«New challenges facing animal production for diversified territories, market demands and social expectations »
The 64th Annual meeting of the European Federation of Animal Science
Nantes, 26 -30 of August, 2013

Herding practices and livestock products in France for 6000 years: contribution of archeozoology

Marie-Pierre Horard-Herbin
- Laboratoire Archéologie et Territoires -
citeres
UMR 7324

1. **Archaeozoology**
2. **The origin of European animals**
3. **Evolution of Animal morphology**
4. **Animal husbandry and products across history**

From Excavation to the Laboratory

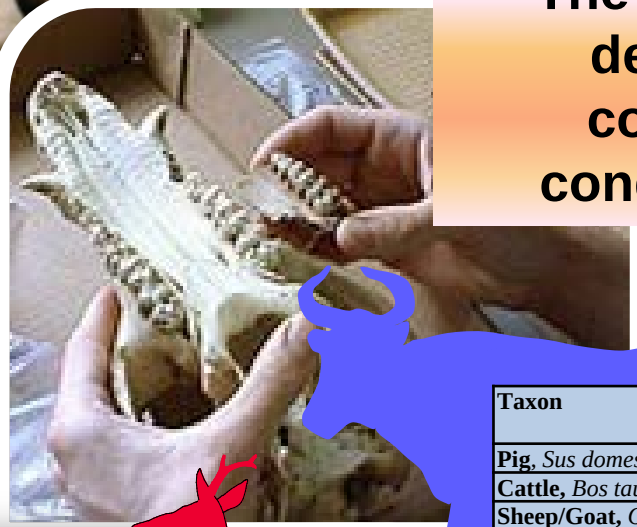
COURCELLES Haut de l'Aunette à Guignard INRAP

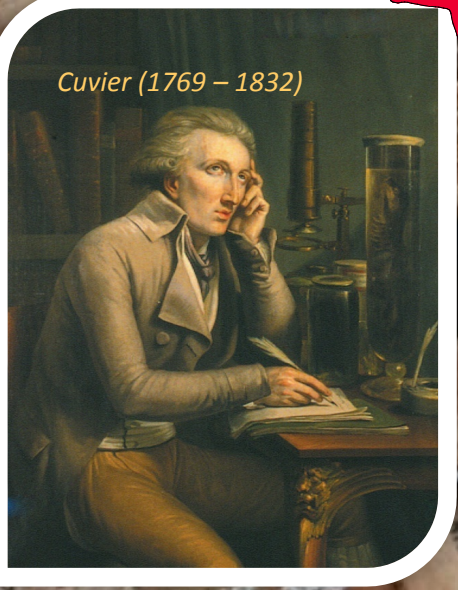
Souppes sur Loing 77 © Carlos Valéro/INRAP

15 laboratories in France

Ostéothèque de Tours CNRS-MSH

The anatomical and specific determination based on comparative anatomy is conducted in the laboratory





Taxon	Number of Identified Species NIPS	Percentage
Pig, *Sus domesticus*	155	37.44
Cattle, *Bos taurus*	100	24.15
Sheep/Goat, *Ovis aries et Capra hircus*	96	23.19
Horse, *Equus caballus*	4	0.97
Dog, *Canis familiaris*	1	0.24
Red Deer, *Cervus elaphus*	32	7.73
Roe deer, *Capreolus capreolus*	2	0.48
Boar, *Sus scrofa*	3	0.72
Hare, *Lepus europaeus*	2	0.48
Hen, *Gallus gallus domesticus*	7	1.69
Duck, *Anser anser domesticus*	2	0.48
Goose, *Anas sp.*	1	0.24
Crane, *Grus grus*	2	0.48
Swan, *Cygnus sp.*	1	0.24
Bird, *Aves sp.*	3	0.72
Pike, *Esox lucius*	1	0.24
Fish, *Pisces sp.*	2	0.48
Total	414	100

Synthesis	Number of bones	Percentage
Identified	414	42.99
Unidentified	549	57.01
Totals	963	100

1. Archaeozoology
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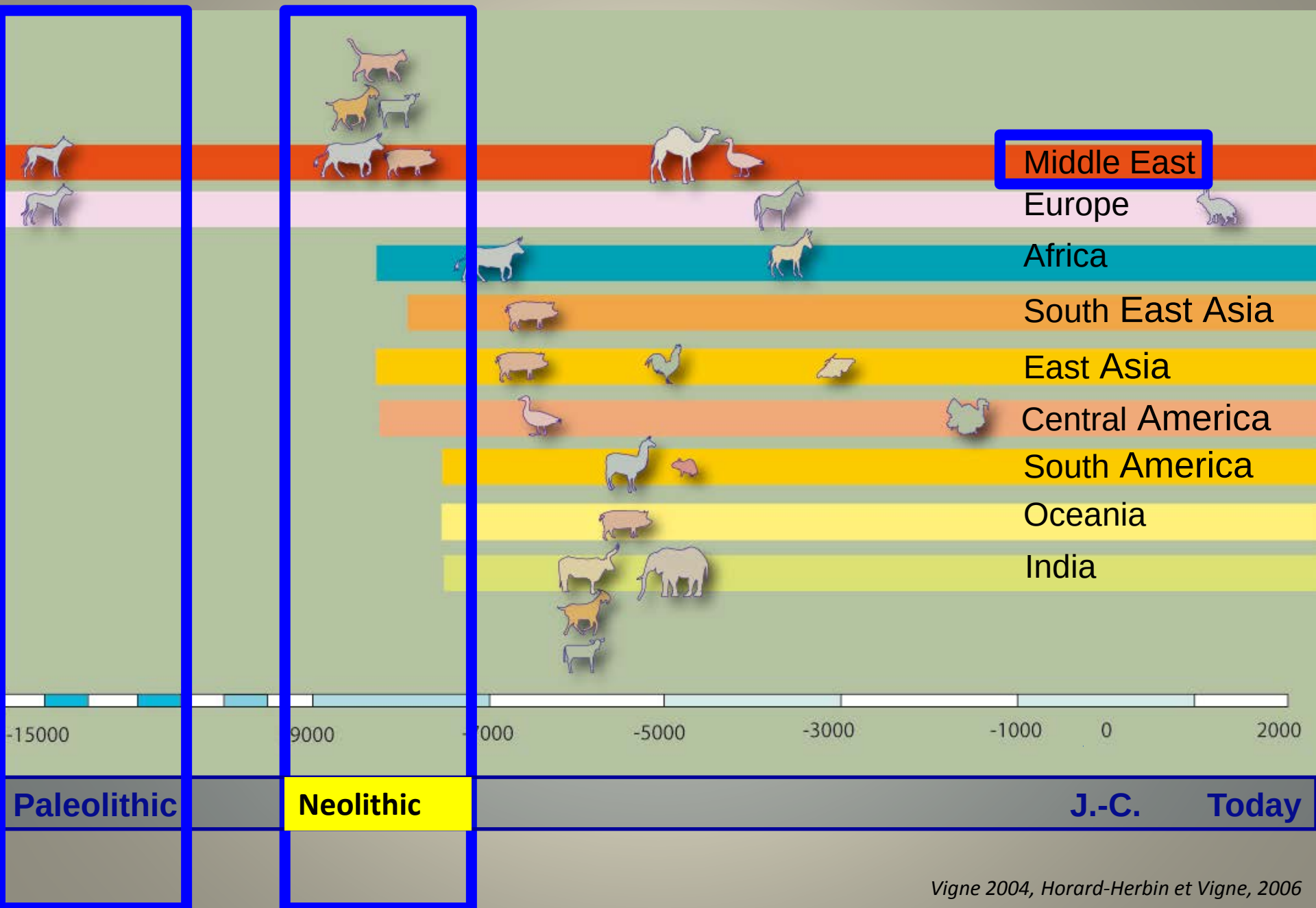
Locations and dates of domestication

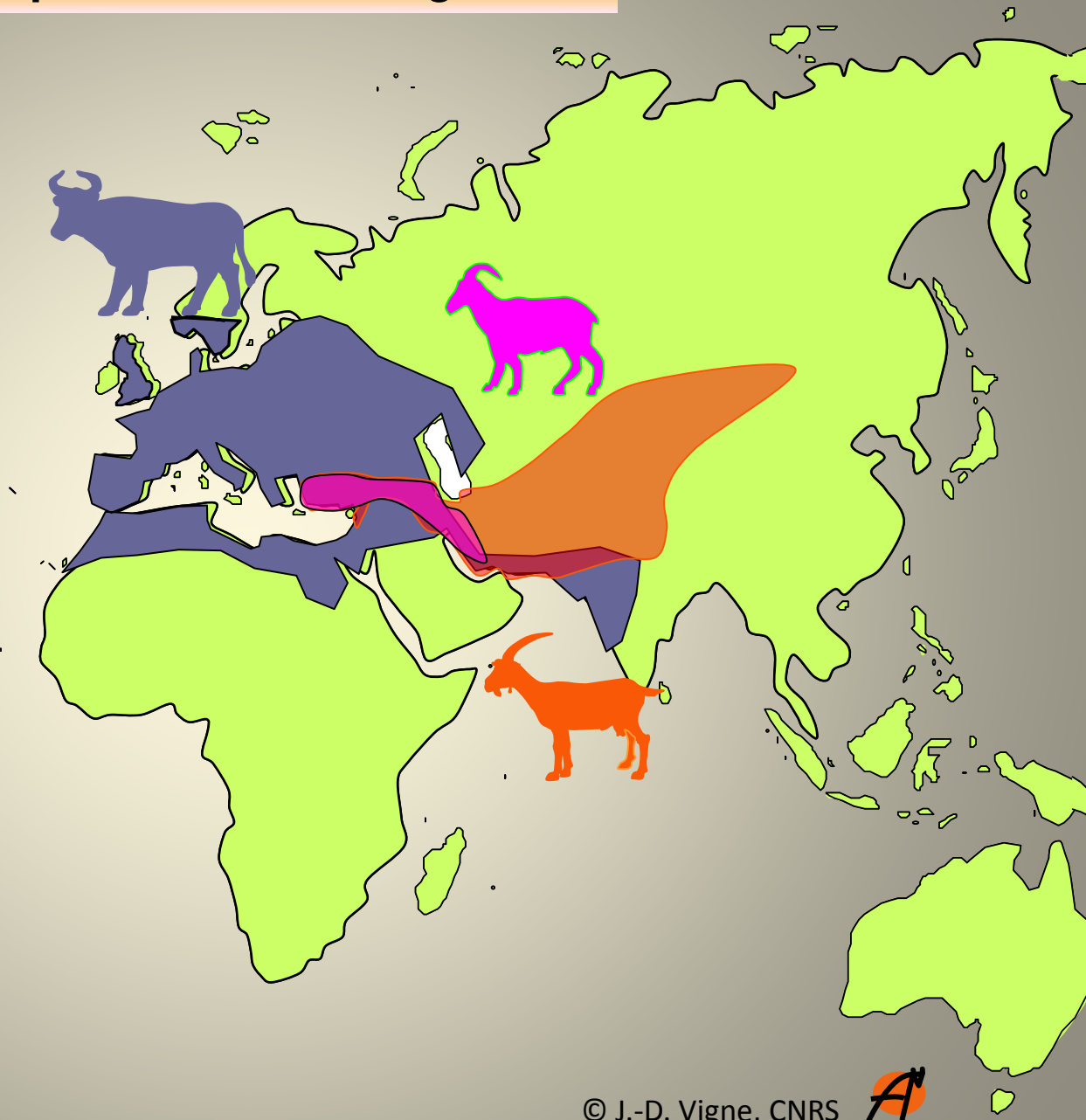


Vigne 2004, Horard-Herbin et Vigne, 2006

Transition from hunter-gatherers to farmers

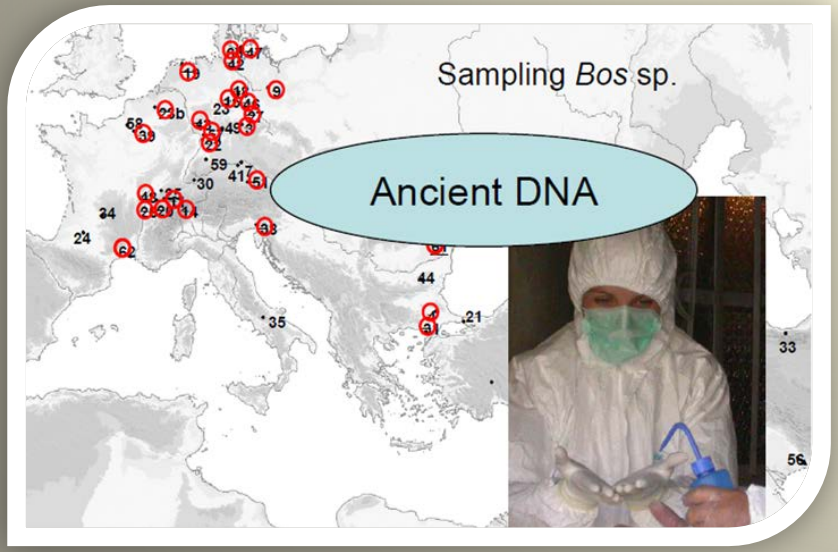
Tresset, A. and J.-D. Vigne (2007). "Substitution of species, techniques and symbols at the Mesolithic-Neolithic transition in Western Europe."

