

Palaeopathology of large mammals from the Pleistocene site of Arago Cave (Pyrénées-Orientales, France) : preliminary results

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Arago Cave (Pyrénées-Orientales-France)



Arago XXI

(<https://archeologie.culture.fr/tautavel/fr/decouvertes-fossiles-humains>)

Dating (BP)	O.I.S	Stratigraphic complex	Stratigraphic unit	Layers	Sedimentology
35 000	3	SUMMIT COMPLEX			Stalactites Black earth
92 000	4	UPPER COMPLEX	IV	A et B	Floors stalagmitic intercalated of anthropic levels
128 000	5				
195 000	6				
220 000	7				
250 000	8				
320 000	9				
370 000	10				
400 000	11	MIDDLE COMPLEX	III	D E F G	Stratified coarse sands
430 000	12				
450 000	13			H I J	Silt, sand and clay
480 000	14			K à S	Stratified sands
530 000	15	LOWER COMPLEX		T	Red clays
570 000	16			U à Z	Brown clays
620 000	17				Floor stalagmitic
660 000					
690 000					

158 pathological remains



Simplified stratigraphy of the Arago Cave

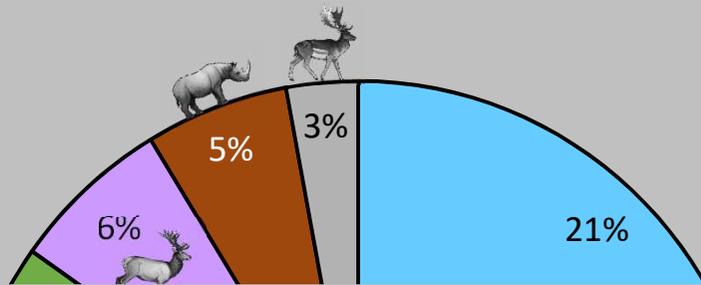
(From Lumley *et al.*, 2014)

The Arago Cave is :

- ✓ 17 meters of stratigraphic filling
- ✓ Middle Pleistocene to Upper Pleistocene
- ✓ 152 human bones
- ✓ 73 800 NISP bones of large mammals



Anomalies on Pleistocene species

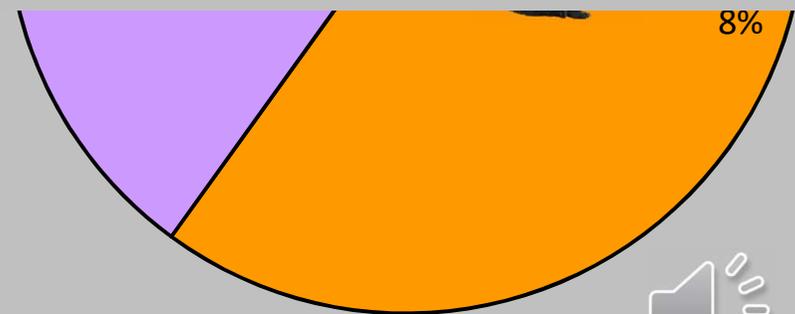


Aim :

Identify and interpret the various anomalies

- Horse
- Mouflon
- Bison
- Reindeer
- Musk ox
- Tahr
- Deer
- Rhinoceros
- Fallow deer

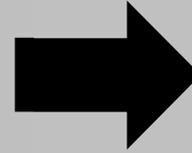
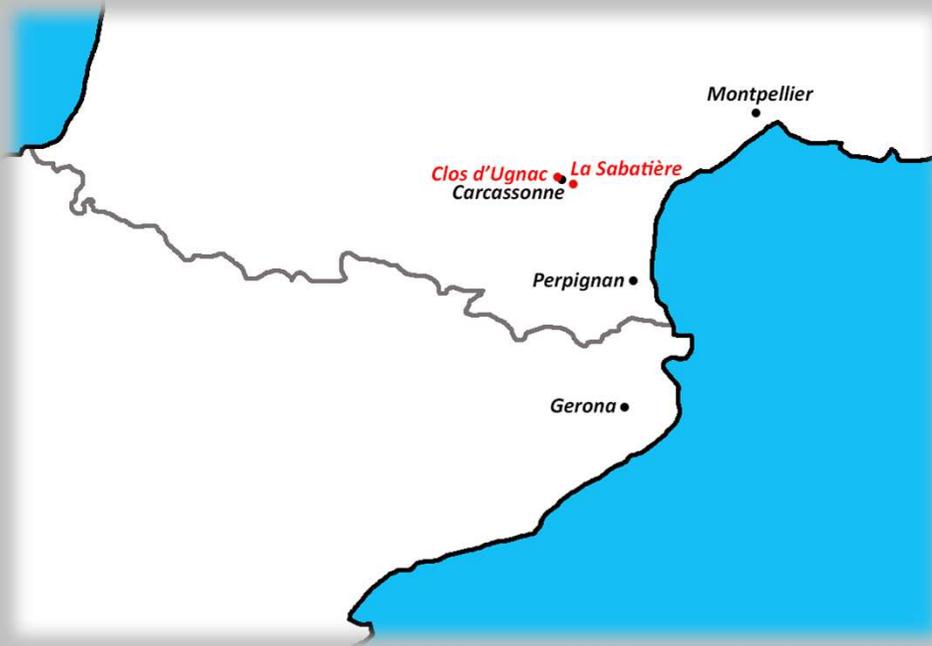
**9 species of herbivores
3 species of carnivores**



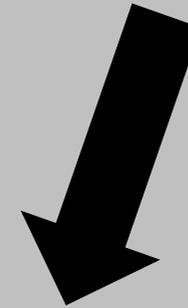
- Bear
- Dhole
- Wolf



Medieval sites as a reference



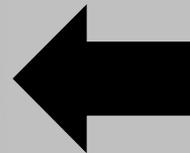
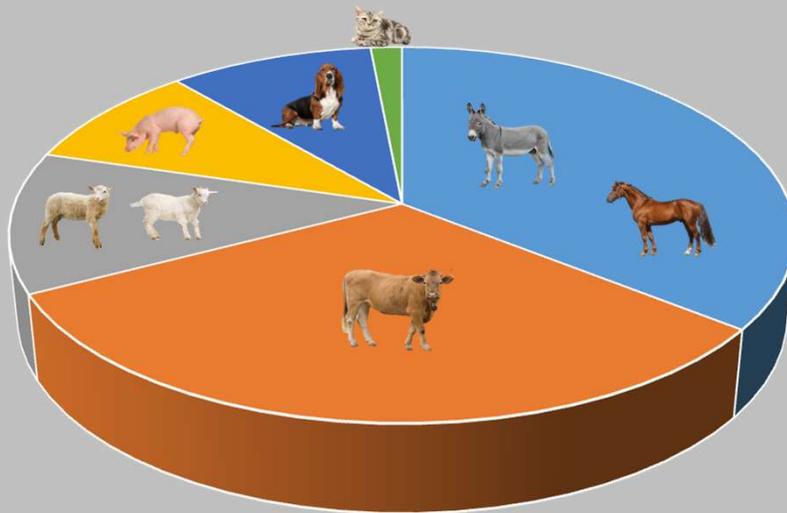
Reference source



