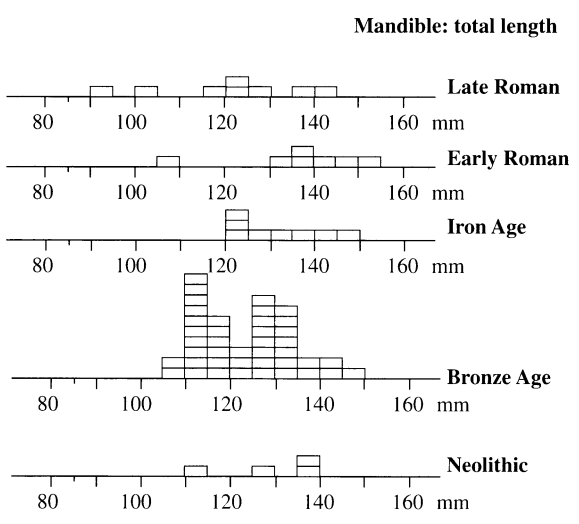

Fig. 3: Dog mandible: total length (mm).

was confirmed (total length between 121-145). The indexes showed a substantial morphological unity and only at Sulmona did there seem to exist at least two different morphologies. Other cases with differentiated morphologies were found at Ficana and Marzabotto. This greater uniformity, in comparison with the Bronze Age can conceivably be due to the scarcity of diagnostic findings. In the early Roman period we have little mandibular data but a high variance in size (total length between 107-151). Nevertheless, it is interesting that this variability concerns the samples from Padova where the indexes seem to be able to distinguish at least three different types. In the late Roman period the existence of greater dimensional differences (total length between 83-142) compares with the presence of very small dogs with brachymelic limbs found at Classe. Different morphologies seem to be distinguish-

Table 2: Measurements of dog's mandibles (BA = Bronze Age, IA = Iron Age, ER = early Roman, LR = late Roman).