Wild ancestors of the European domestic ungulates

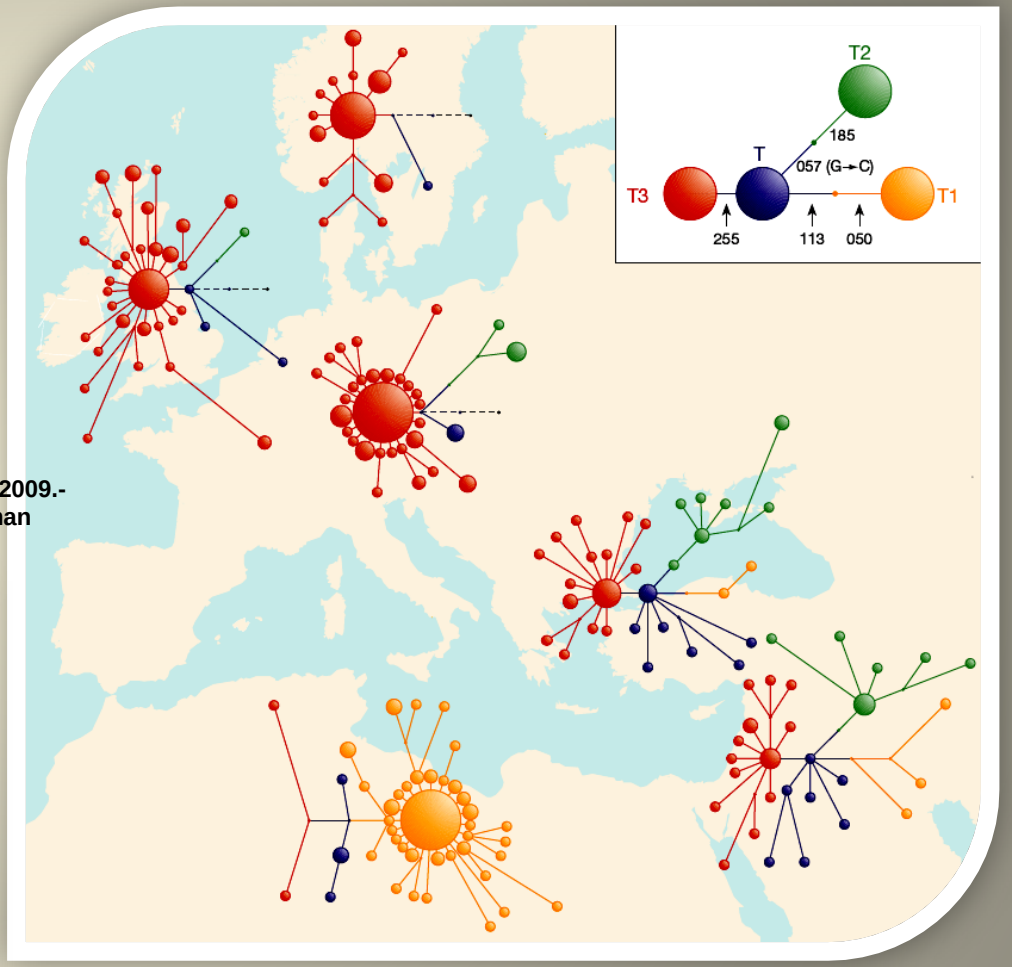


The European domestic cattle resulted from the introduction of Near Eastern lineages, like sheep and goats

Tresset A., Bollongino R., Edwards C. J., Hughes S. & Vigne J.-D., 2009.- Early diffusion of domestic bovids in Europe: An indicator for human contact, exchanges and migrations ?



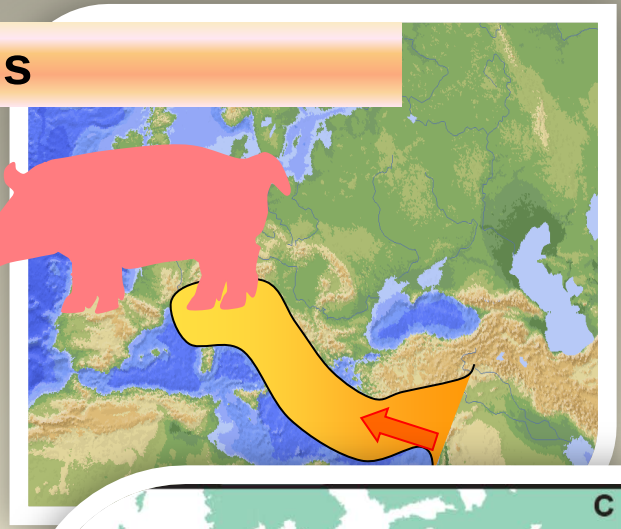
Edwards, Bollongino et al. 2007. Mitochondrial DNA analysis shows a near Eastern Neolithic origin for domestic cattle and no indication of domestication of European Aurochs. *Proc. Roy. Soc. B., 274 : 1377–1385.*

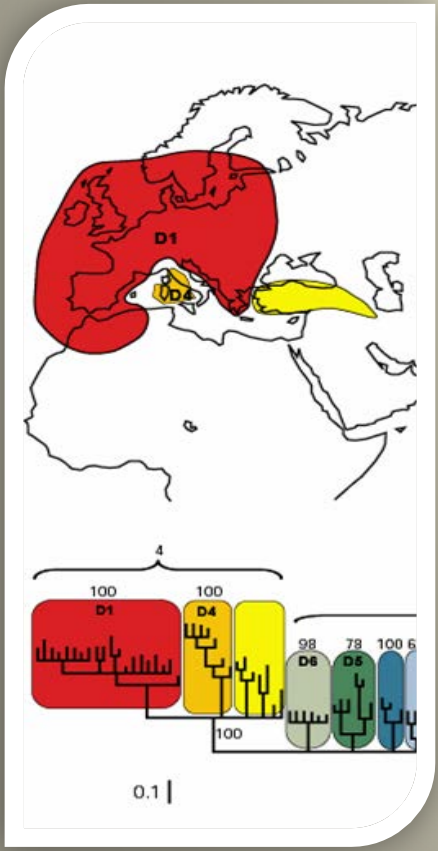


Bollongino R et al. 2012. Modern Taurine Cattle Descended from Small Number of Near-Eastern Founders. *Mol Biol Evol (2012) 29 (9): 2101-2104.*

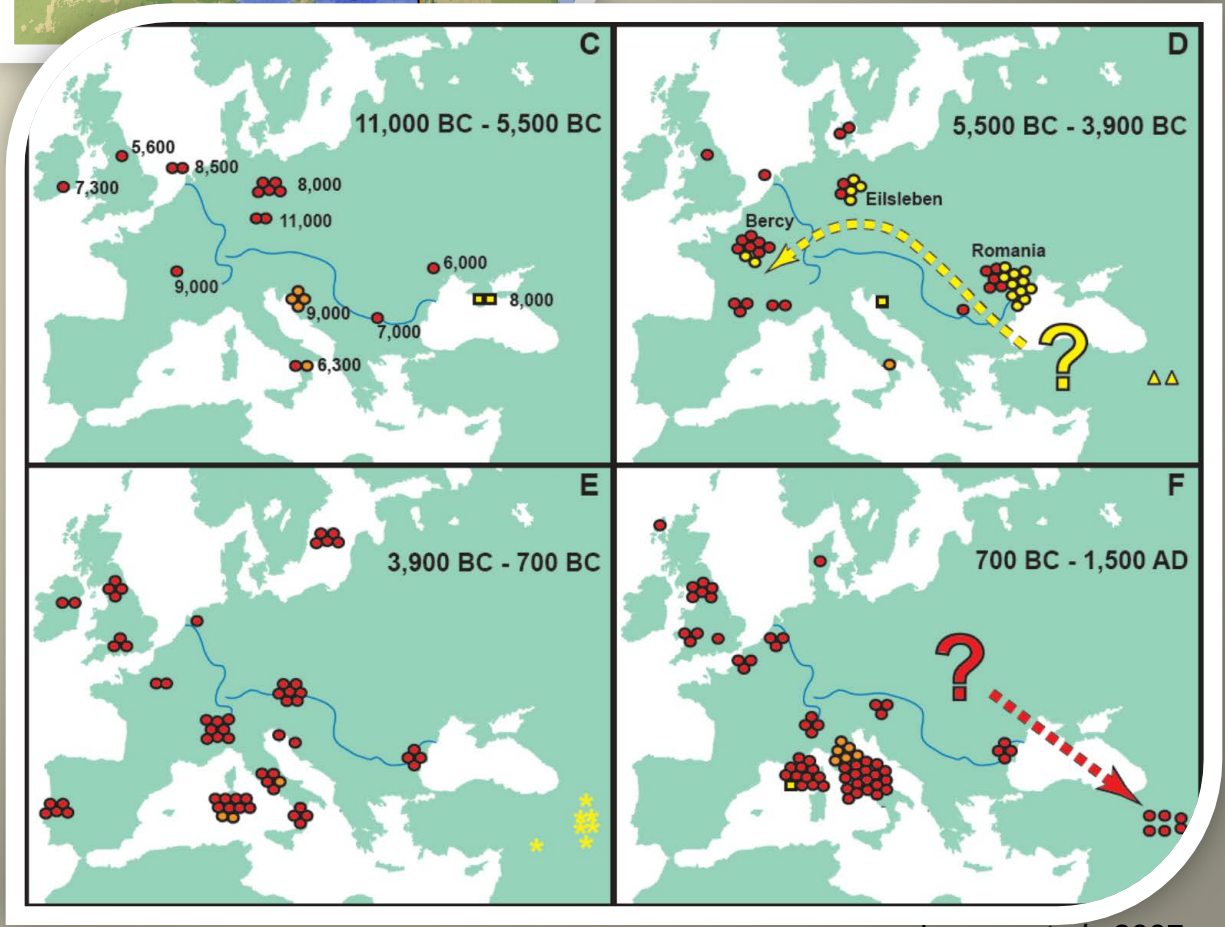
UMR 7209 du CNRS
Archéozoologie, archéobotanique
http://archeozoo-archeobota.mnhn.fr