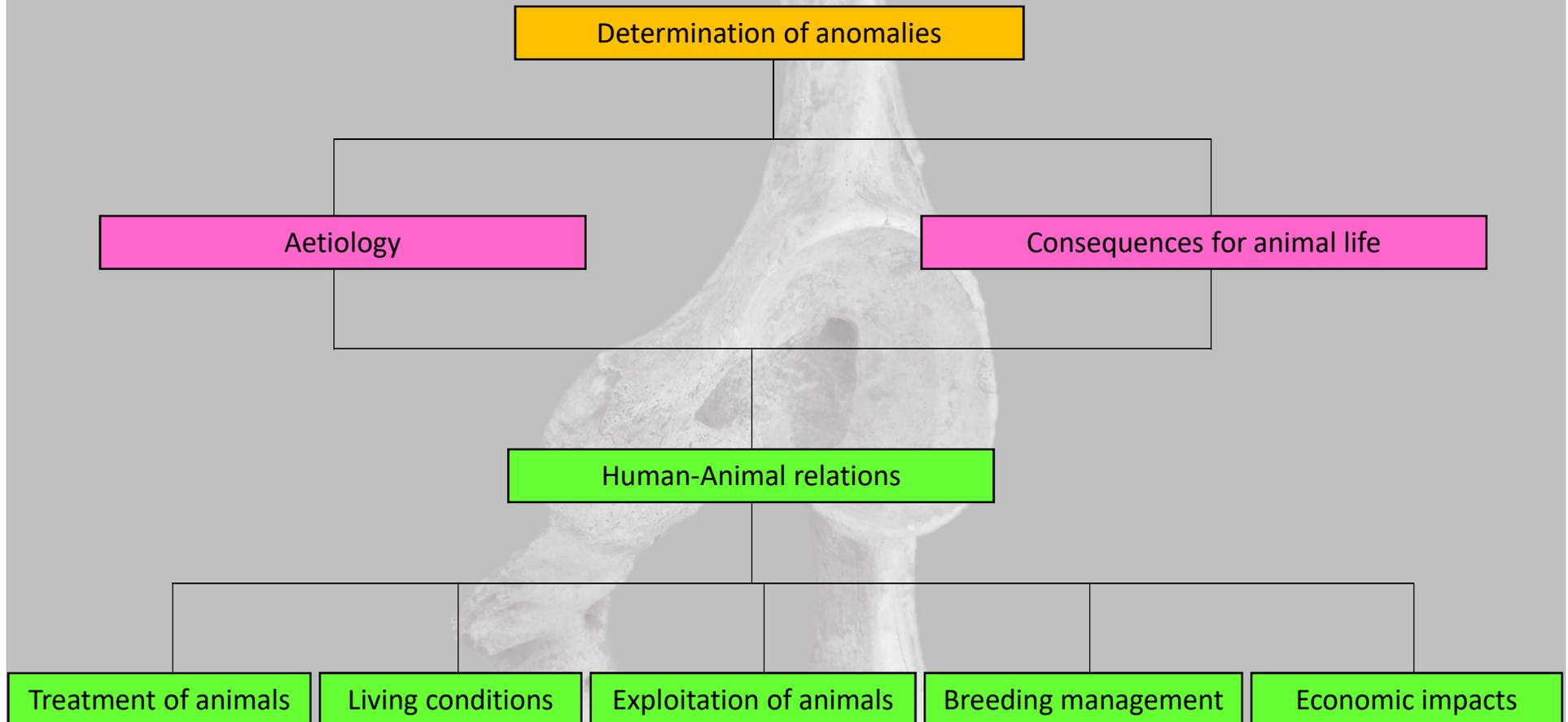
25 lesions

13 dental
anomalies

12 bone
anomalies



Human behaviour through dental and bone anomalies





**What can animal
paleopathology contribute to
the knowledge of sites prior to
the phenomena of
domestication?**

Tacuinum sanitatis, Latin 9333, folio 57r (<https://gallica.bnf.fr>)



Human behaviour through dental and bone anomalies

Medieval sites

The study of the health status of individuals

The determination of anomalies classically accepted as being related to domestication
(e.g. asymmetries of the distal articular eminences of the metapods)

Provision of care for domestic animals

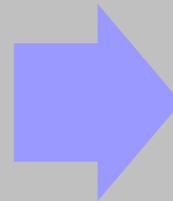
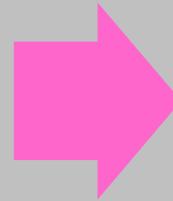
Pleistocene sites

To determine whether or not humans preferentially hunted diseased animals, and at the same time to find evidence of hunting practice through traumatic lesions.

Are anomalies considered to be related to domestication found at sites where animals live in a natural, non-anthropogenic environment?

If so, demonstrate that these are not related to domestication, but rather to the impact of climate and environment.

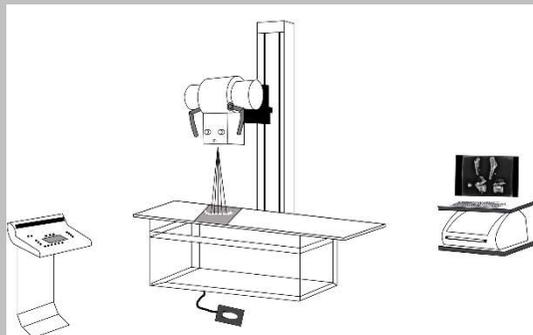
To determine whether animals in the Pleistocene, as is the case today, for example in Chimpanzees, could have consumed plants for medicinal purposes