Site	date	(1)	(6)	(8)	(10)	(13)	(18)	(19)	ind.1	ind.2	ind.3	ind.4	ind.5	ind.6
Cetona	BA	111.7		59.6	30.1		45.0	17.6	40.3	75.5	15.8	29.6	66.9	58.6
Cetona	BA	111.8		61.2	30.2		48.8	16.8	43.7	79.8	15.1	27.5	61.9	55.7
Cetona	BA	121.3		63.5	30.9		46.1	19.1	38	72.6	15.8	30.2	67	62.1
Cetona	BA	122.6		64.2	31.1		45.4	19.2	37.1	70.7	15.7	29.9	68.5	61.8
Cetona	BA	128.8		63.1	27.1		50.8	20.4	39.5	80.7	15.8	32.4	53.1	75.5
Cetona	BA	148.2		77.6	37.3		59.8	23.3	40.4	77.1	15.7	30	62.3	62.4
Feniletto	BA	119.2	104.1	65.5	31.7		47.7	20	40	72.8	16.8	30.5	66.5	63.1
Frattesina	BA	129.5	113	68.5	33.7	20.3	50.5	23.3	39	73.7	18	34	66.7	69.1
Frattesina	BA	134.5	121	68.5	33	20.5	56	23.3	41.6	81.8	17.3	34	58.9	70.6
Isolone	BA	113.6	99.7	63.6	32.8	20.8	41	20.7	36.1	64.5	18.2	32.5	80	63.1
Isolone	BA	114.2	101.2	62.2	31.2	18.7	42.9	20	37.6	69	17.5	32.2	72.7	64.1
Ledro	BA	111	99.2	64.7	33	19.6	46.6	21.4	42	72	19.3	33.1	70.8	64.8
Ledro	BA	114.5	99	65.8	30.3	18.2	45.3	18.2	39.6	68.8	15.9	27.7	66.9	60.1
Ledro	BA	114.8	103.4	65.3	32	19.2	45.6	18.3	39.7	69.8	15.9	28	70.2	57.2
Ledro	BA	115.5	101.3	52.1	30.7	18.2	44.2	20	38.3	84.8	17.3	38.4	69.5	65.1
Ledro	BA	125.7	111.3	69.2	33.6	20.5	49.6	21.7	39.5	71.7	17.3	31.4	67.7	64.6
Ledro	BA	127	113.5	70	33	20.8	50.8	21.8	40	72.6	17.2	31.1	65	66.1
Ledro	BA	130.7	117	70.8	32.5	20.6	52.3	23.7	40	73.9	18.1	33.5	62.1	72.9
Ledro	BA	133.3		69.5	32.9	18.2	53.2	23.2	39.9	76.5	17.4	33.4	61.8	70.5
Ledro	BA	134.7	118.2	71	31.8	19.2	51.6	23	38.3	72.7	17.1	32.4	61.6	72.3
Ledro	BA	137.4	123	73.6	34.7	20	54.7	21.9	39.8	74.3	15.9	29.8	63.4	63.1
Ledro	BA	140.7	128.3	75.4	35.3	22.5	58.6	24.1	41.6	77.7	17.1	32	60.2	68.3
M. Castell.	BA	109	95.1	60.2	31.5		41.5	17	38.1	68.9	15.6	28.2	75.9	54
M. Castell.	BA	109.7	95	60.5	31		41.3	19.5	37.6	68.3	17.8	32.2	75.1	62.9
M. Castell.	BA	123.8	106.7	67.5	33.5	20	46.2	18.9	37.3	68.4	15.3	28	72.5	56.4
Montevenera	BA	114	98.4	64	29.9	18.3	45.5	20.1	39.9	71.1	17.6	31.4	65.7	67.2
Redù	BA	134.4	117	69.2	34	21.6	50.3	22	37.4	72.7	16.4	31.8	67.6	64.7
Terramare	BA	119		64.5	33.5	19	48	20	40.3	74.4	16.8	31	69.8	59.7
Terramare	BA	127.5	112.5	70	34.3	22	50	21	39.2	71.4	16.5	30	68.6	61.2
Ficana	IA	129		72.5	34		53	22	41.1	73.1	17.1	30.3	64.2	64.7
Padova	ER	107.5		55	25.73		39.8	15.3	37	72.4	14.2	27.8	64.6	59.5
Padova	ER	130.4		70.1	30.3		50.9	20.4	39	72.6	15.6	29.1	59.5	67.3
Padova	ER	144.6		75.7	30.6		50.9	20.3	35.2	67.2	14	26.8	60.1	66.3
Padova	ER	150.6		73.8	34.1		55.7	23.2	37	75.5	15.4	31.5	61.4	68
Classe	LR	94.8	81.6	57.9	25.1	15.1	36.3	14.2	38.3	62.7	15	24.5	69.1	56.6
Classe	LR	105	87.4	63.8	30.9		37.5	15.1	35.7	58.8	14.4	23.7	82.4	48.9
Classe	LR	115	99.2	62.3	29.3	19.2	47.7	21.2	41.5	76.6	18.4	34	61.4	72.4
Classe	LR	123.4	108	63.6	29	17.7	49.6	19.6	40.2	78	15.9	30.8	58.5	67.6
Classe	LR	124	108.5	65.7	30.6	18	50	19.8	40.3	76.1	16	30.1	61.2	64.7
Classe	LR	127	109.8	66.3	30.1	19	49.6	19.3	39.1	74.8	15.2	29.1	60.7	64.1
Classe	LR	135	114.4	70.2	31.1	19.2	50.2	20.4	37.2	71.5	15.1	29.1	62	65.6

Table 3: Measurements of the long bones of dog (BA = Bronze Age, IA = Iron Age, ER = early Roman, LR = late Roman).