Origin of neolithic pigs



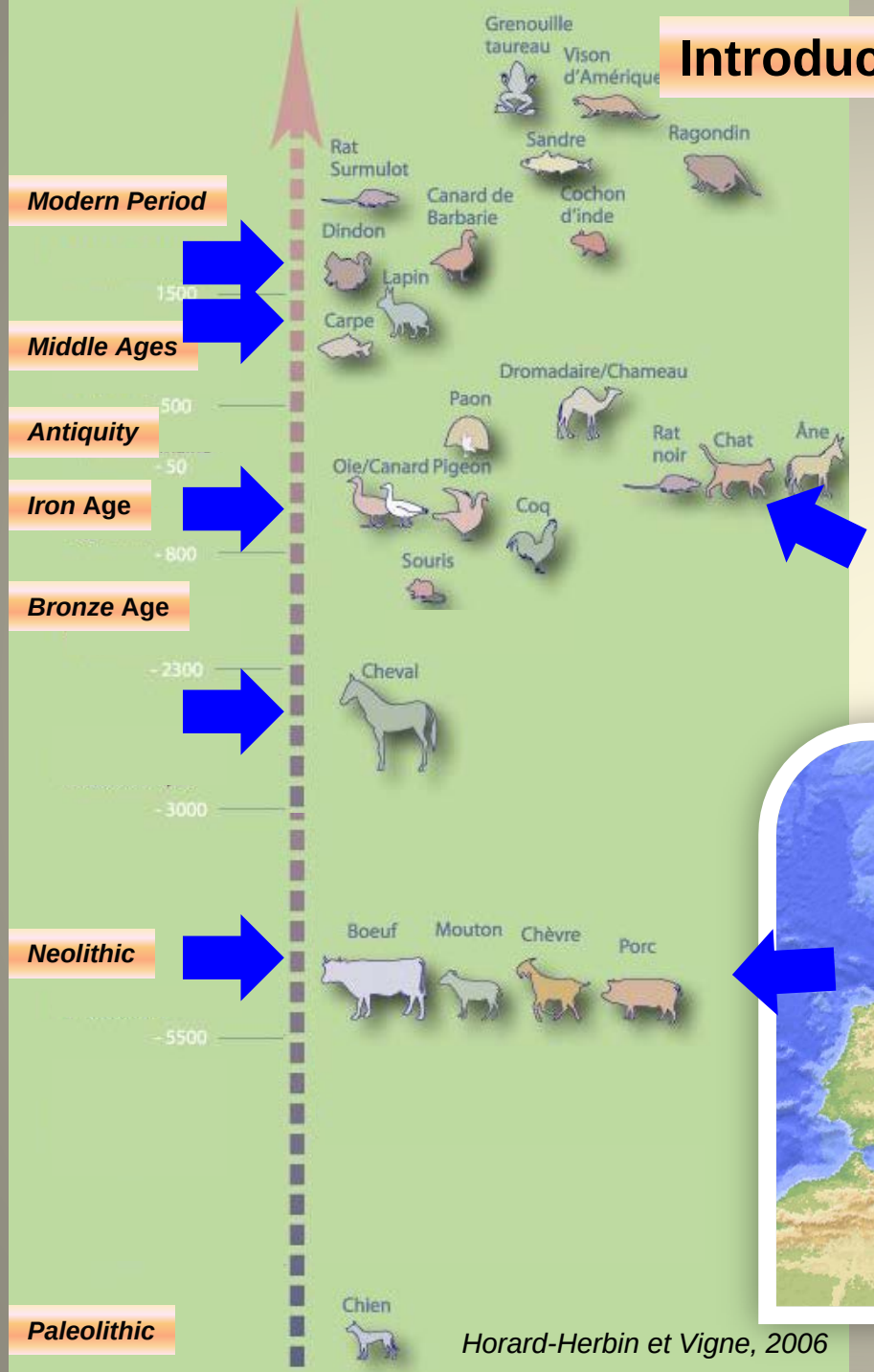


Larson *et al.*, 2005

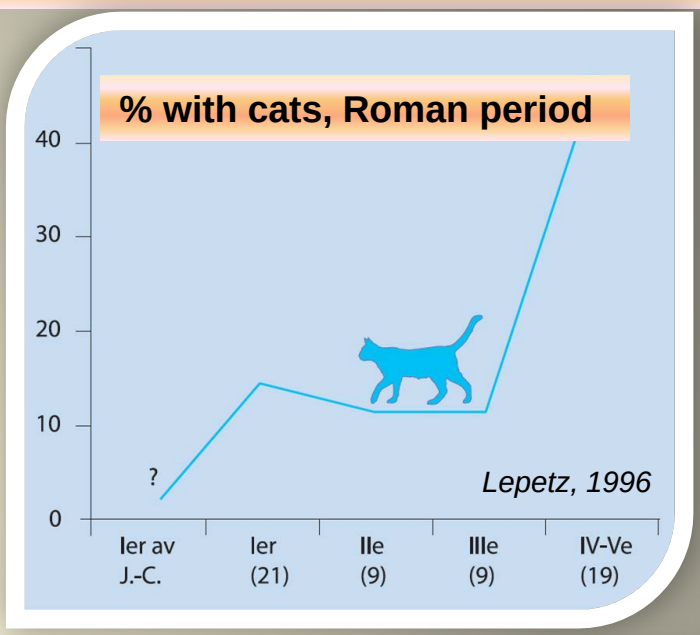


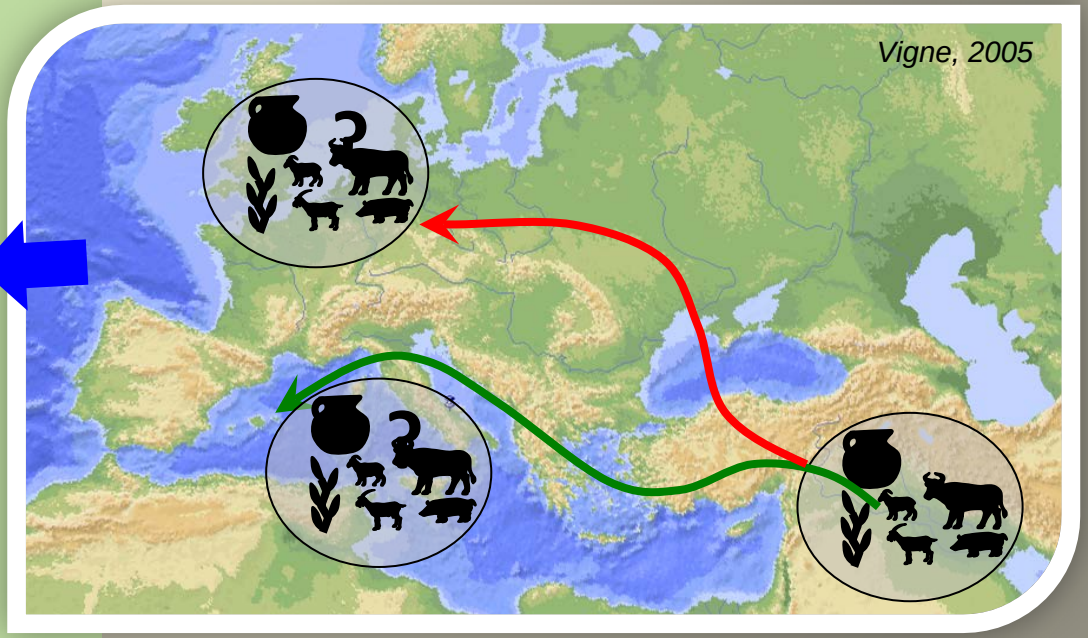
Larson *et al.*, 2007

Introduction of domestics animals in France



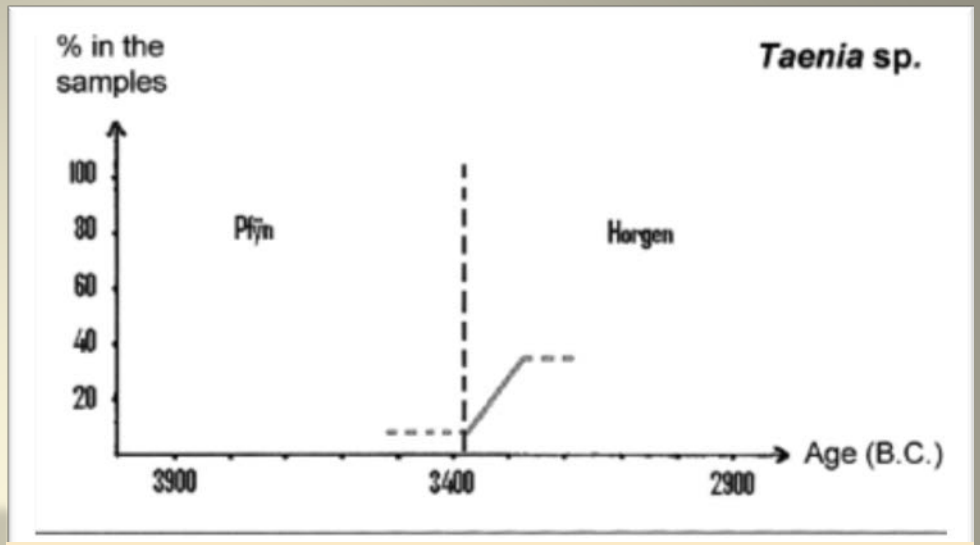
Horard-Herbin et Vigne, 2006





introduction of new harmful pests and diseases

Lebailly et al., 2005.- *J. Parasitol.,* 91(4) pp. 957–959



Variations of the occurrence of Taenia sp. (bottom) in the Neolithic samples studied.

A fragment of a right mandible of an ox presenting a bone lesion corresponds to a case of **cattle actinomycosis** discovered on the site of Rougiers (Var-France) from the XIIth to the XIIIth.

S. Servat *et al. Revue Méd. Vét.*, 2003, 154, 8-9, 525-530

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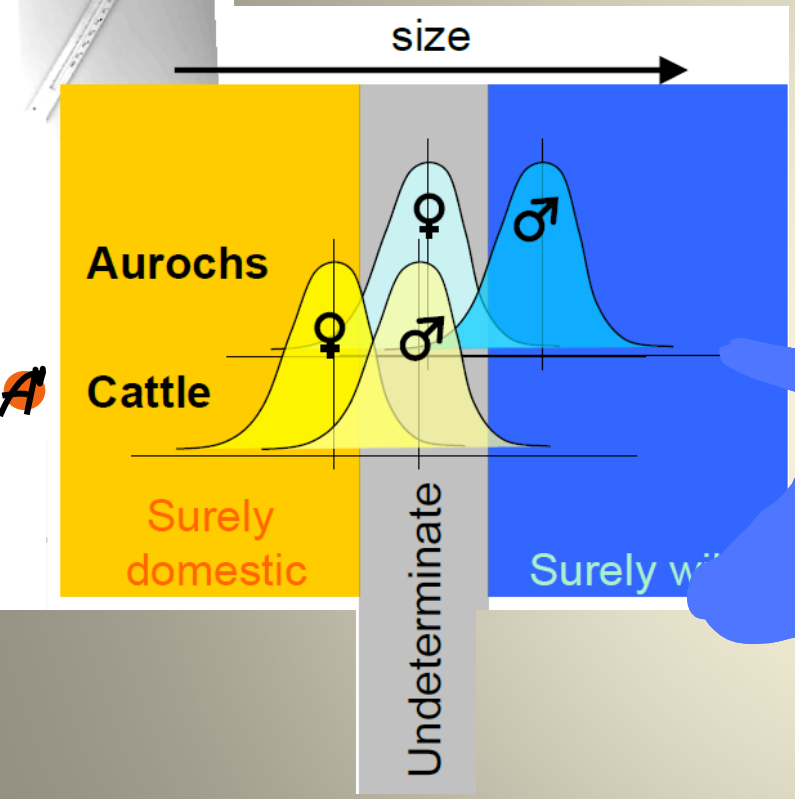
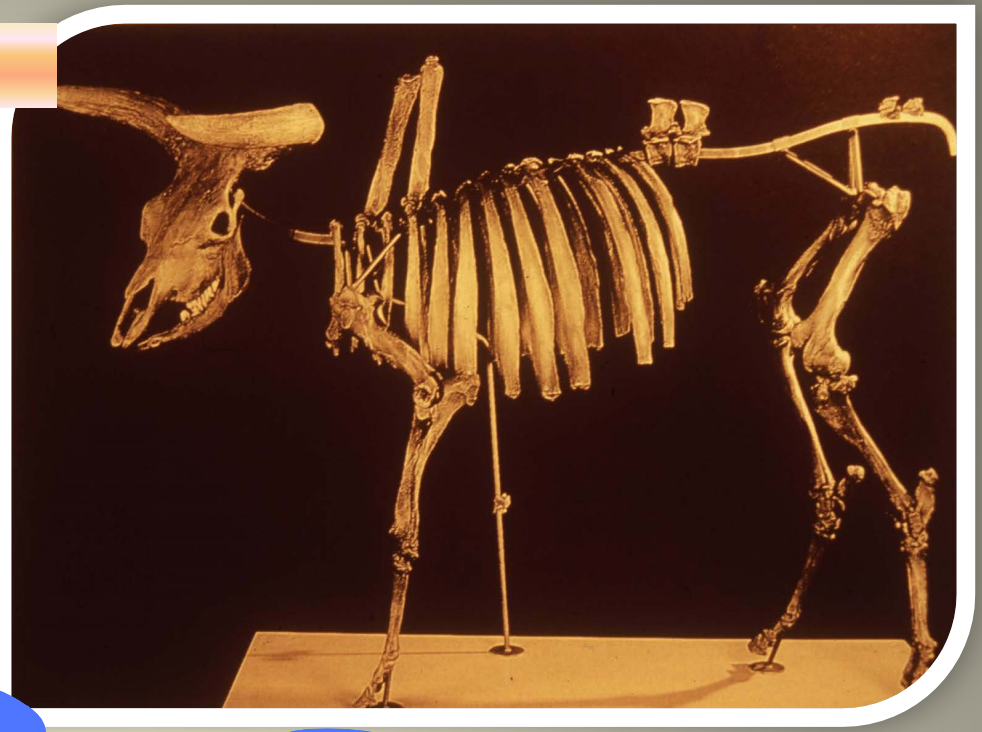
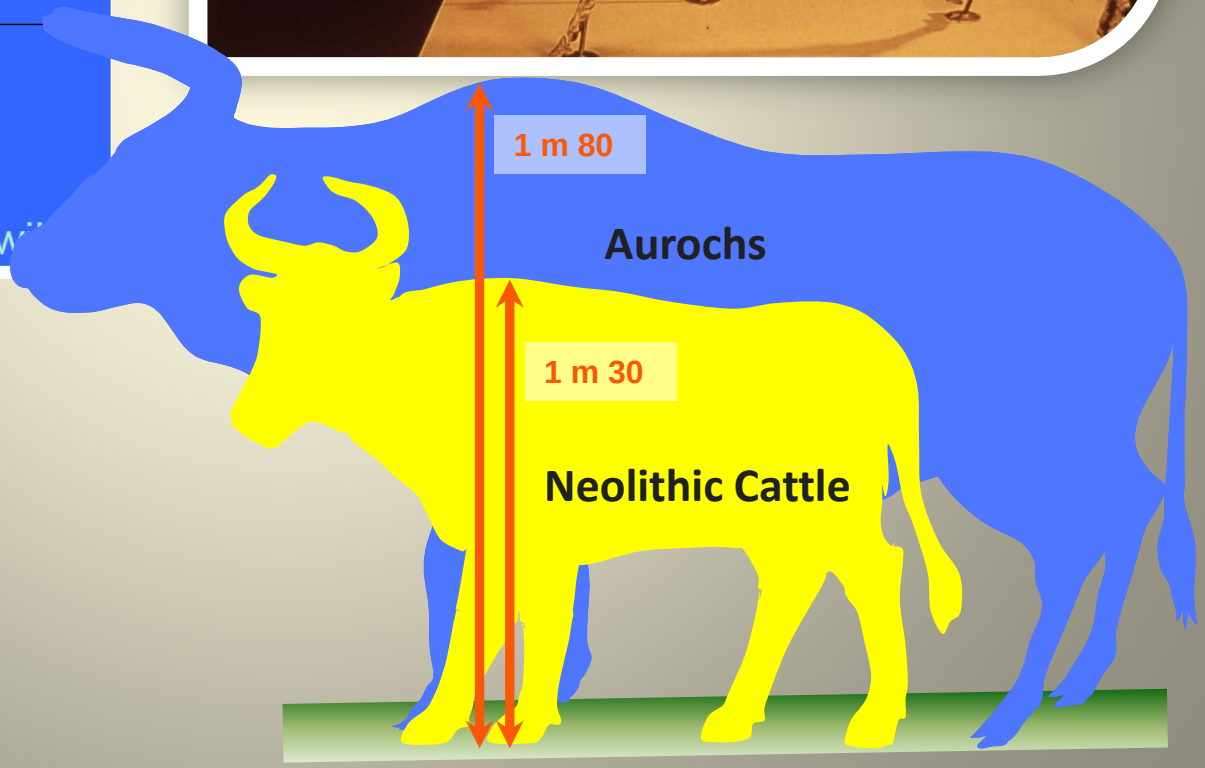
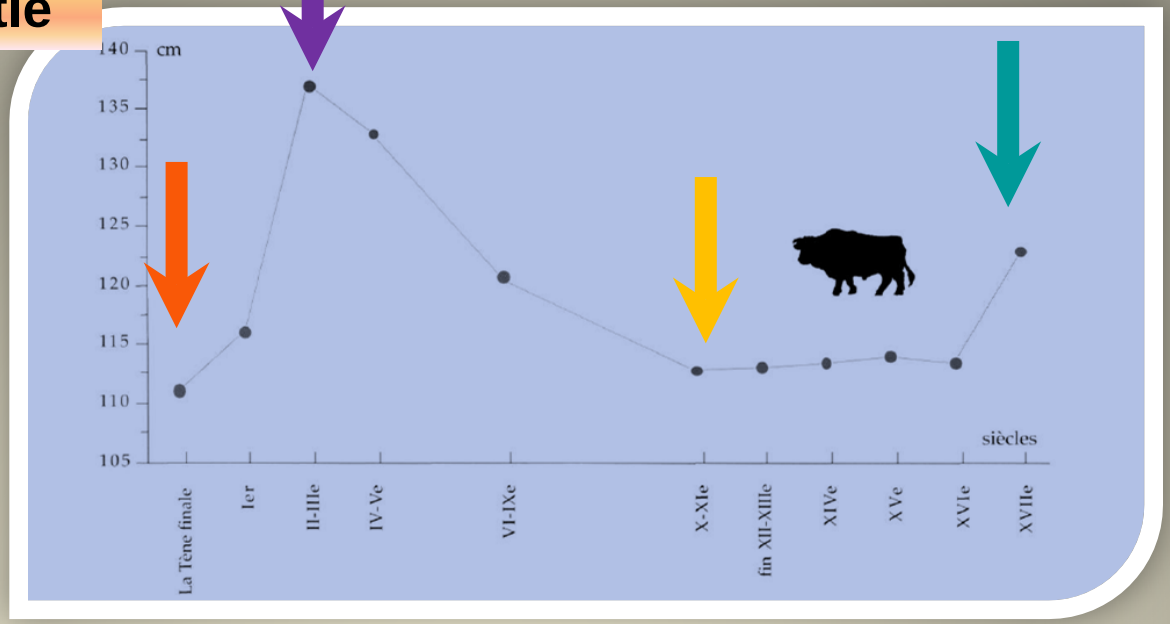
From aurochs to Neolithic Cattle



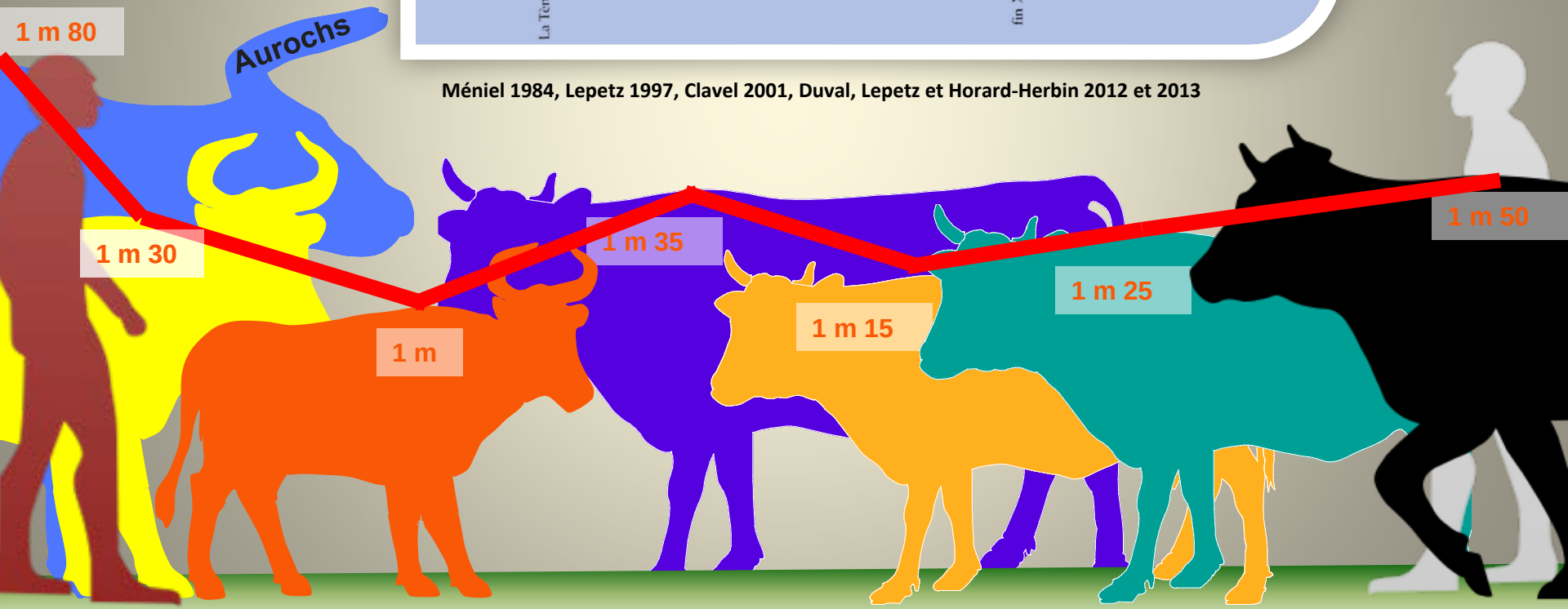




An history of Cattle



Méniel 1984, Lepetz 1997, Clavel 2001, Duval, Lepetz et Horard-Herbin 2012 et 2013