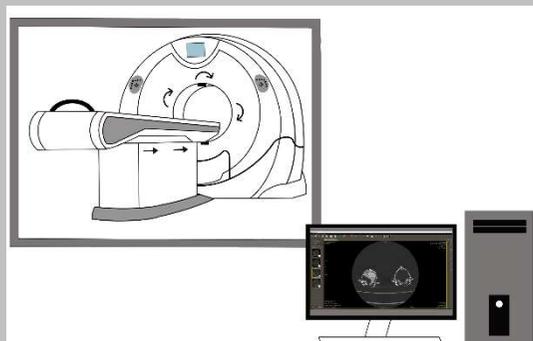
Study protocol



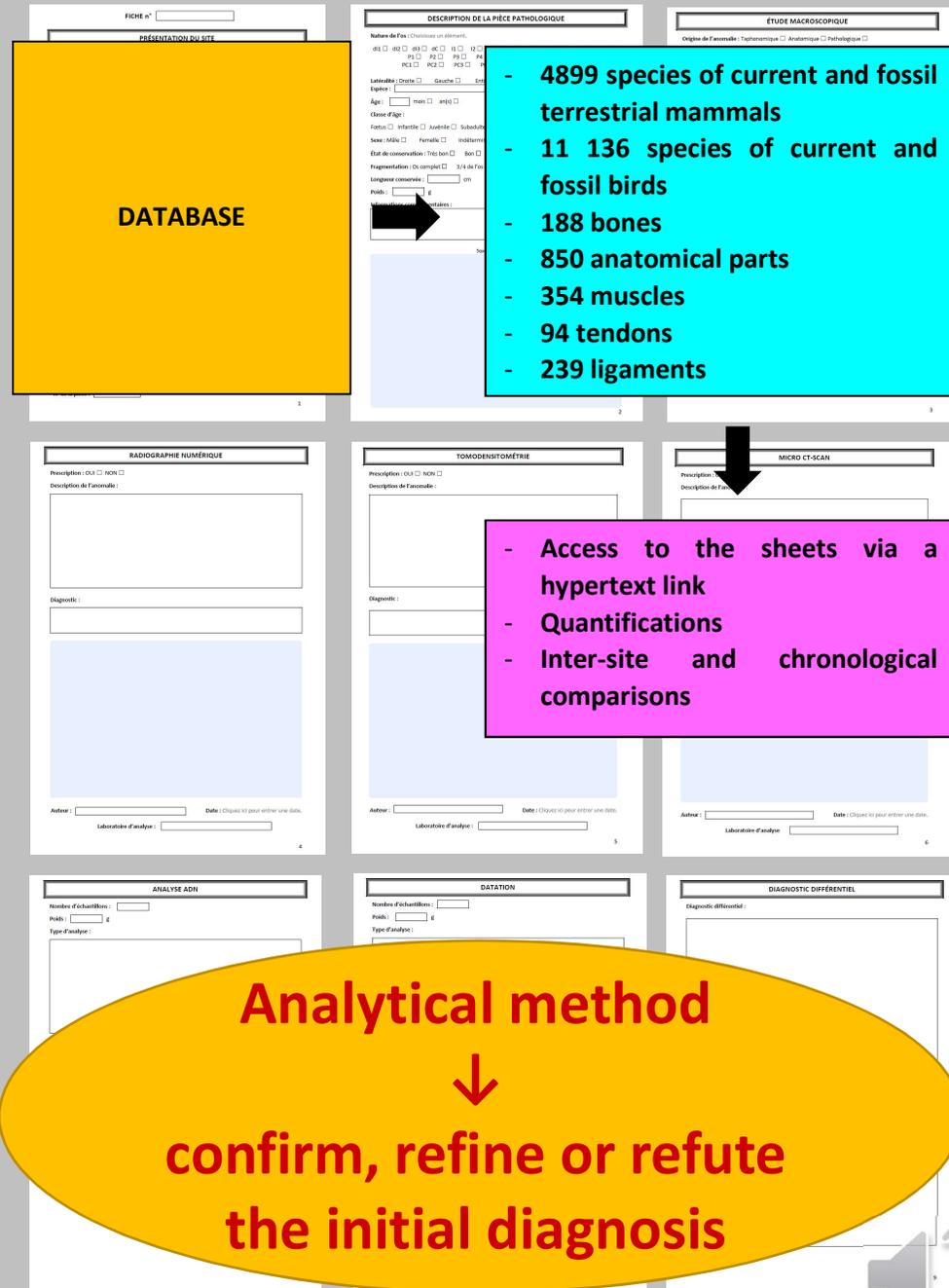
Macroscopic analysis



X-ray

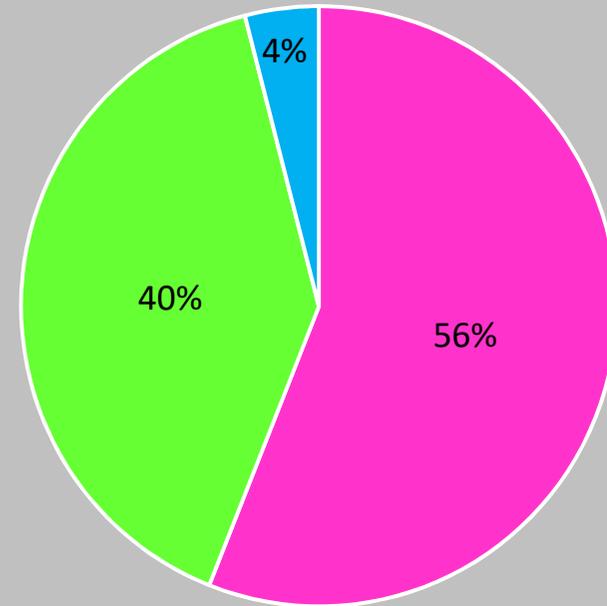


CT-scan

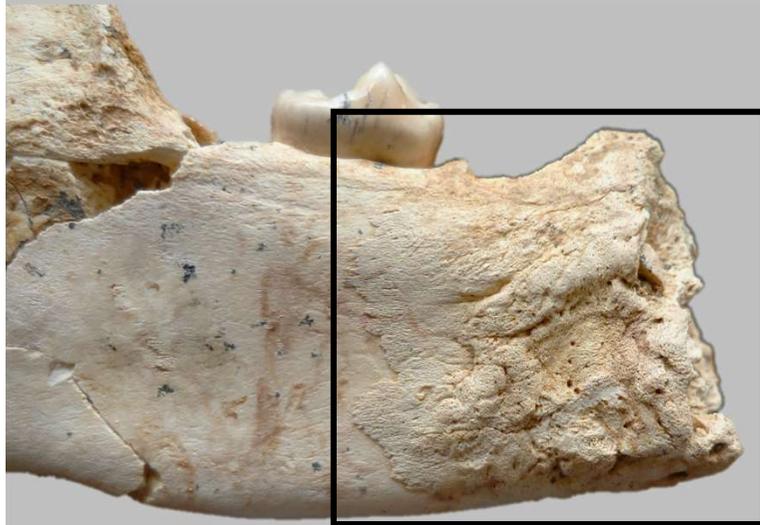


The anomalies of the Arago Cave

19 different lesions



■ Bone anomalies ■ Dental anomalies ■ Indeterminate



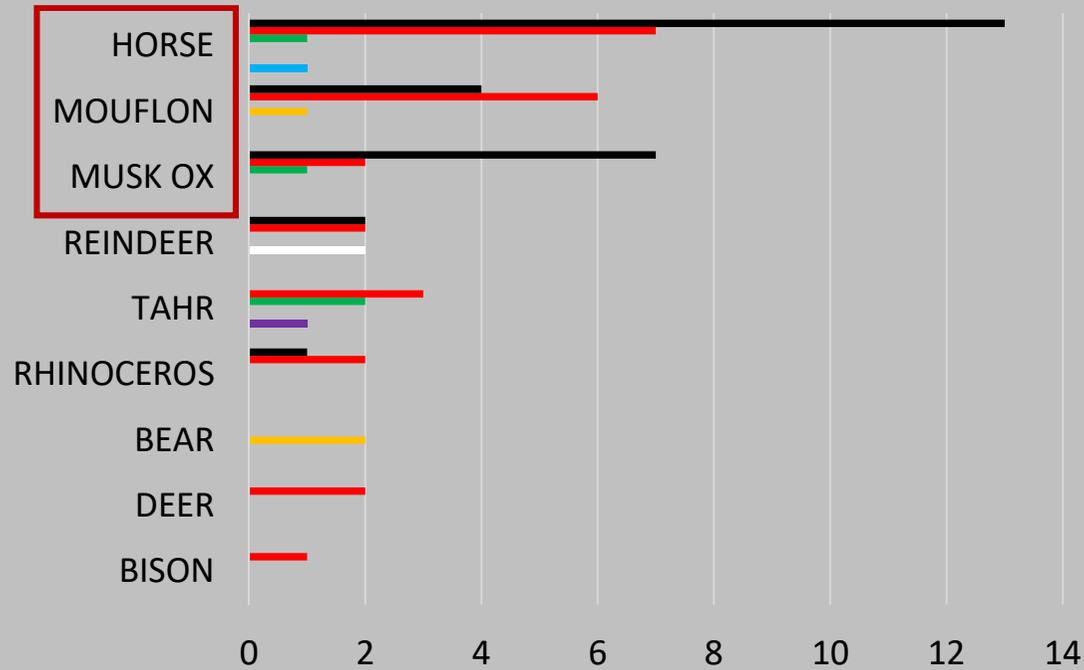
Osteomyelitis on *Canis mosbachensis* mandible
(L. BERTIN)