Site	date	bone	GL	Bd	Site	date	bone	GL	Bd
Gr. Continen.	N	humerus	128	25.8	**Meta sudans**	LR	radius	166.3	24.8
Barche	BA	humerus	138.5	26.8	**S. Giacomo**	LR	radius	177	26.1
Barche	BA	humerus	138.5	29	**Barche**	BA	femur	137	24.9
Barche	BA	humerus	139	27.5	**Barche**	BA	femur	137	27.9
Barche	BA	humerus	158	30	**Barche**	BA	femur	142	25.2
Barche	BA	humerus	161	30.8	**Barche**	BA	femur	148	24.4
Cotariova	BA	humerus	144.3	29.6	**Barche**	BA	femur	158	27.3
Ledro	BA	humerus	128	27.5	**Frattesina**	BA	femur	167.5	26.5
Ledro	BA	humerus	150	26.5	**Ledro**	BA	femur	144.7	25.7
Ledro	BA	humerus	156.5	30.8	**Ficana 3b-c**	IA	femur	159	27
Ledro	BA	humerus	159.4	31.5	**Nivize**	IA	femur	181	31.5
M. Castell.	BA	humerus	140	27.1	**Padova**	ER	femur	192.3	30.7
M. Castell.	BA	humerus	152	30.5	**Padova**	ER	femur	196.3	36.6
Morandine	BA	humerus	184	33.5	**Padova**	ER	femur	196.7	29.5
Scalucce	BA	humerus	175	35	**Classe**	LR	femur	96.1	22.7
Terramare	BA	humerus	143	28	**Classe**	LR	femur	99.2	22.7
Ficana 3b-c	IA	humerus	144	29.5	**Classe**	LR	femur	101.8	22.7
Nivize	IA	humerus	165	33	**Classe**	LR	femur	102	22.5
Nivize	IA	humerus	173	34.5	**Classe**	LR	femur	110.6	23.3
Sulmona	IA	humerus	146	28.5	**Classe**	LR	femur	138.8	28.1
Padova	ER	humerus	191.17	30.8	**Classe**	LR	femur	156.1	27.4
Padova	ER	humerus	161.4	31	**Classe**	LR	femur	157	27.5
Piercastello	ER	humerus	188	37	**Classe**	LR	femur	189.4	27.6
Sestino	ER	humerus	162.3	30.5	**Classe**	LR	femur	189.8	31.5
Classe	LR	humerus	89.2	22.1	**Classe**	LR	femur	190.4	31.5
Classe	LR	humerus	92.7	22.9	**Meta sudans**	LR	femur	166.5	30.5
Classe	LR	humerus	93.8	22.4	**Meta sudans**	LR	femur	188.2	32.5
Classe	LR	humerus	105.4	24	**Meta sudans**	LR	femur	191.3	33
Classe	LR	humerus	115.4	21.5	**Meta sudans**	LR	femur	203	34.5
Classe	LR	humerus	141.1	27.5	**S. Giacomo**	LR	femur	195.5	32.9
Classe	LR	humerus	142.2	27.6	**S. Giacomo**	LR	femur	199.5	34.5
Meta sudans	LR	humerus	123.3	27.9	**Barche**	BA	tibia	149.5	18.5
Meta sudans	LR	humerus	173.2	34.5	**Barche**	BA	tibia	151	19.5
Meta sudans	LR	humerus	174	34.1	**Barche**	BA	tibia	161	20.3
Meta sudans	LR	humerus	176	31	**Barche**	BA	tibia	161.5	20.5
Meta sudans	LR	humerus	191	37.5	**Frattesina**	BA	tibia	162.5	20.2
S. Giacomo	LR	humerus	171	33.7	**La Starza**	BA	tibia	147	18.6
Scamuso	N	radius	164.1	23.8	**La Starza**	BA	tibia	150.5	20.1
Barche	BA	radius	128	18.8	**Ledro**	BA	tibia	141.7	17
Barche	BA	radius	134	19.5	**Ledro**	BA	tibia	142.8	16
Barche	BA	radius	138	19.4	**Ledro**	BA	tibia	147.9	17.5
Barche	BA	radius	144	21.2	**Morandine**	BA	tibia	201	21.5
Barche	BA	radius	161	22.8	**Terramare**	BA	tibia	143	18.5
Cavalzara	BA	radius	146.5	18.3	**Nivize**	IA	tibia	185	22
Le Paludi	BA	radius	178	23.5	**Nivize**	IA	tibia	186	22
Ledro	BA	radius	139.2	20.1	**Nivize**	IA	tibia	189	23
Ledro	BA	radius	145.7	22.7	**Nivize**	IA	tibia	191	24
Ledro	BA	radius	183	27.9	**Padova**	IA	tibia	176	22.6
Peschiera	BA	radius	117.2	13.4	**Sulmona**	IA	tibia	165.5	20
Sonnenburg	BA	radius	137.4	21.8	**Morandine**	ER	tibia	199	24.5
Ficana 3b-c	IA	radius	140	20.5	**Padova**	ER	tibia	157.2	18.4