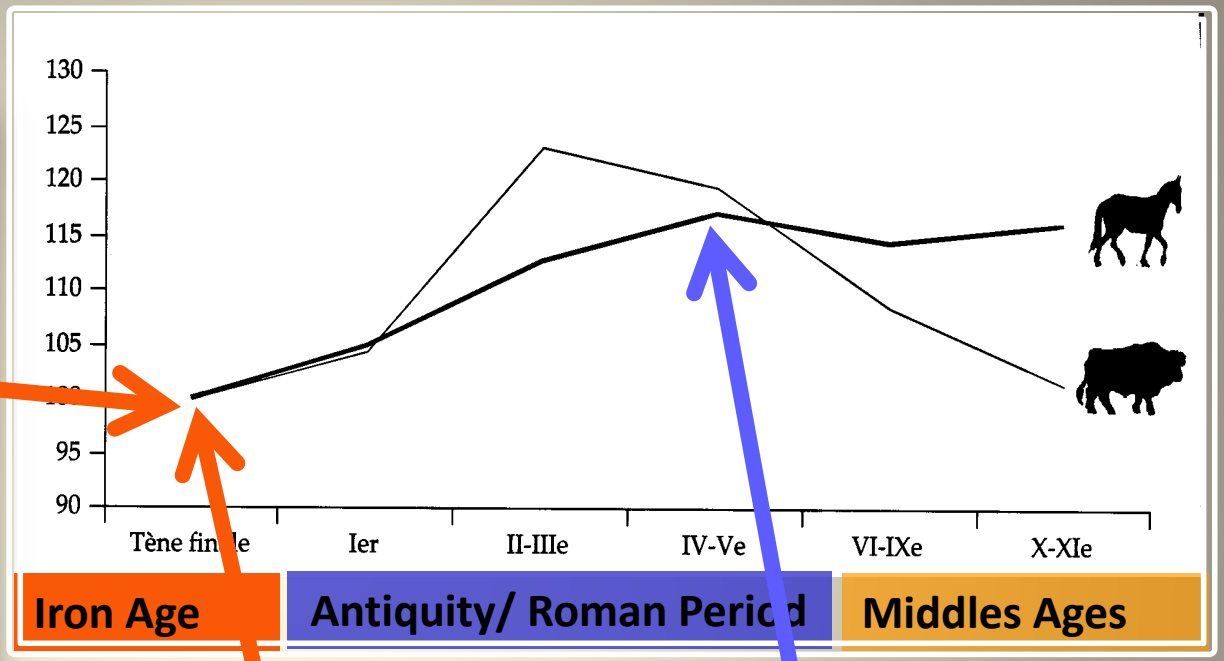


Neolithic | Iron Age | Antiquity | Middles Ages | Modern period | *Charolais breed*

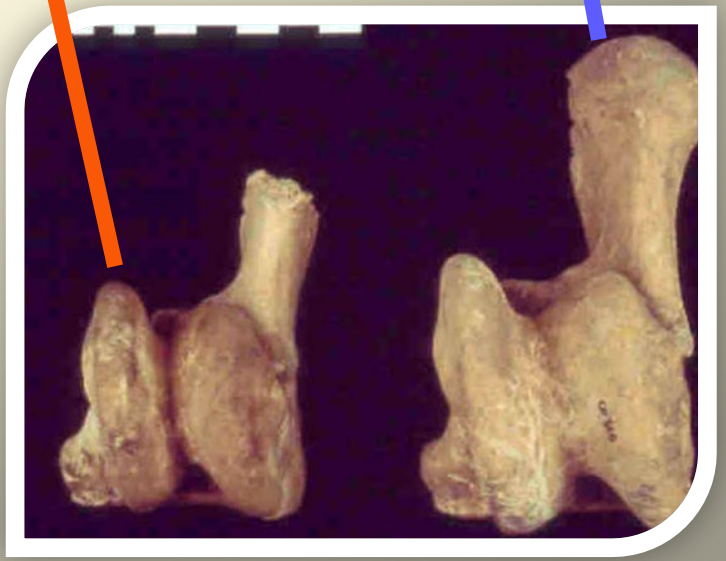
Dravings J.D. Vigne et M. Coutureau

Very small Celtic horses

The Celtic Gundestrup Cauldron

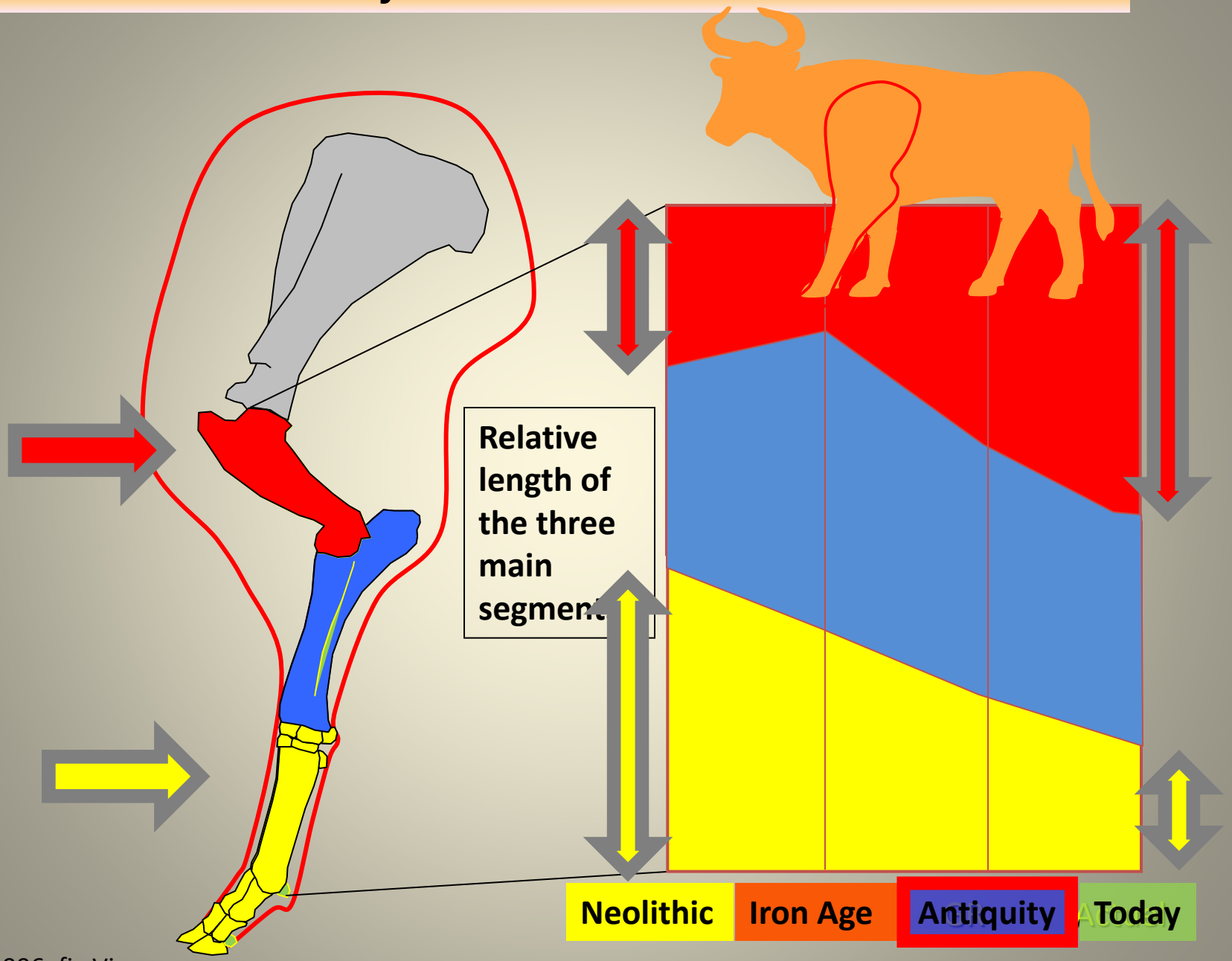


Lepetz, 2006



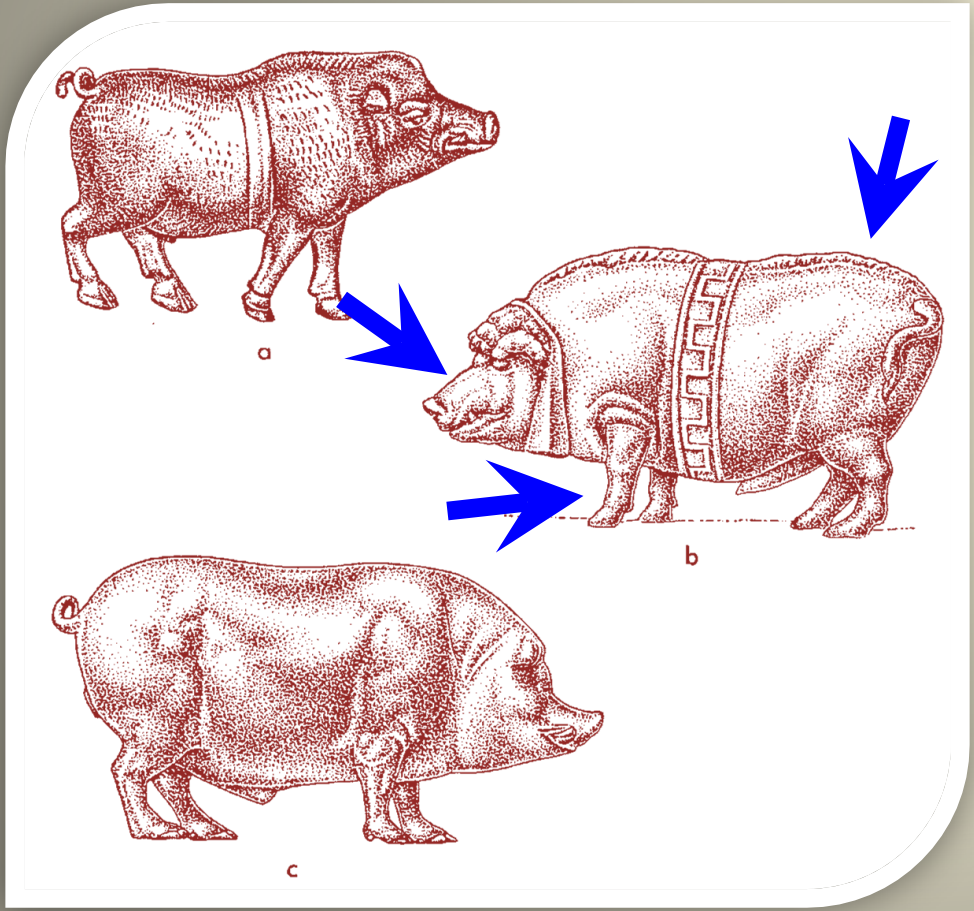
Bones from the Celtic Site of Levroux (Indre et Loire)

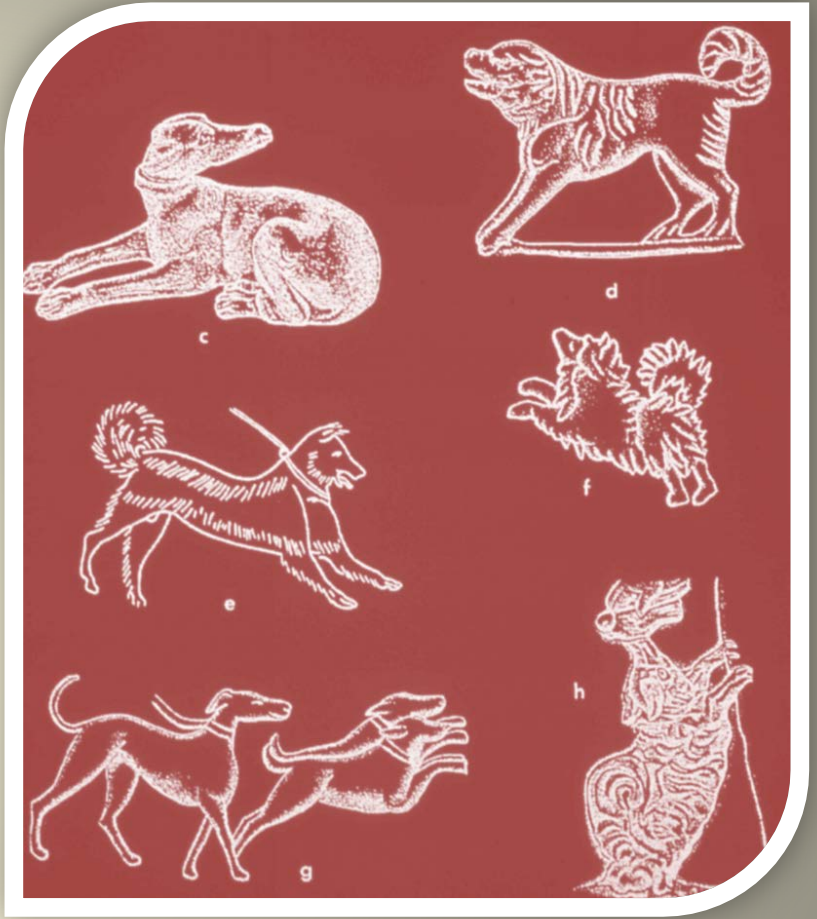
Gradual selection of fleshy races in the north of France