Enamel hypoplasia on a lower M2 of *Praevibos priscus*
(L. BERTIN)



The anomalies of the Arago Cave



■ Enamel hypoplasia

■ Irregular tooth wear

82%

■ Abscess (6%)

■ Root-absorption (5%)

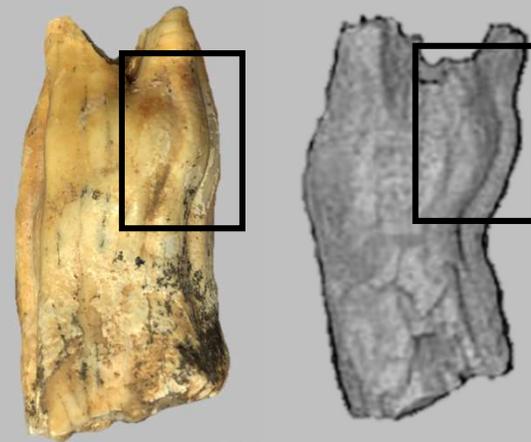
■ Dens invaginatus (3%)

■ Caries (2%)

■ Equine odontoclastic tooth resorbtion and hypercementosis (EOTRH) (2%)



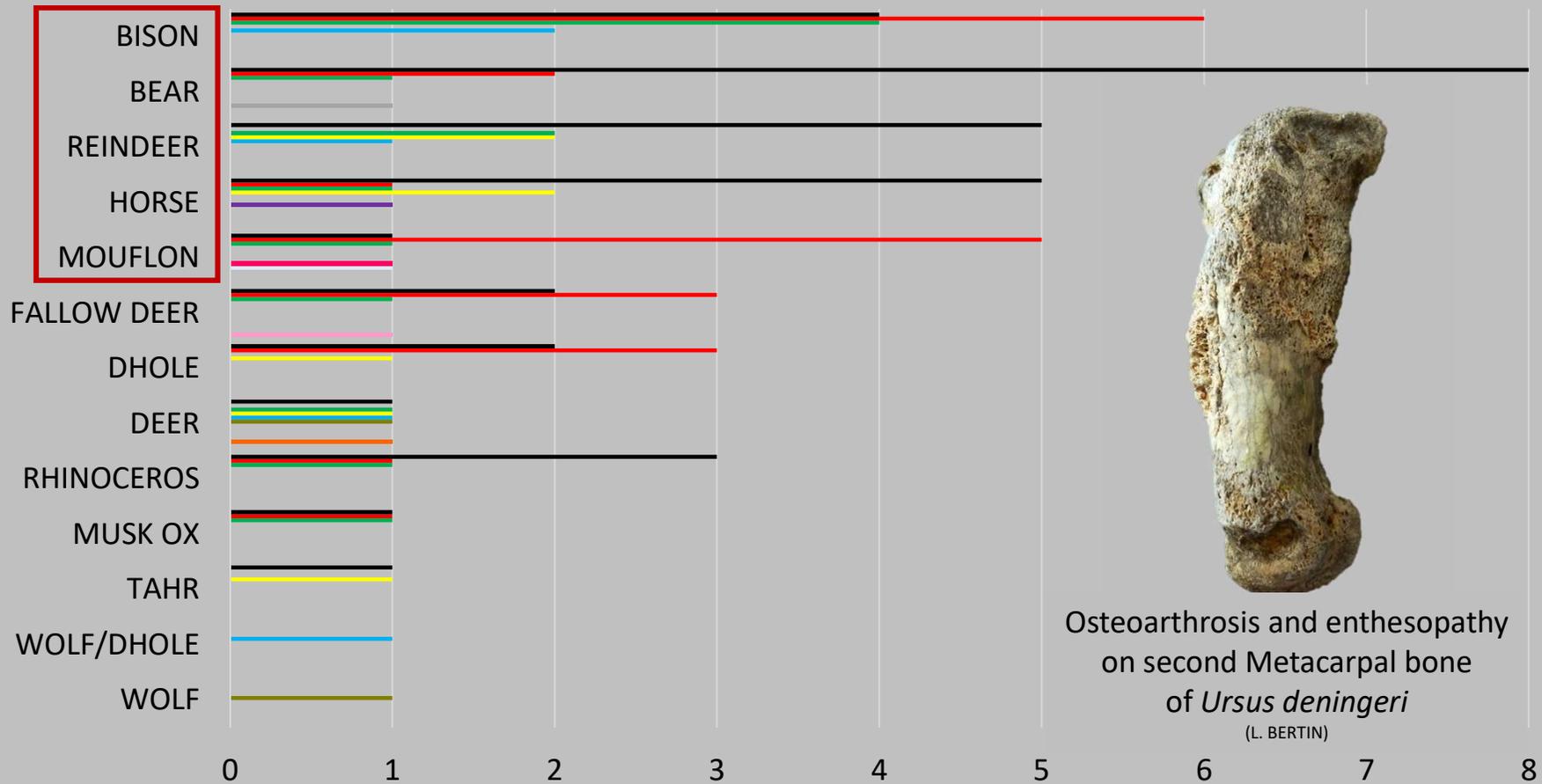
Dens invaginatus
Upper P2 of *Rangifer tarandus*
(L. BERTIN)