Table 3: Continued.

Nivize	IA	radius	161	24	**Padova**	ER	tibia	163.4	18.2
Nivize	IA	radius	169.5	25	**Classe**	LR	tibia	86.5	14.8
Nivize	IA	radius	172	24.5	**Classe**	LR	tibia	86.7	14.8
Osimo	IA	radius	171.1	26.2	**Classe**	LR	tibia	90.7	16
Ossa	IA	radius	180.5	24.8	**Classe**	LR	tibia	92.6	15
Santorso	IA	radius	171	24	**Classe**	LR	tibia	122.2	15.2
Sulmona	IA	radius	151.5	19.3	**Classe**	LR	tibia	155.5	19.2
Classe	LR	radius	84.3	16.2	**Classe**	LR	tibia	155.8	19.1
Classe	LR	radius	108	15.3	**Classe**	LR	tibia	192.5	22.8
Classe	LR	radius	115.6	20.8	**Meta sudans**	LR	tibia	197.5	22
Classe	LR	radius	132.5	20.3	**S. Giacomo**	LR	tibia	193	24.6
Classe	LR	radius	147.2	20.2	**S. Giacomo**	LR	tibia	201	24.8

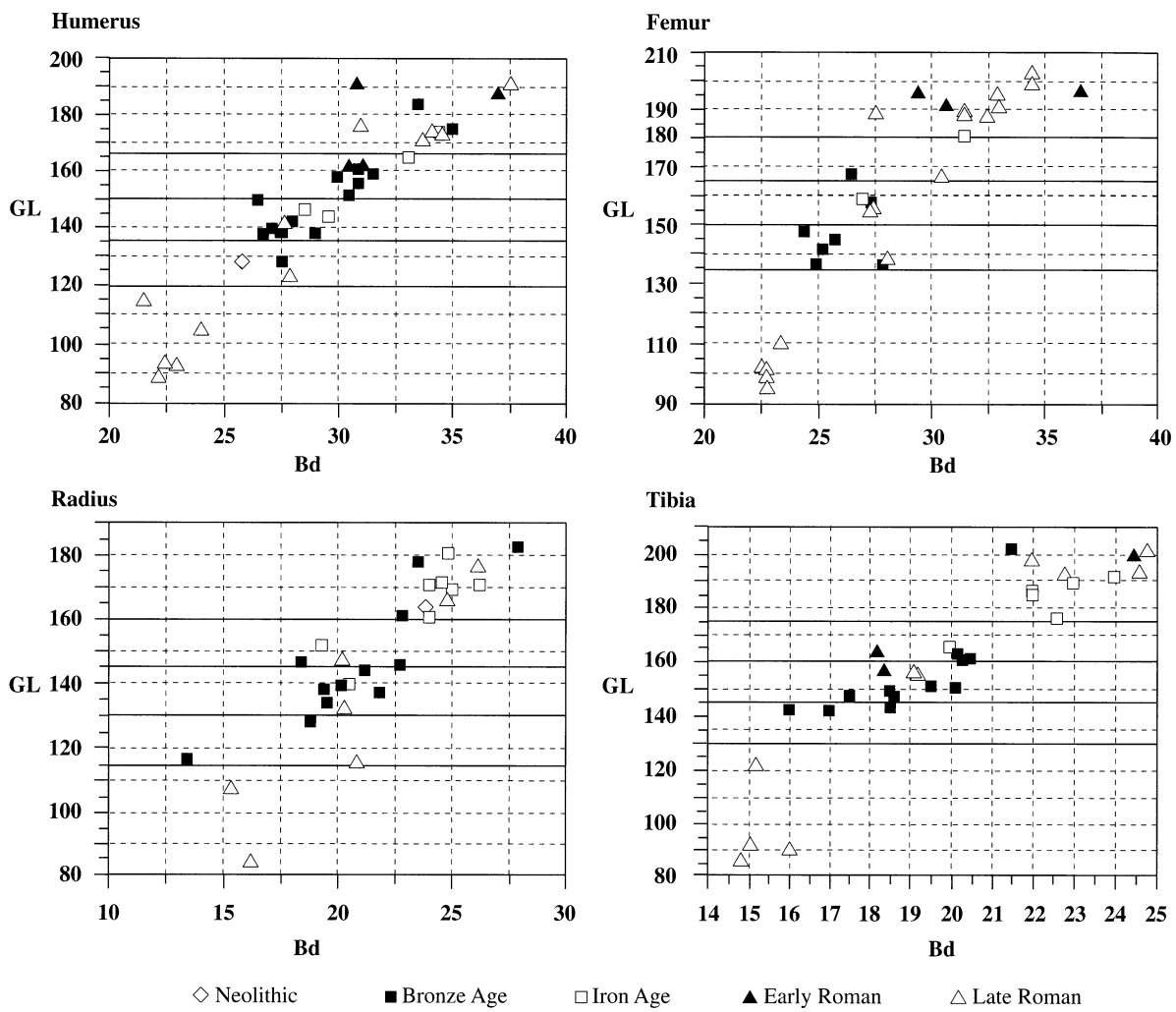

Fig. 4: Dog's long bones: scatter diagram (GL x Bd) (mm).

able in the sample from Meta Sudans and Classe, where even among only the small dogs, a differentiation in the mandibles was noticeable.

The skeletal material for limbs and trunks that was analyzed included 666 specimens (59 Neolithic, 1 Copper Age, 241 Bronze Age, 181 Iron Age, 49 early Roman and 133 late Roman period) but for this work only the long bones of the limbs (humerus, radius, femur and tibia) with data on total length were taken into consideration (tab. 3). The withers heigth indicates an average increase in stature from the Bronze Age to the early Roman period but a consistent variability up until the Bronze Age (tab. 4).