Lepetz, 1996, fig Vigne

Various selections by humans

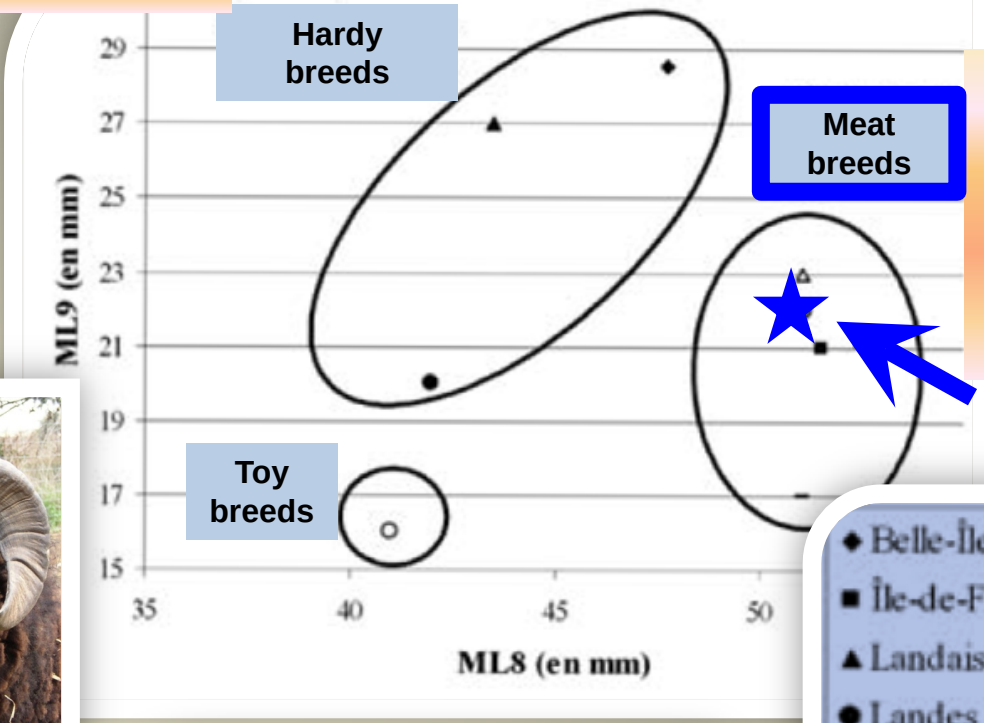




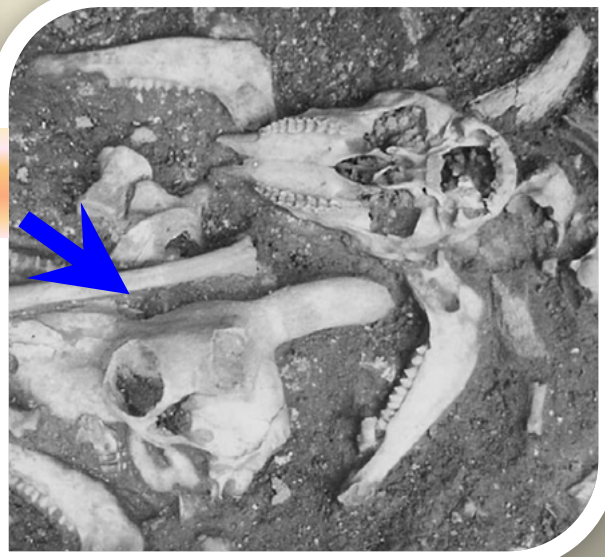
Romans pigs and dogs,
From Peters 1997

Various selections by humans

Iron age sheep
(Méniel 2005)



Study based on 89 skull and 83 mandible of the **domestic sheep**.
Guintard, Revue Méd. Vét., 2008



Various selections by humans

Gallo-Roman bronze
Grand (Vosges).

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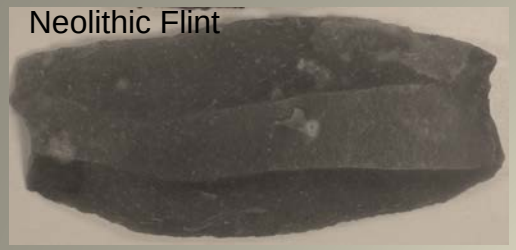
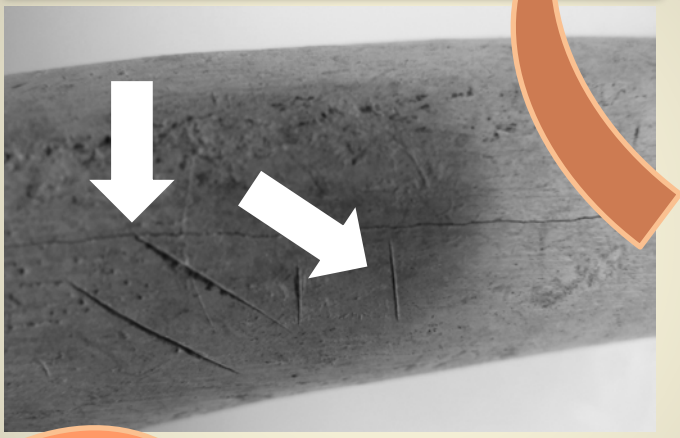
From cut marks to tools and butchers' art

Neolithic Flint



Celtic knife



Electric knife

Roman cleaver

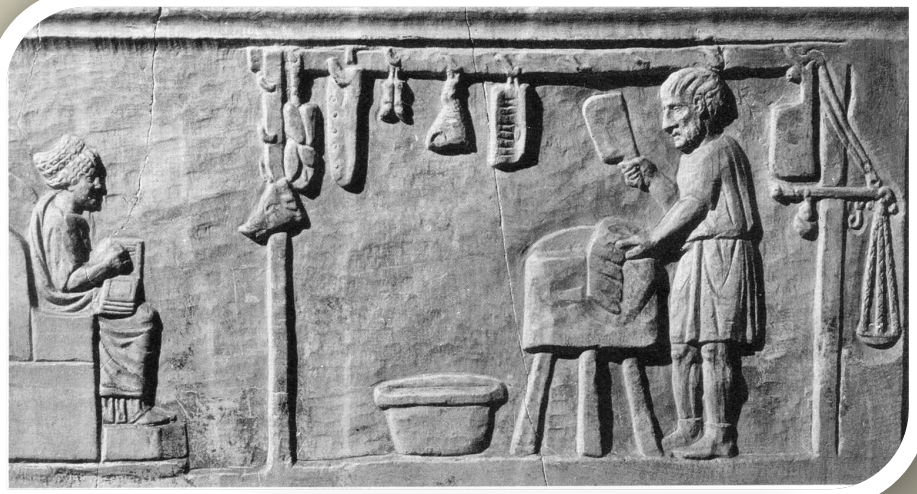
Horard-Herbin 2010

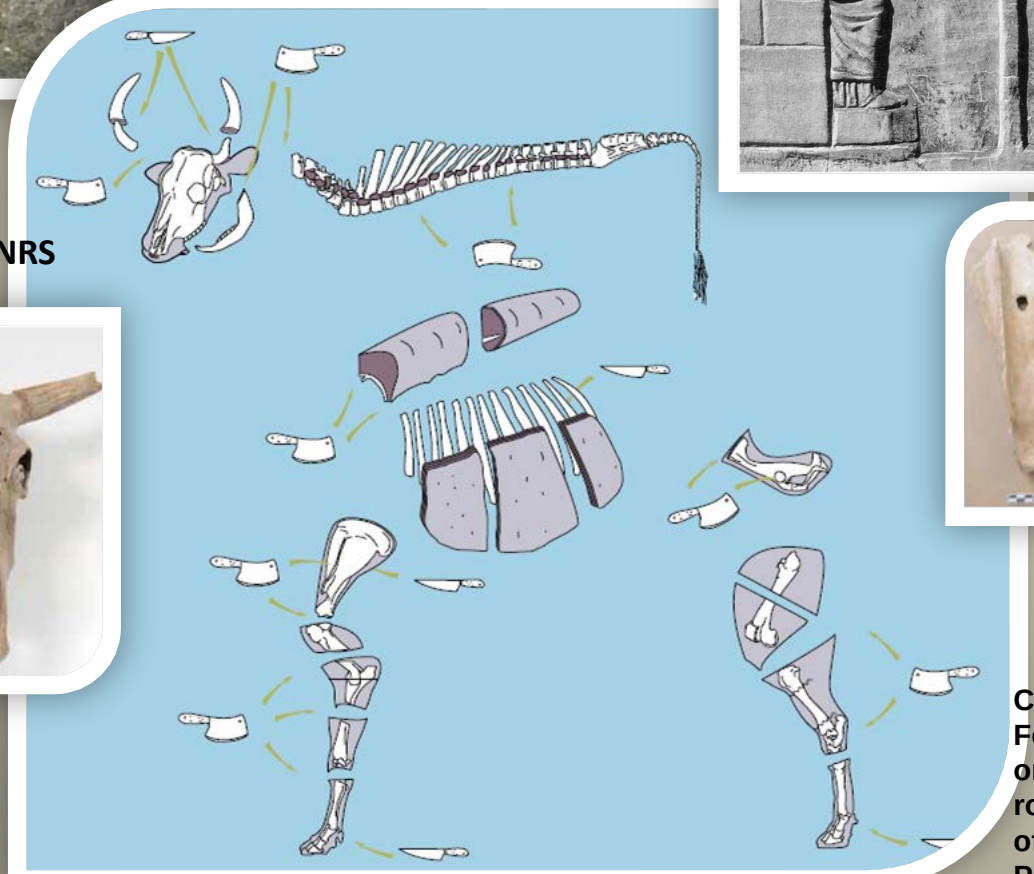
Tacuinum Sanitatis, XVe siècle
Paris, BnF, Département des manuscrits, Latin 9333, fol. 71v

Beef cuts during the Roman period

Site d'Arras

Funerary relief of Rome



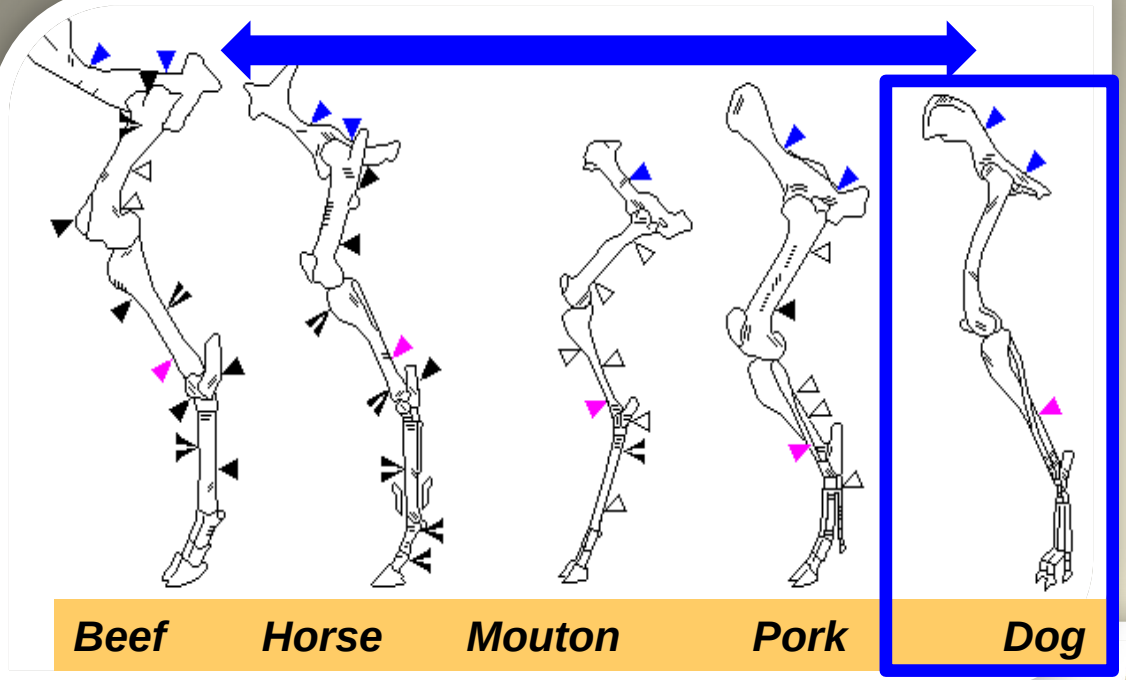


© S. Lepetz CNRS

F. Poupon 2010

Cattle Footprints on the roman site of Angers, P. Chevet, INRAP

Highlighting the consumption of dog during the Celtic period



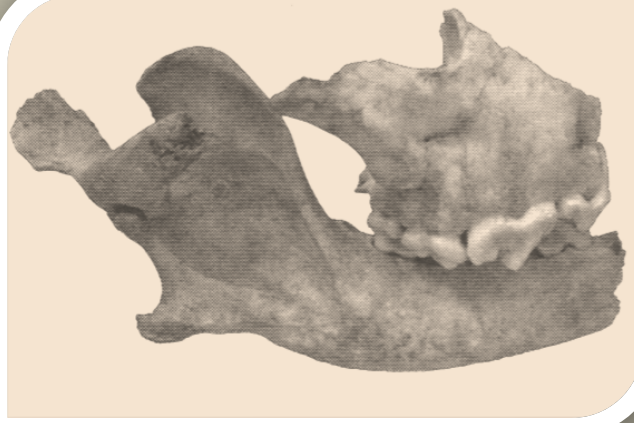
Légende :

▶ : section transverse (hache ou couperet) ; découpe prédominante

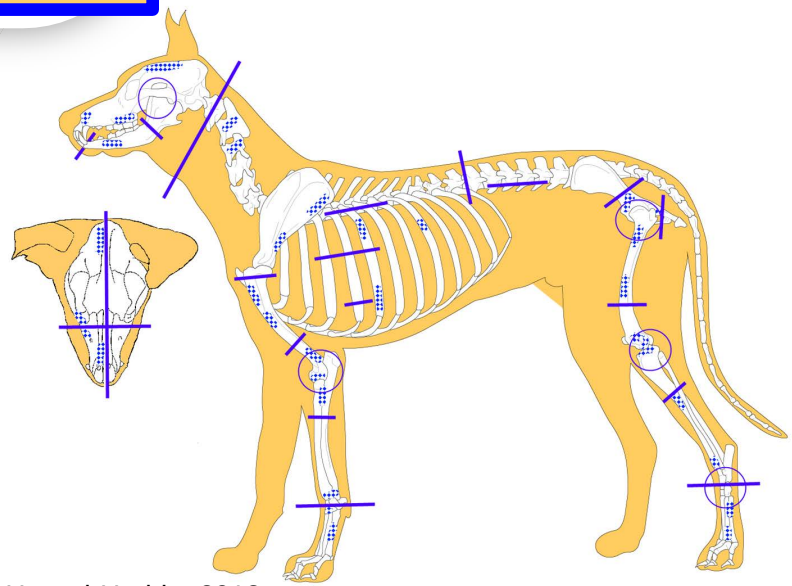
▷ : section transverse ; découpe sporadique