EOTRH

Upper M1 of *Equus mosbachensis* of Arago Cave (L. BERTIN) compared to an upper molar of Cumanian Horse, Tiszagyenda-Morotva-Part, Hungary (15th century) (Bartosiewicz, 2013)

The anomalies of the Arago Cave



Osteoarthritis and enthesopathy
on second Metacarpal bone
of *Ursus deningeri*
(L. BERTIN)

78%

■ Osteoarthritis

■ Ligamentopathy

■ Periostitis (6%)

■ Lack of articulation (1%)

■ Elbow incongruity (1%)

■ Laminitis (1%)

■ Enthesopathy

■ Ossifying haematoma (8%)

■ Osteomyelitis (2%)

■ Asymmetry of the distal condyles (1%)

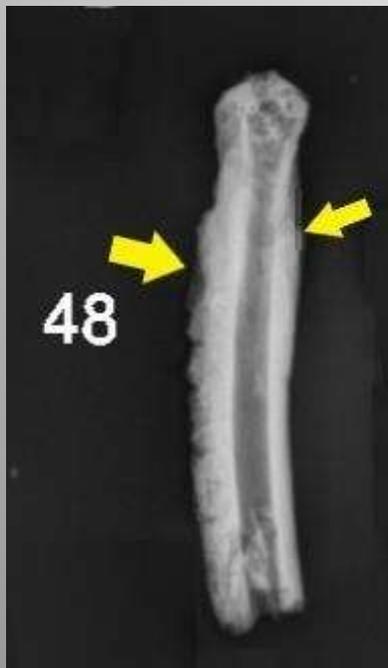
■ Bone fracture (1%)

■ Osteitis (1%)



CANIDS ARAGO

X-RAY IMAGES



ARAGO

Significant periostitis of the metapod consistent with infection (osteomyelitis) or Cadiot-Ball (hypertrophic osteopathy)