From the relationship between total bone length (GL) and the width of the distal end (Bd) for each period considered, figure 4 was developed. Again the samples are not equally balanced, and therefore a reliable statistical evaluation is not possible. Nevertheless, the diagrams demonstrate a number of correlations that lead, overall, to a series of considerations useful in framing the problem.

It is possible to note that in the Bronze Age, the majority of the dogs, within a wide range of variability, are of medium build. It is interesting, however, that on the basis of Hasebe's classification (Shigehara, 1994), the bones of the forelimb belong to a medium-large build while the hind limbs are medium-small. In the period studied, large dogs were present at Ledro, Celano, Morandine and Scalucce. Even in the Iron Age there was a lesser range of variability but in the diagrams a general increase in size, particulary evident in the sample from Nivize is apparent. With the Roman period, however, the range of variability increases substantially, especially in the final phase. What is even more interesting is evidence of the existence of a breed of very small dogs with brachymelic limbs, both in Rome, in the area of Meta Sudans (V-VIth centuries BC), and at Classe (IV-Vth centuries BC).

The use of the dog as human food

Since prehistoric times, dogs have been used especially in hunting and for the protection of flocks, however, sometimes the presence of evidence of butchering on skeletal remains leads one to speculation of the dogs use, even if in a sporadic fashion, as food.