➢ : section longitudinale (hache ou couperet)

traces fines et superficielle (couteau)



Half head consumed of Celtic Dog
Méniel 1997



Horard-Herbin 2013

Pork half Head and Ham in an Iron Age Necropole

Reconstitution of offerings
(Clara Nomdedeu)

Cremation

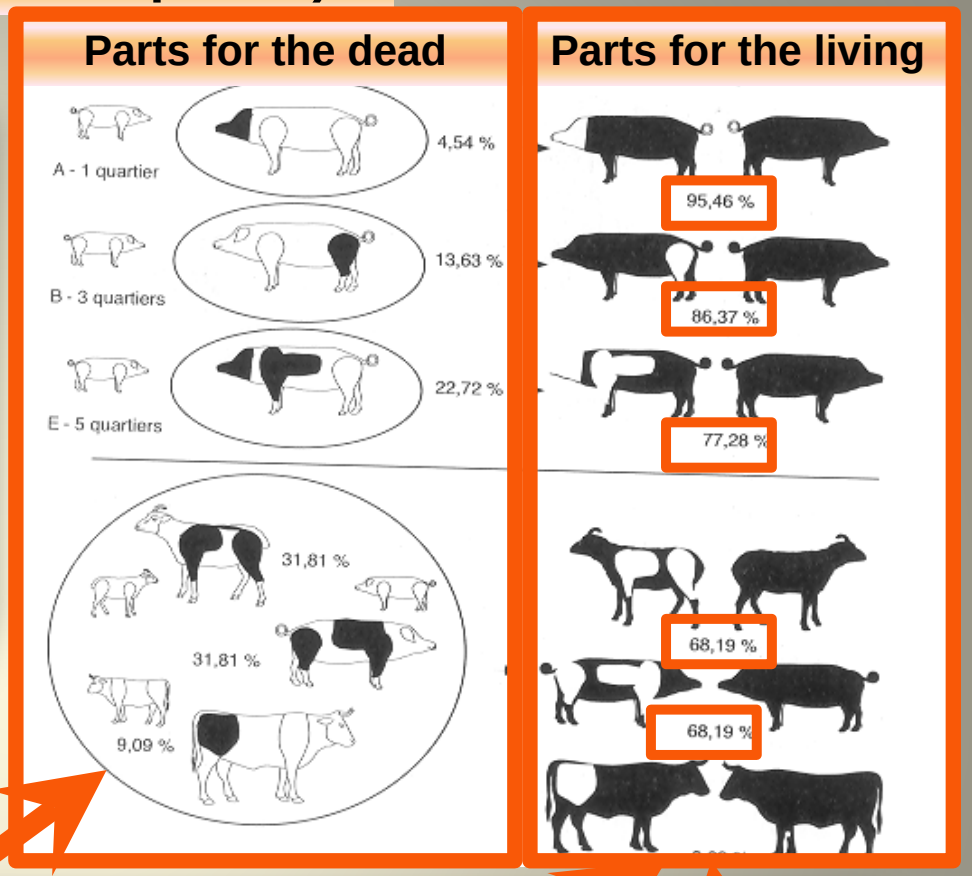
La Madelaine, (Luxembourg), Lambot B., Metzler J. et Méniel P. 1999

Pork in the tomb with a chariot (Celtic period)

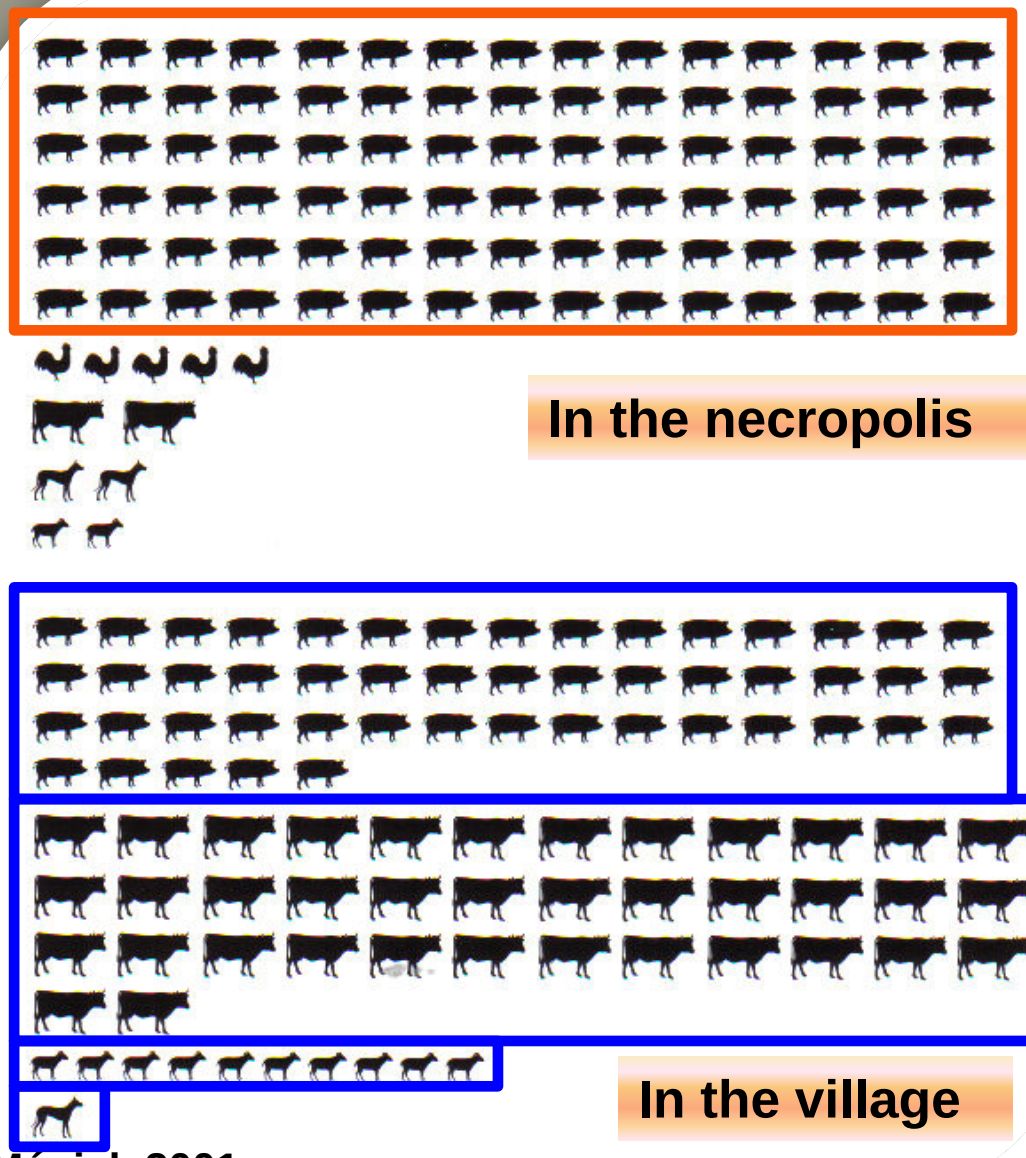
Bucy le long "The Héronnière" reconstitution of a grave char, Ve et IVe B. C., © ASAVA, S. Thouvenot

Pork in the tomb with a chariot (Celtic period)

Bucy le long "The Héronnière« © ASAVA, S. Thouvenot, G. Auxiette INRAP

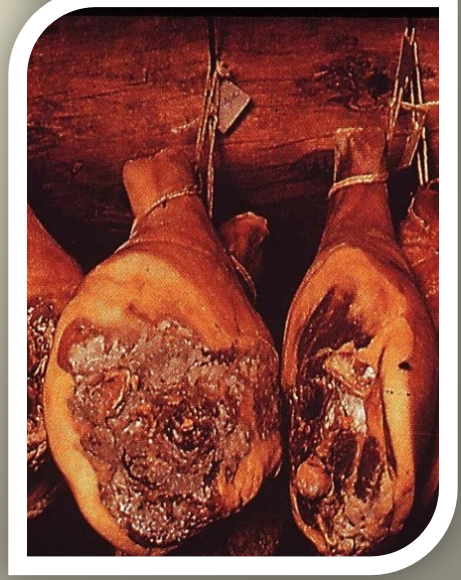


The species eaten



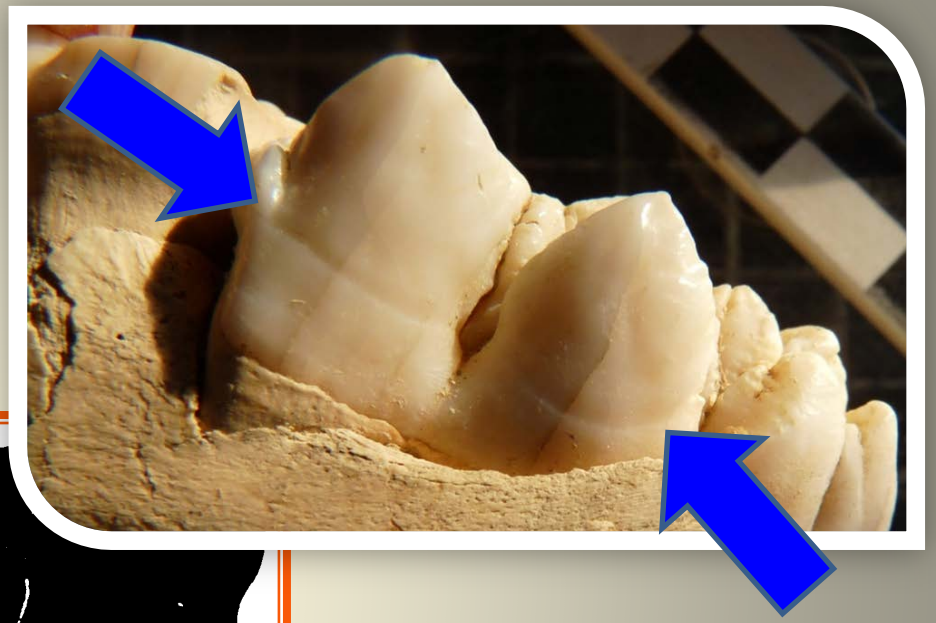
Méniel, 2001

Ham, necropolis of
La madelaine
Méniel 2001

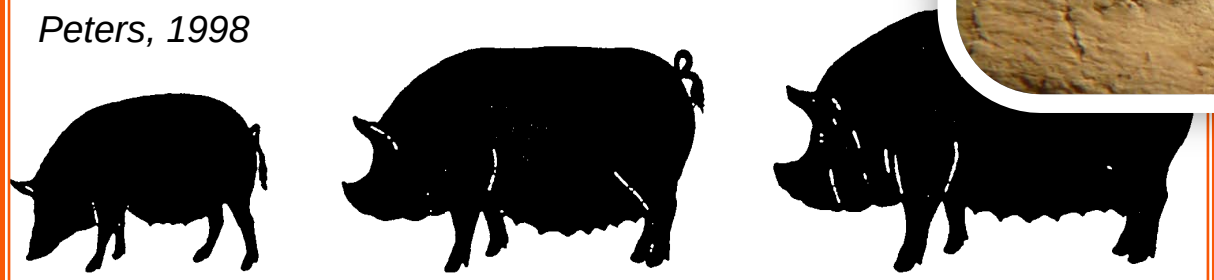


Variability in weight according to pig age

This linear enamel hypoplasia is a deficiency in enamel thickness occurring during tooth crown formation (Levroux, Cl. MPHH)