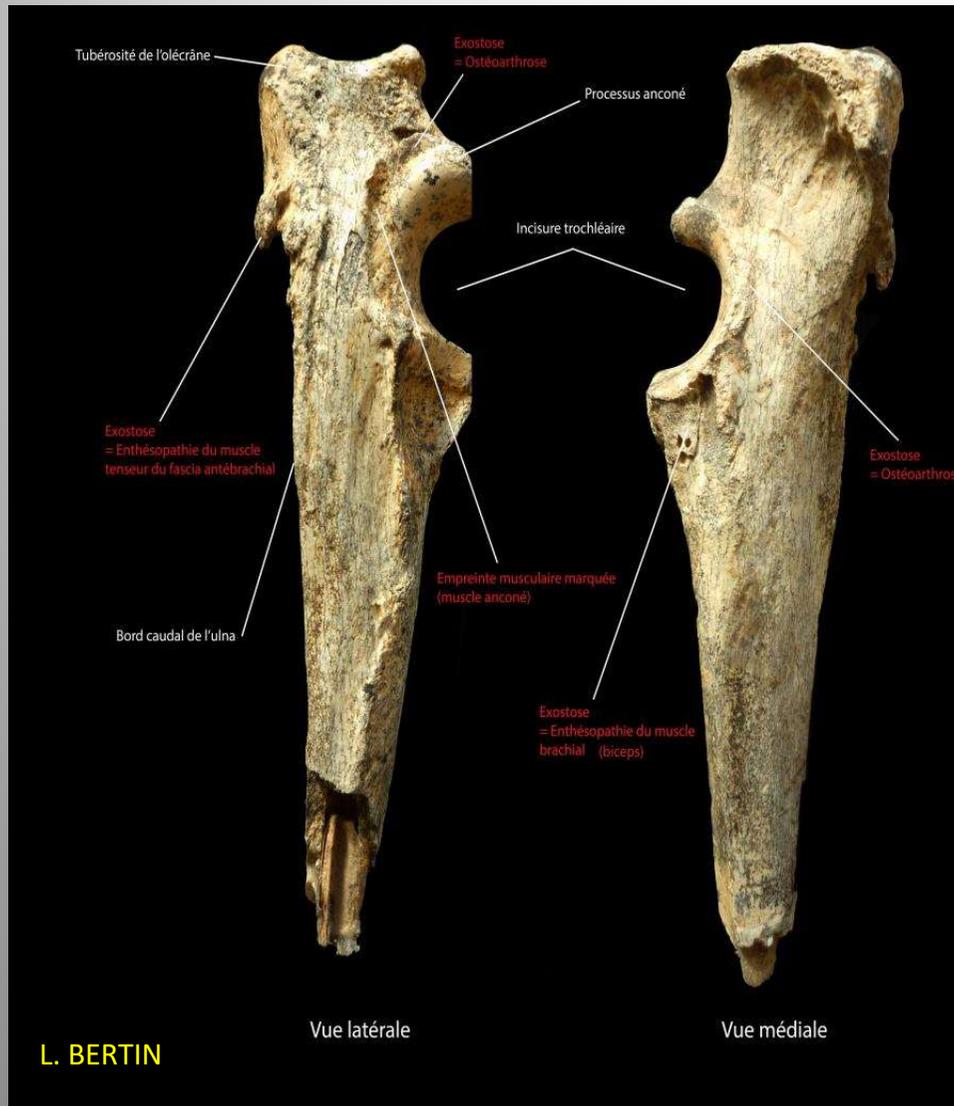


ACTUAL

consequences: severe lameness



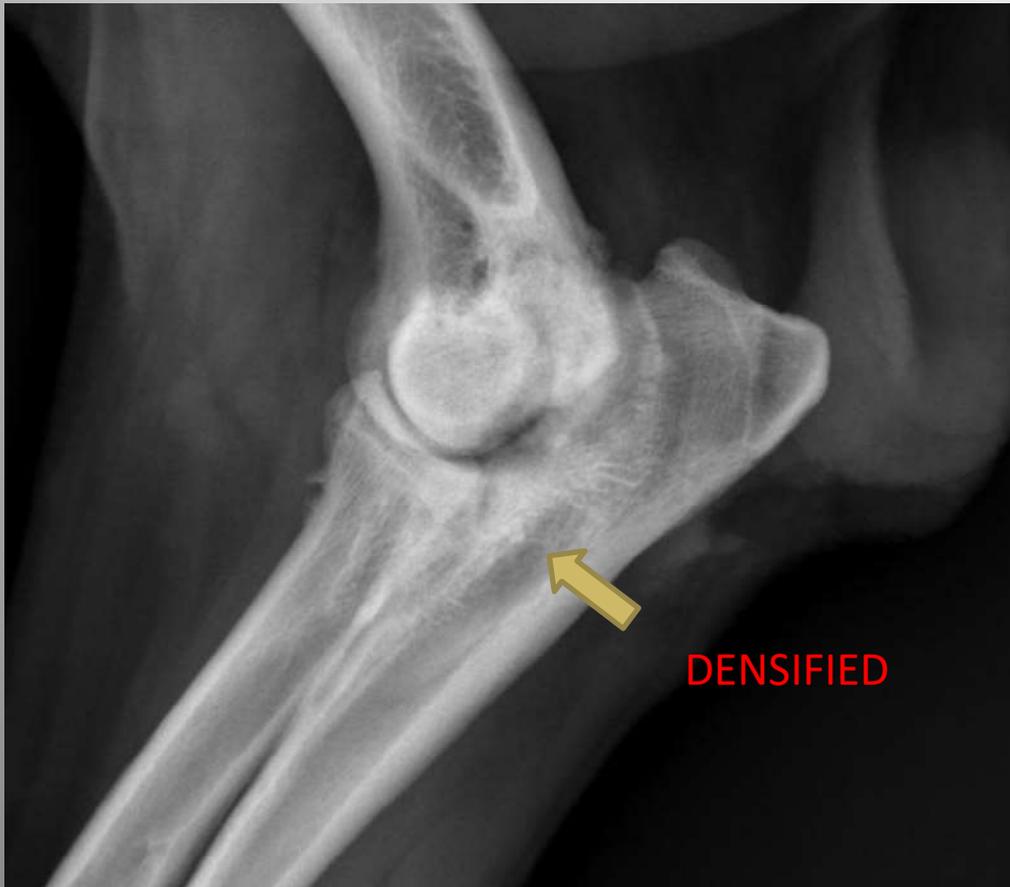
CANIDS ARAGO: X-RAY IMAGES



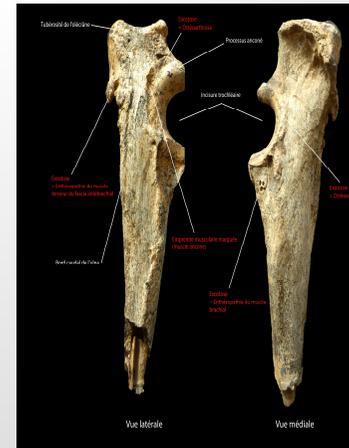
Many anomalies but what is pathological?



CANIDS ARAGO: X-RAY IMAGES



Many anomalies but what is pathological?

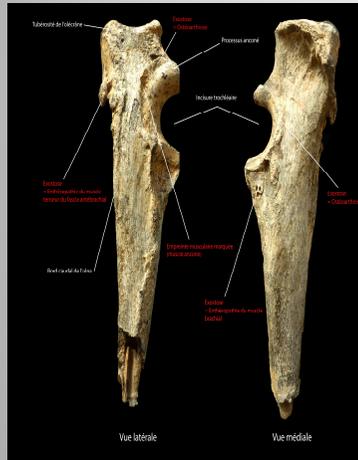


ARAGO

WHEN THERE IS SUFFERING
THERE IS A SUBCHONDRAL
REACTION OF THE BONE WHICH
IS TRANSLATED ON THE X-RAY
BY A DENSIFICATION OF THE
TISSUE



CANIDS ARAGO: X-RAY IMAGES



Many anomalies but what is pathological?

1 - subchondral densification at the insertion of the biceps brachii = entesopathy

2 - a significant osteophyte in the anconeal muscle (tensor of the antebrachial fascia), and probably in all anconeal muscles given the significant changes seen macroscopically

So a chronic limp of the forelimb in both extension and flexion



CANIDS ARAGO: X-RAY IMAGES



ARAGO



ACTUAL

Osteoarthritis lesion in the V metatarsal causing discomfort, especially when starting up



CANIDS ARAGO: X-RAY IMAGES



Osteomyelitis of the jaw probably as a result of a dental abscess; when the lesion is unilateral, the animal will use the other jaw to eat but this may still result in weight loss. In this case the lesion should have healed spontaneously as can be seen macroscopically with scar tissue in the bone...

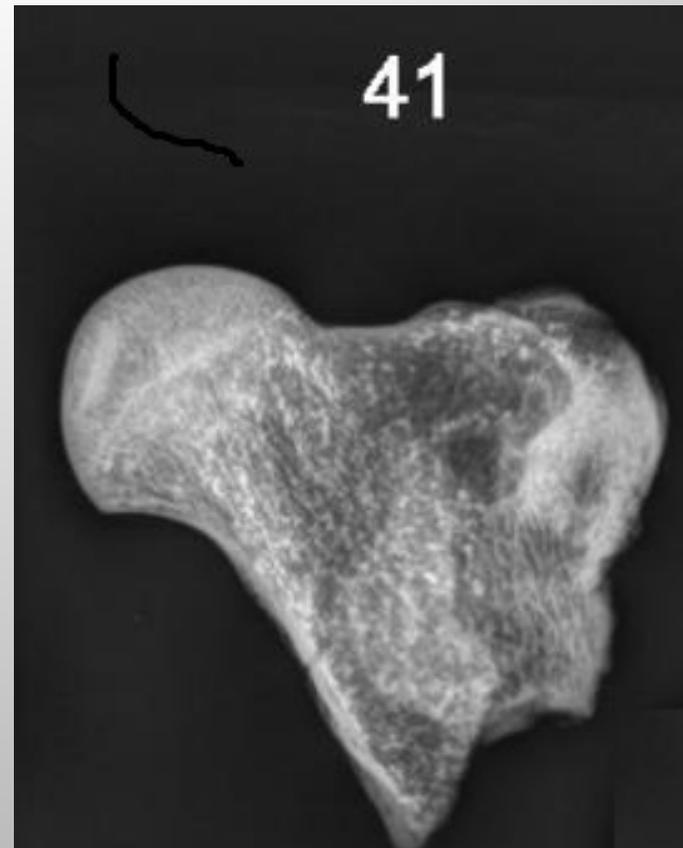
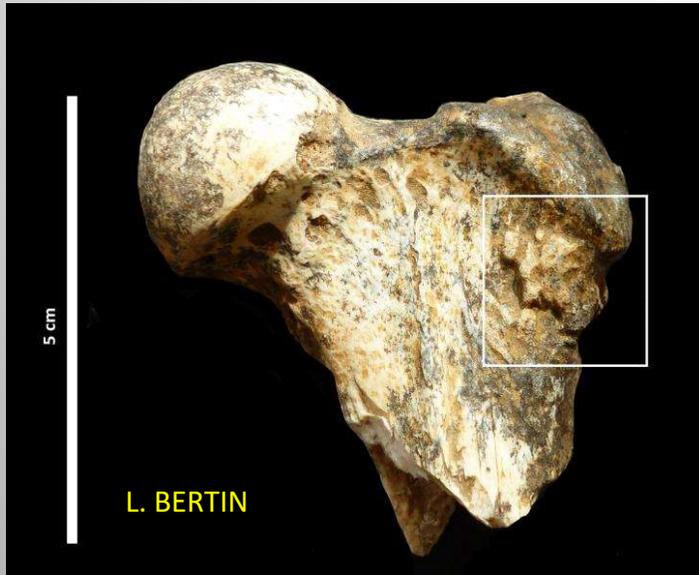
ARAGO