On several dog metapodia found at the Neolithic level of Grotta Continenza (Wilkens, 1989-90), scratches produced by the skinning are visible, while on other bones signs of butchering are evident. The author, on the basis of this evidence, hypothesizes that thes dog may have been part of ritual feasts. Even in other Neolithic sites such as Rendina (Bökönyi, 1977-1982) and Grotta S. Angelo, bones have been found with evidence of slaughter. In the Bronze Age, signs of the removal of the flesh were noted on skeletal remains in the settlements of Frattesina (De Grossi Mazzorin, in study), Luni sul Mignone (Gejvall, 1967), Trasacco nel Fucino and Punta Le Terrare.

The presence of cut marks is also documented in the sites of historic period. In the Etruscan settlement of Montecatino near Lucca (VI-Vth centuries BC), a mandible and coxal showed evident traces of filleting (Ciampoltrini *et*

Table 4: Dog's withers heigth (BA = Bronze Age, IA = Iron Age, ER = early Roman, LR = late Roman).

Withers heigth following Koudelka (1885)					
dat.	**N**	**min.**	**max.**	**average**	**stand. dev.**
N	2	426	528	477	
BA	50	377	620	476	57.1
IA	23	398	583	522	43
ER	10	459	644	570	59.7
LR	59	245	644	442	120
Withers heigth following Harcourt (1974)					
dat.	**N**	**min.**	**max.**	**average**	**stand. dev.**
N	2	431	541	486	
BA	50	386	621	479	55.6
IA	23	420	593	529	42.1
ER	10	468	633	572	58.7
LR	59	262	632	448	120.5

al., 1991). Also, bones from dogs that had been slaughtered were present in two Etruscan sites in Emilia Romagna: an ulna at Casale di Rivalta (Farello, 1990) and a tibia and mandible at Fiorano Modenese (Farello, 1989). Finally, at the settlement of Santorso near Padova (V-IIth centuries BC), series of incisions from cutting instruments were discovered on the distal end of a tibia and the proximal end of a femur (Cassoli and Tagliacozzo, 1991). On the tibia there were slight traces on the antero-lateral face. On the femur they were deeper transversal cuts on the caudal face of the neck, and the edge of the articular head and lighter traces on the cranial face of the neck. The noticeable traces on the tibia could indicate the skinning of the animal, both for their location and for the development of the cuts which likely represent the cutting of the tendons and ligaments in an area where the skin is almost in contact with the bone.

For the femur, the cuts were situated in a area with greater muscular mass indicating the dismembering and disarticulation of the hind limbs from the body of the animal. This obviously demonstrates slaughtering but it is not clear if this was done for nutritional reasons. Perhaps, it was aimed at the recovery of bones for their use as raw material. This is confirmed by the discovery, among the finds at Santorso, of a dog tibia out of which a handle had been carved.

No bones with signs of butchering were found in Roman context, however the ancient authors wrote that the meat of puppies was used in sacred feasts (Festo XXXIX, 8) and in the ordinary cooking of the Republican period (Plin., *N.H.* XXIX, 14, cfr. Plauto in *Paul Diac., ecc., s.v. cutilinam carnem*).

The use of the dog in cultural and funeral rites

The practice of combining dog with human burial remains is documented in Italy from the early Neolithic to the Roman period. In the funerary and ritual cave Continenza in the Fucino basin Grifoni (1986), in the early Neolithic layers, dog remains have been found, sometimes deposited in artificial holes. In a grave in the Neolithic village of Ripoli in Abruzzo, dated to the 4th millennium bc, a dog was discovered at the feet of a woman's remains (Cremonesi, 1965). In the Neolithic hypogeum at Cala Colombo (Giove *et al.*, 1977), along with ceramics of the style called Serra d'Alto (beginning of IIIrd millennium bc) and human remains, numerous dog remains were found.

In the Copper Age excavation of a double burial in a tomb Ponte San Pietro called "The Tomb of the Widow", the skeleton of a dog was recovered just outside the stone slab sealing the tomb closed. Several authors have interpreted this find as the positioning of man's best friend outside the tomb to continue his work as faithful guardian even after death (RittatoreVonwiller *et al.*, 1978).