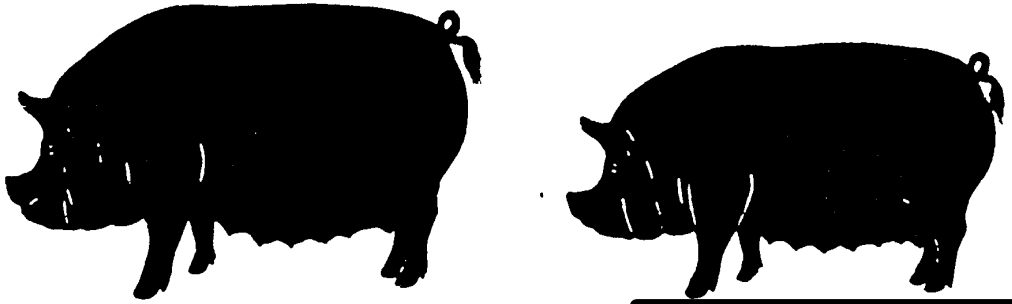
Peters, 1998



1800
40 kg for 2-3 years

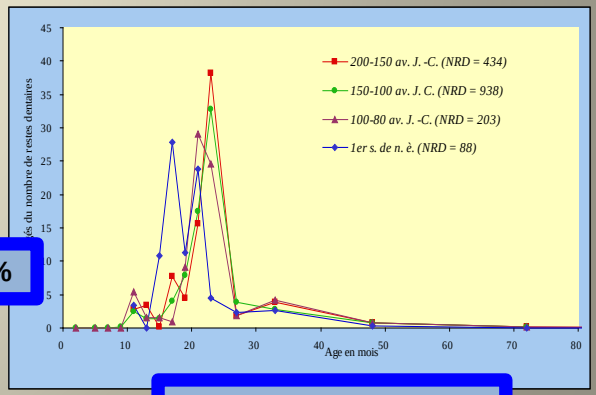
1850
70 kg mit 2 Jahren

1900
100 kg for 11 months



1950
150 kg mit 12 Monaten

1985
100 kg for 6 months



%

Age in months

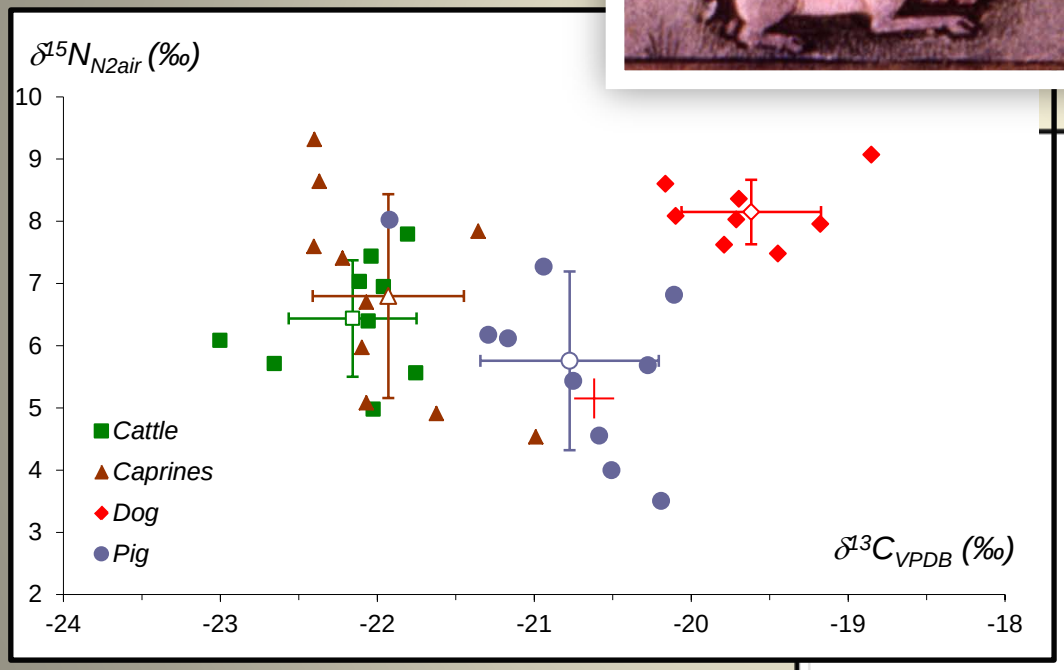
Stable isotopic analyses

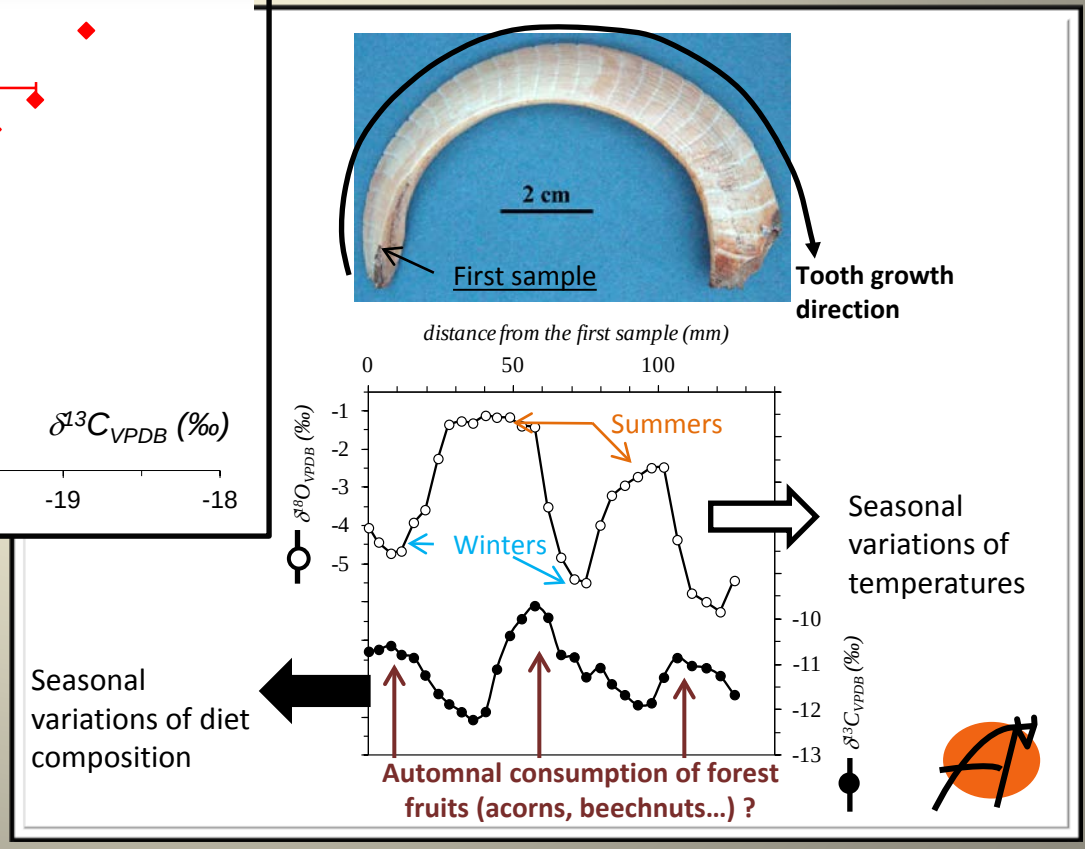
© M. Balasse, CNRS

os - bone
émail - enamel
dentine
20 %
25 %
75 %
70 %
97 %
fraction organique
fraction minérale: bioapatite
collagène (protéine)
lipides
carbonate
phosphate
acides aminés
$\delta^{13}C$ $\delta^{15}N$
$\delta^{34}S$
cholestérol
$\delta^{13}C$
$\delta^{13}C$ $\delta^{18}O$
$^{87}Sr/^{86}Sr$
$\delta^{18}O$

UMR 7209 du CNRS
Archéozoologie, archéobotanique

Stable isotopic analyses

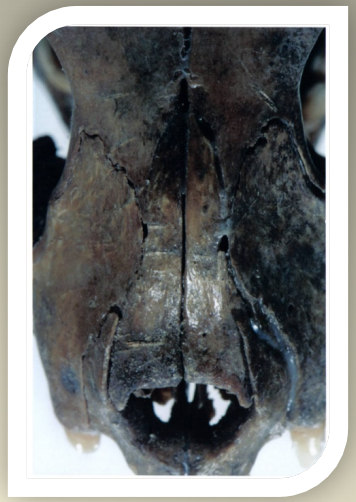




Frémondeau D. 2012.
Seasonal rhythms of archaeological pig husbandry : proposition for a protocol of stable isotope analysis of archaeological remains. PHD du Muséum d'Histoire naturelle de Paris.

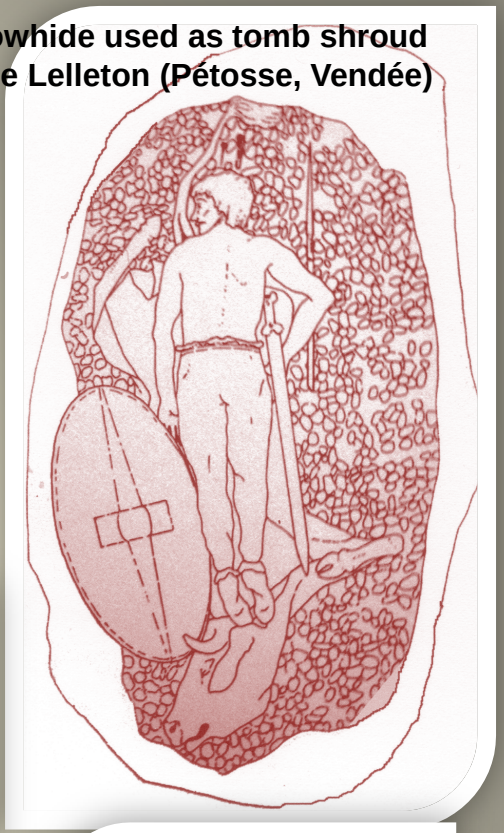
Raw materials from animals

- Tendons
- Glue
- Skin and furs
- Fat
- Meat
- Horn
- Bones

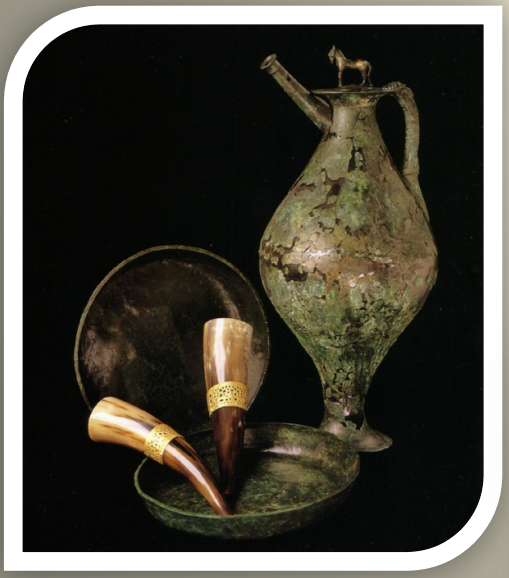


Removal of the skin on a cat skull, B. Clavel

Cowhide used as tomb shroud
The Lelleton (Pétosse, Vendée)



Drinking horns from an Iron age tomb



Roman Cosmetic spoons
Hôtel Gouin, Tours

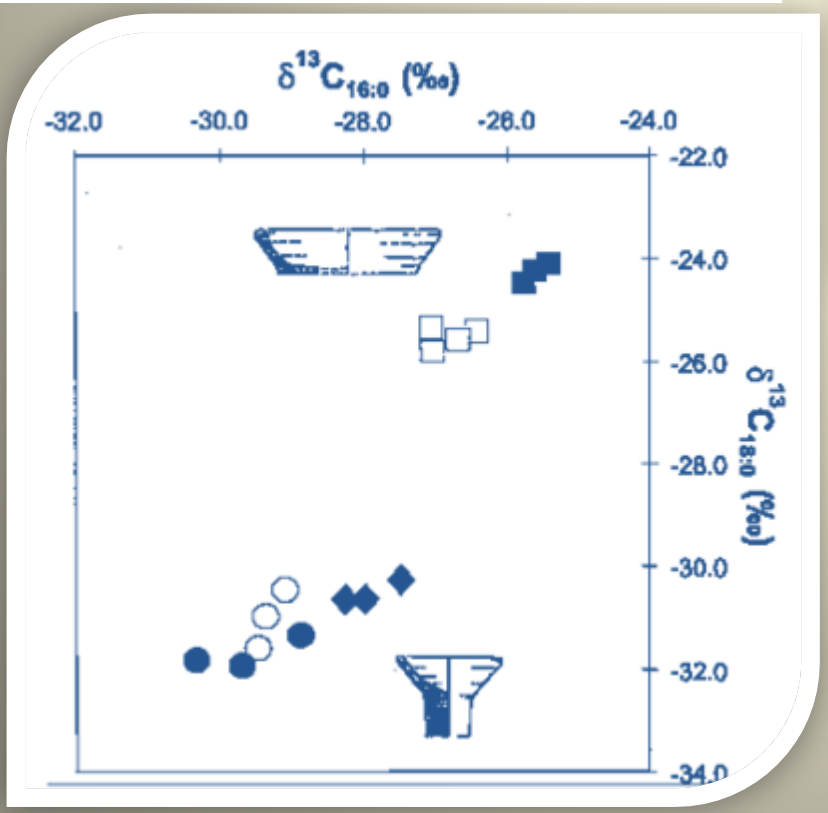
Iron age Die.
N. David, Musée de l'Ardennes

Iron Age salt basket made of leather and fur (Site Hallstatt)

Use of milk

Chemistry of Archaeological Animal Fats, Evershed *et al*., *M Acc. Chem. Res*. 2002

FIGURE 10. Plot showing the $\delta^{13}C$ values of the 16:0 and 18:0 fatty acids form archaeological lamps (○) and dripping dishes (□) and from modern reference animal fats [cattle (◆), sheep (●), and pig (■)].



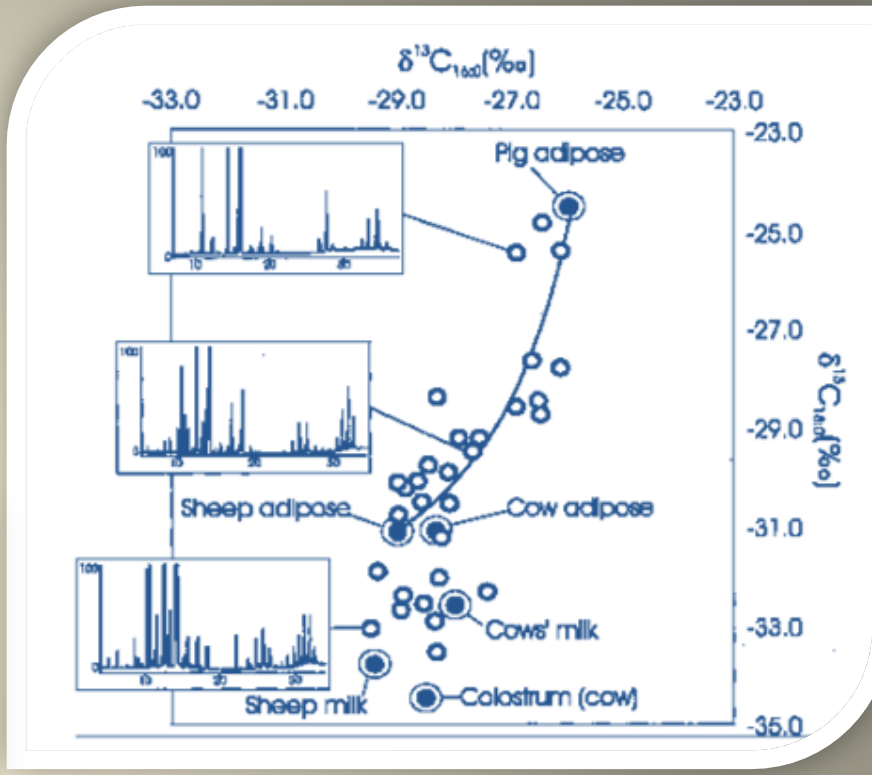


FIGURE 11. Plot of the $\delta^{13}C$ values of the major *n*-alkanoic acid components ($C_{16:0}$ and $C_{18:0}$) of modern reference fats and the lipid extracts of potsherds from the Late Saxon/early medieval site of West Cotton, Northamptonshire, U.K. The filled circles represent the archaeological fats. The mixing curve was determined as in Woodbury et al.[38] to illustrate the $\delta^{13}C$ values which would result from mixing ovine and porcine fats in the vessels. Reference fat fatty acid $\delta^{13}C$ values have been corrected for the post-Industrial Revolution effects of fossil fuel burning.[39] Instrumental error is ±0.3‰, and samples were run in triplicate. The inset HT-GC chromatograms show the total lipid extracts obtained from selected vessels to illustrate characteristic differences in the distributions of triacylglycerols (eluting >30 min).