L. BERTIN



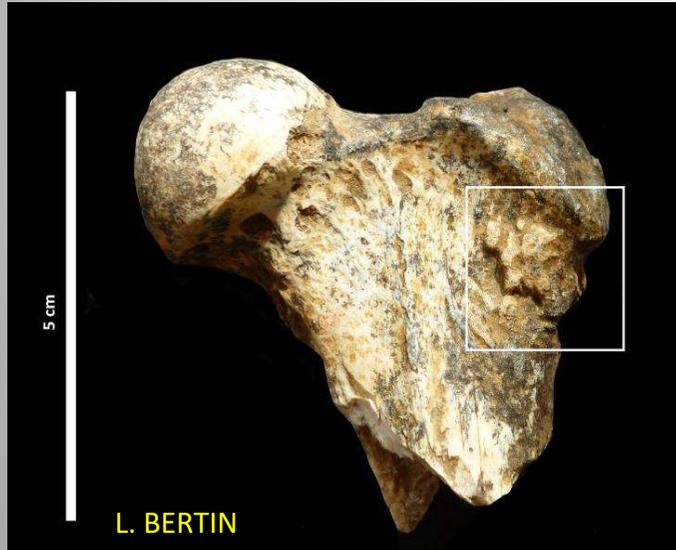
CANIDS ARAGO: X-RAY IMAGES



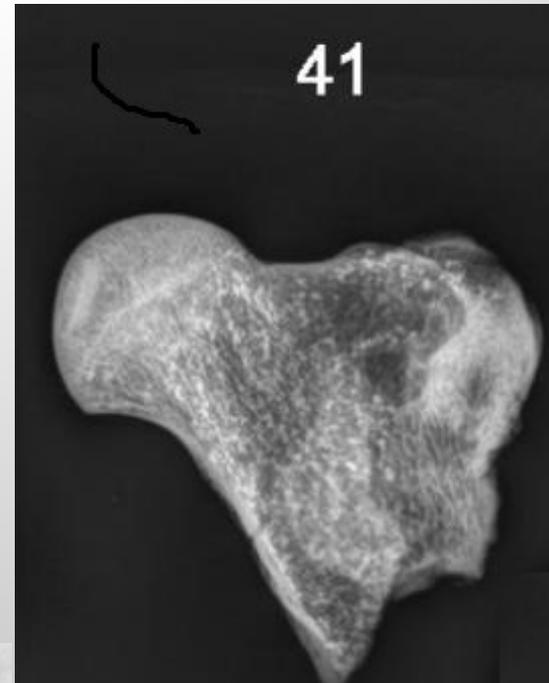
Is it pathological?