In another tomb of the same period in the necropolis of Gaudo, the skeleton of a dog was situated touching the feet of the human remains, and a similar case was noted in the tomb of S. Maria delle Grazie of Mirabello Eclano (cited in Pellegrini, 1992). Finally at Tursi, in Basilicata, the cranium of a dog was found above four river pebbles outside a single tomb (Cremonesi, 1976). Here also the positioning of the dog outside of the tomb can be interpreted as the wish to place the dog on watch for the deceased.

On Monte Cetona in Umbria, in several small funerary caves from the Bronze Age, the "secondary burial" of skulls of both humans and dogs seems to have been practised (cited in Guidi, 1992).

In a ritual pit dug in the early Iron Age necropolis of Osteria dell'Osa (VIII-VIIth centuries BC), a deposit of canine cranial remains was discovered (De Grossi Mazzorin 1992). In the funerary chamber of the tomb (VIIth century BC) in the necropolis of Poggio Sommavilla in Sabina, the bodies of five dogs were found buried with a woman, while a partially complete skeleton was found in the Etruscan tumulus of Molinello near Asciano (both De Grossi Mazzorin, in study).

The custom of burying dogs with human remains was also documented in the burial tombs at Fonte d'Amore near Sulmona, dating from the necropolis from IIIrd and IVth centuries BC. In fact, in tomb 56B, the tomb of a more than 50 years old man, numerous fragments of cranium and long bones from a very young dog were found. Tomb 57, the tomb of a woman between 20 and 30 years of age revealed the fragmentary skeletal remains of a neonatal dog. Finally, in tomb 17, apparently of a woman over 50 years old, the skeletons of two adult and one sub-adult dog were present (De Grossi Mazzorin, 1995).

Aside from funerary practices, dogs were also used in sacrificial rites. It is enough to recall that in the Roman period the rites of "*Robigalia*," against Rubigo, the disease known as grain rust, and the *Augurium Canarium* which both required the sacrifice of red dogs, while in *Lupercalia*, a dog was sacrificed along with a goat to the God Fauno, to recall the dogs roles as a guard animal. Also, according to some scholars, the sacrifice of the dog could have been practised in the rituals of Vesta. The dog was also venerated in the cult of the Lari as protectors of the city, as in the Copper Age these were represented dressed in dog skins and with dogs are their feet.

In Italy, few sanctuaries have been investigated archaeozoologically, however in the Archaic Temple in the sacred area of S. Omobono in Rome, among the animals sacrificed were two canine pups not older than two months (Tagliacozzo, 1989).

Conclusions

From the data reported above, it is possible to make some final remarks regarding the modifications in morphology and size of dogs in Italy in ancient times. For the Neolithic, the statements concerning the variability of mandibular material cannot be confirmed for lack of data on other bones, making it premature to formulate any type of hypothesis.

In the Bronze Age, in addition to the strong variance in size of the limbs, it is possible to note a certain selection of features both on the cranium and the mandible which in some areas could seem to point to the presence of true and distinct breeds.

In the Iron Age, due to the lack of data, this substantial morphological variability does not appear as evident as in the previous period. What is fairly well demonstrated is an increase in the average build.

Well defined breeds, with already acquired characteristics (dogs with strong differences in the size and general shape of the cranium) are distinguishable only in the late Roman period. Here in at least two sites, dogs are present with brachymelic limbs but with different cranial forms. The absence of brachymelic dogs in the first Roman period is most probably due to the scarce archaeozoological documentation for this period. In fact, brachymelic dogs appear in this period in several Roman provinces outside Italy.

Aside from the most probable but difficult to demonstrate uses of the animal for hunting or work, zooarcheological documentation demonstrates the sporadic use of the dog as human food from the Neolithic to the Iron Age. In the Roman period, in contrast with reported sources, there are no certain proofs of the animal's slaughter but frequent indications of the ritual and funerary use of dogs in all the periods considered.

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