Use of milk

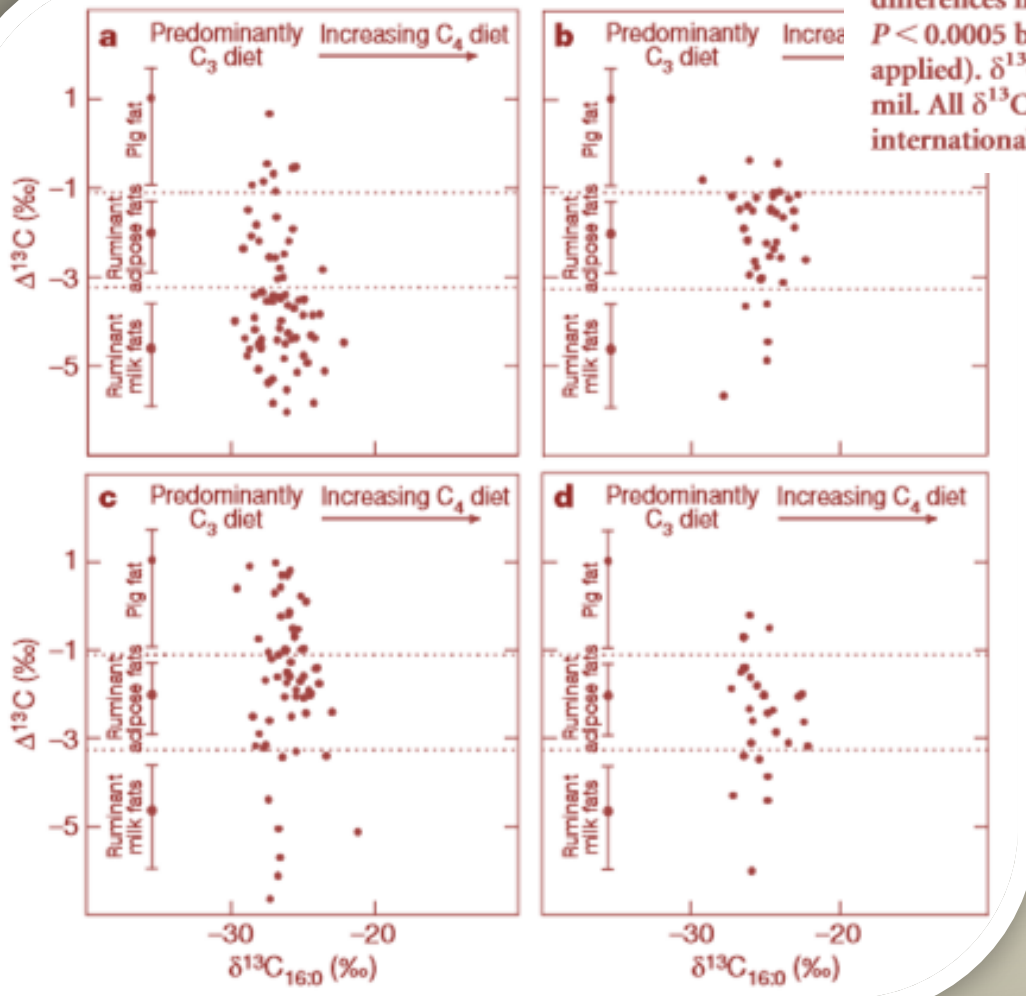


Figure 3 | Plots of the $\Delta^{13}C$ values for archaeological animal fat residues in Neolithic pottery. Pottery was from: **a**, northwestern Anatolia; **b**, central Anatolia; **c**, southeastern Europe/northern Greece; and **d**, eastern Anatolia and the Levant. The $\Delta^{13}C$ values ($= \delta^{13}C_{18:0} - \delta^{13}C_{16:0}$) for the ruminant dairy fats are more depleted than the ruminant adipose fats; the difference in the means is ~2.8‰ which is highly significant (*t*-test; $P < 0.0005$). Pig fats have positive $\Delta^{13}C$ values which do not exhibit significant variance and the differences in the mean values are also highly significant (ANOVA; $P < 0.0005$ between all three commodity groups; Bonferroni adjustment applied). $\delta^{13}C = [(^{13}C/^{12}C)_{sample}/(^{13}C/^{12}C)_{standard}] - 1$, expressed in per mil. All $\delta^{13}C$ values are relative to Vienna PeeDee Belemnite (VPDB) international standard.

Earliest date for milk use in the Near East and southeastern Europe linked to cattle herding, Evershed *et al.*, *Nature* 2008

Weaning age

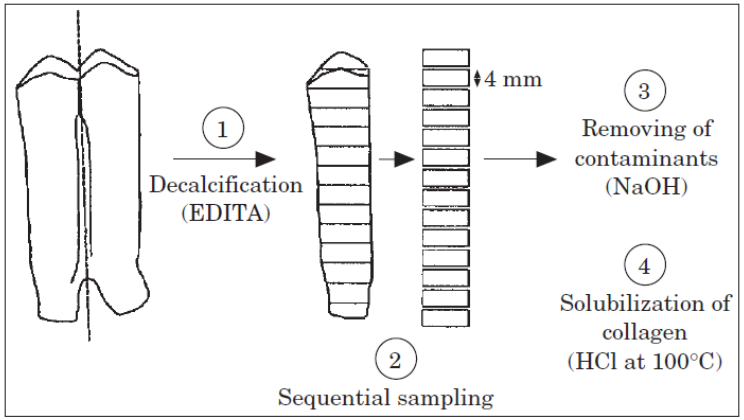
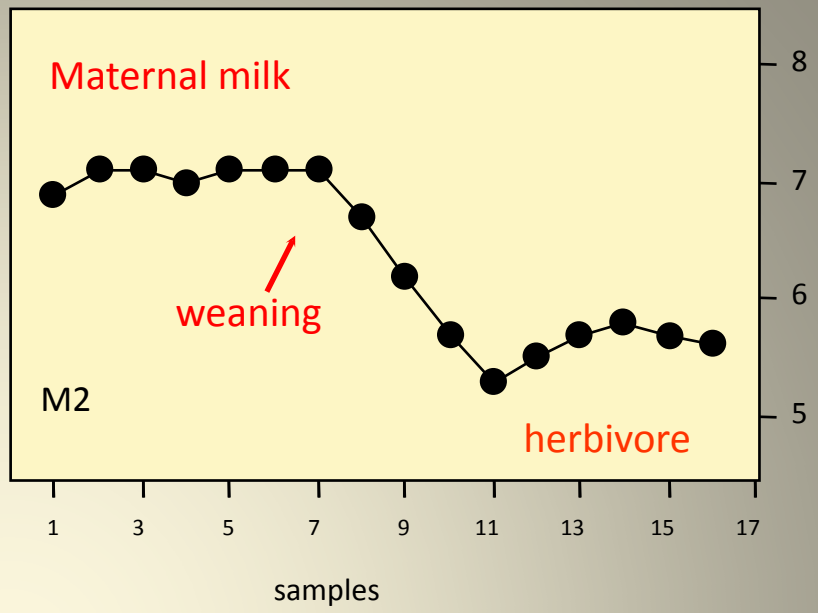


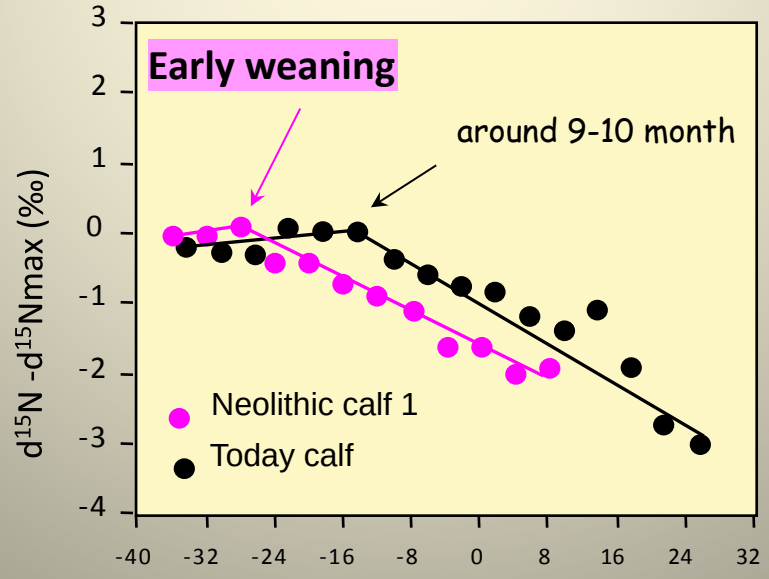
Figure 1. Tooth sampling and collagen extraction procedure.



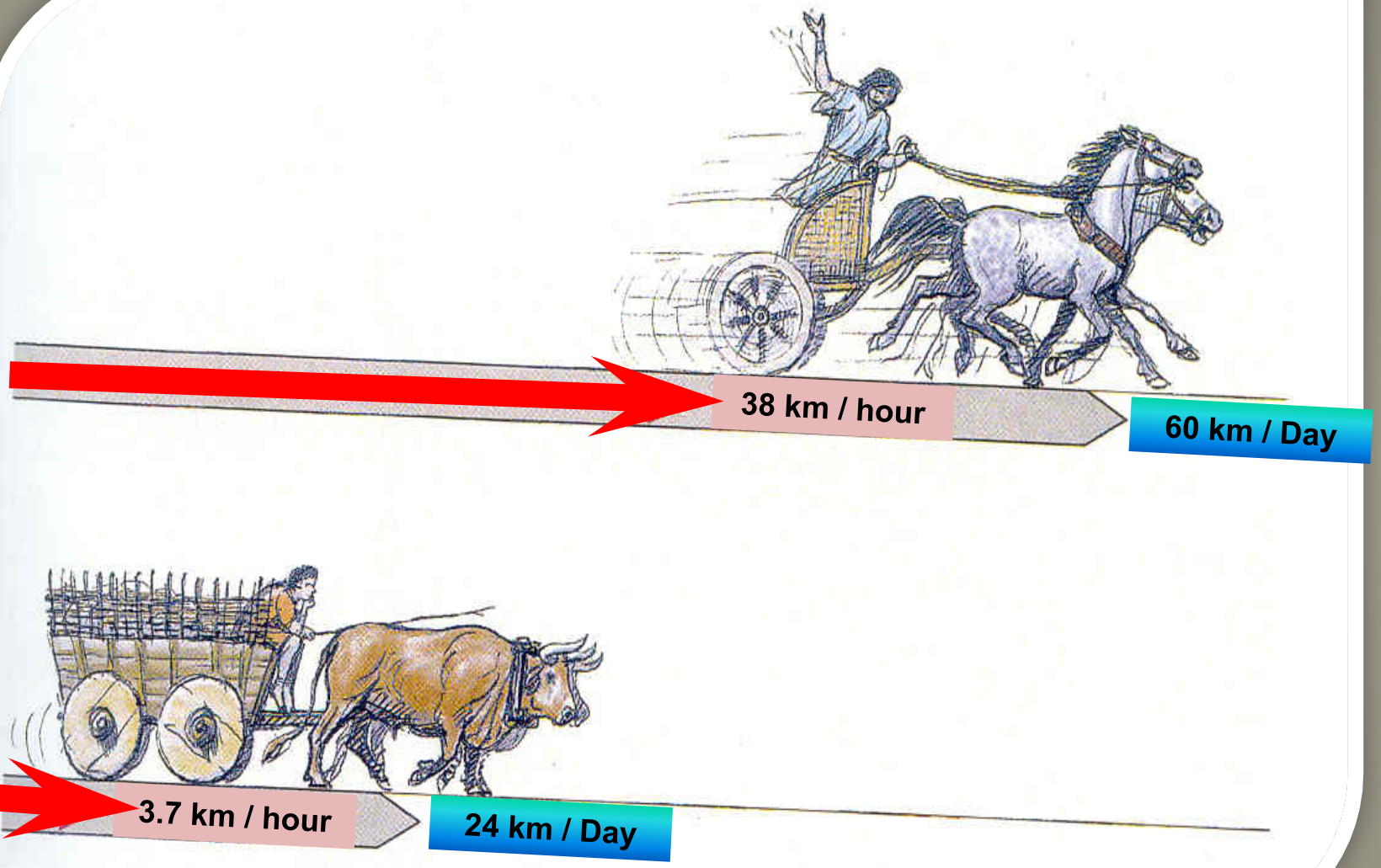
Marie Balasse and Anne Tresset, 2002 : Early Weaning of Neolithic Domestic Cattle (Bercy, France). Revealed by Intra-tooth Variation in Nitrogen Isotope Ratios

Comparaison of neolithic and present-day calves.

(Bercy, Paris)



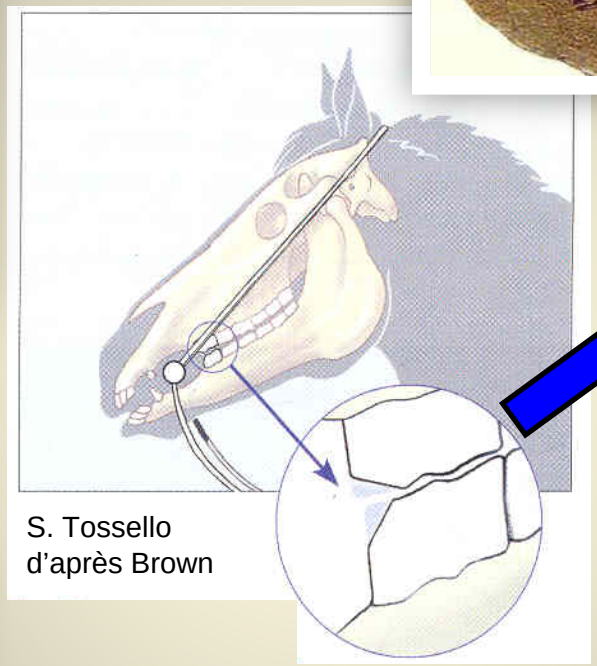
An essential energy



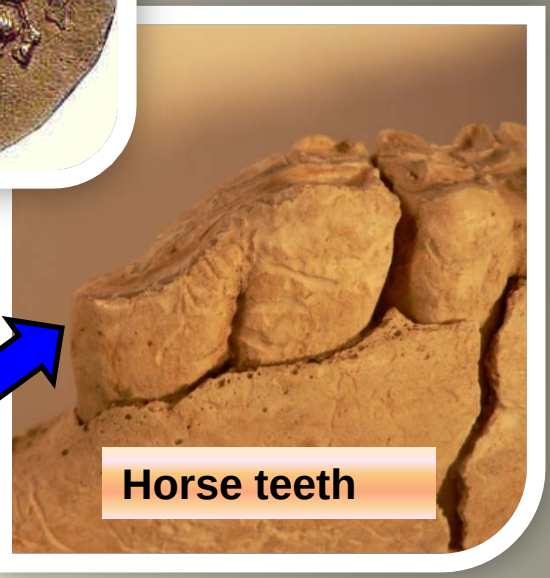
Dessin G. Tossello

…and a complementary energy

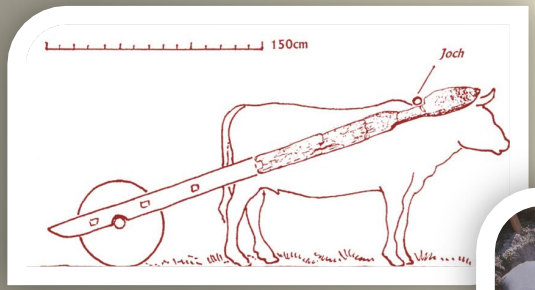
Roman mosaic



S. Tossello
d'après Brown



Horse teeth



Neolithic site de Châlain.
(Jura, © A.-M. Pétrequin

Vertebrae

Ox skeleton

Horse skeleton

P. Méniel

Premières données sur les animaux du site du mormont. (Vaud, suisse, 100 BC). P. Méniel

…but the use and the symbolic role are symbiotic

Site of Gondola (-70 et -20 BC).

Eight riders baried along-side their horses

Le Cendre, Puy-de-Dome).
U. Cabezuelo, INRAP

To conclude

Roman mosaic depicting a symposium , collection Castle of Boudry, Switzerland