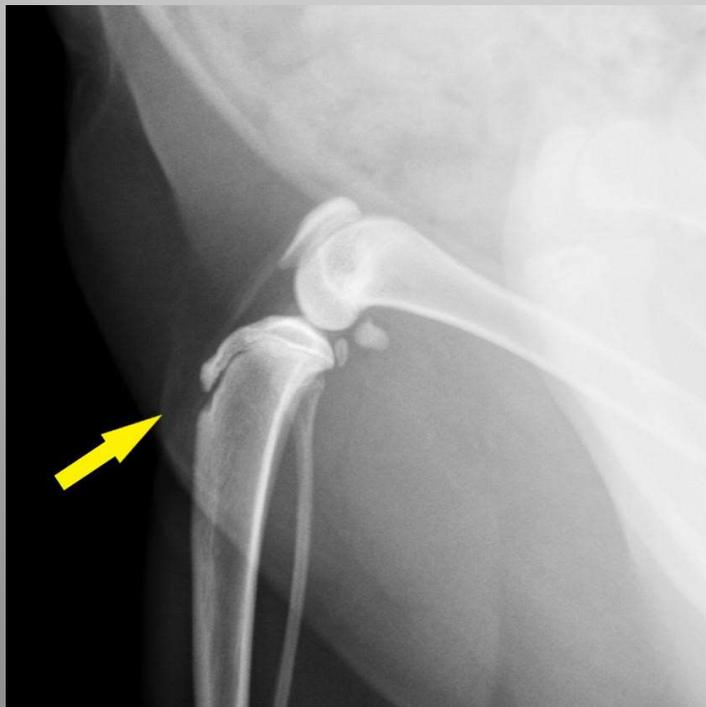
CANIDS ARAGO: X-RAY IMAGES



ARAGO



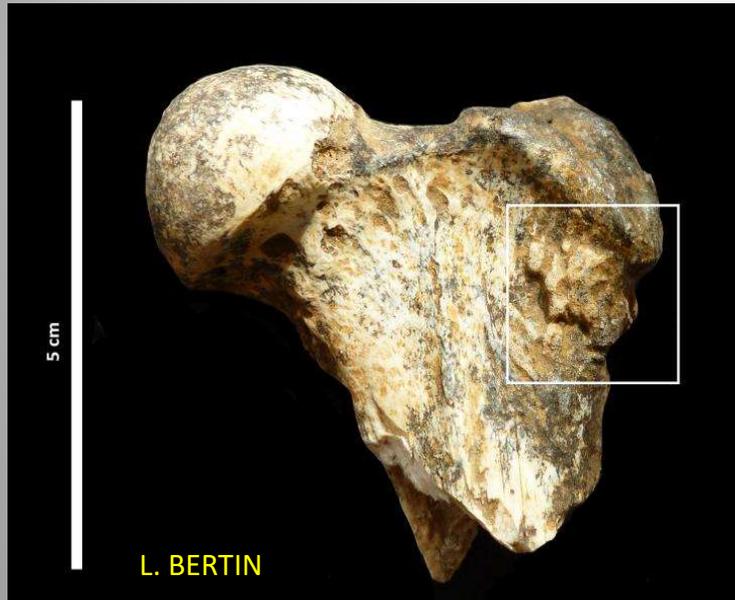
ACTUAL



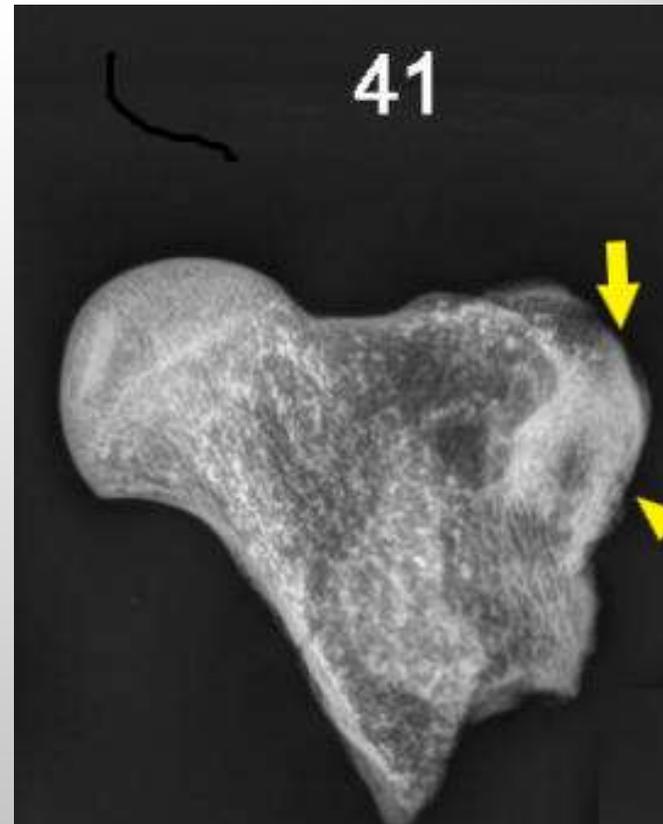
We can see this type of image which corresponds to a partial calcification of the growth plate but which does not necessarily lead to a pathology...



CANIDS ARAGO: X-RAY IMAGES



ARAGO



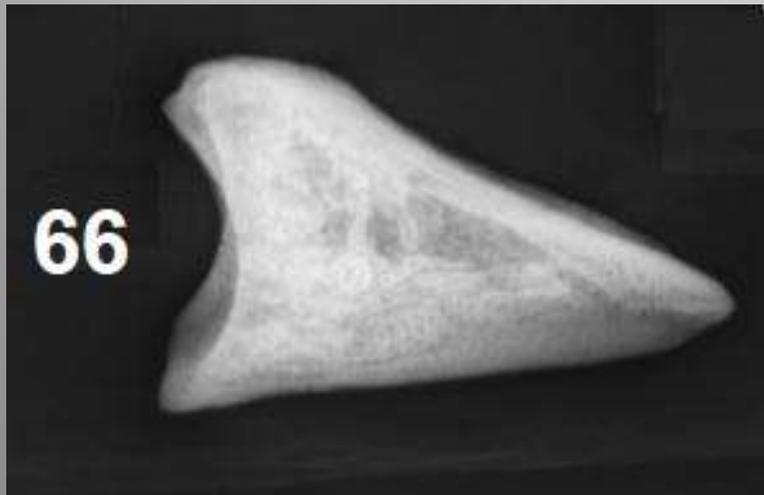
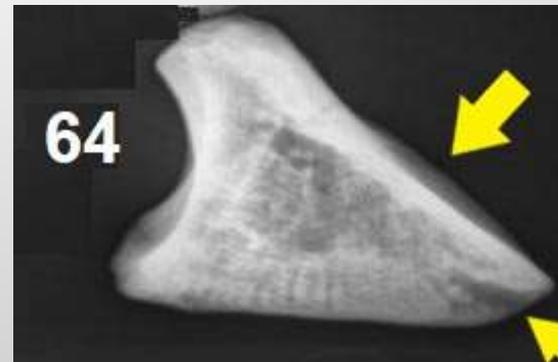
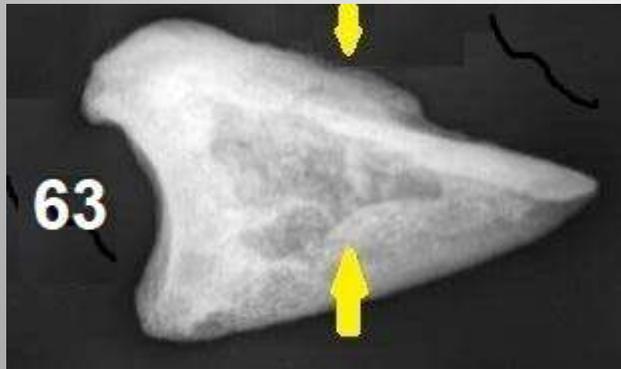
But in this case we can see a densification at the level of the greater trochanter which underlines a suffering of the bone and a chronic osteitis with perhaps an entesopathy



ACTUAL



CERVIDS ARAGO: X-RAY IMAGES



Even if macroscopic changes are visible, the X-ray reveals osteomyelitis lesions on these two deer phalanges, probably due to foot abscesses.

Consequences: significant lameness which can even lead to the limb being unable to bear weight, making the animal an easier prey for potential predators



Conclusion

METHODOLOGICAL CONTRIBUTION

Systematic application of digital radiography (443) and CT-scan (179) to pathological remains from Clos d'Ugnac, La Sabatière and Arago Cave, systematically compared to healthy bone from the same site, or to a current bone belonging to the same species, to show that :

- Radiography is essential to confirm, refine or refute the macroscopic analysis of the bone remains.
- Radiography provides little additional information to the macroscopic analysis of the dental remains.
- CT-scan does not bring additional elements to the radiography, except for particular cases, like tumors.

CONTRIBUTION OF ANIMAL PALEOPATHOLOGY

It is essential to:

- **Know the causes of the anomalies and the consequences on animal life**



To approach complementary and essential problematics to the taphonomic and archaeozoological studies.

- **Study a complete bone assembly (not a case study)**



Identify new anomalies → contribution of additional data → **Complete vision of the health status of individuals**

E.g.: the recent study of 861 Wolf and Cuon remains from the Arago Cave has made it possible to multiply by 3 the number of dental and bone lesions and thus to obtain new results (article in progress)

