# Intrasite spatial analysis based in a Geographic Information System and apply to extensive Middle Palaeolithic open-air sites in northern France. The example of Caours (Somme, France).

Gwénaëlle Moreau [1], Jean-Luc Locht [2,3], Marylène Patou-Mathis [4] and Patrick Auguste [5]

1: University of Liège (Ulg, Belgium), 2: Physical geography Laboratory (LGP, France), 3 : National Institute of Preventive Archaeological Research, (Inrap, France) 4 : Histoire Naturelle de l'Homme Préhistorique (HNHP), CNRS : UMR 7194,5 : Evolution-Ecologie-Paléontologie (EEP), Université des sciences et technologies de Lille 1, CNRS : UMR 8198

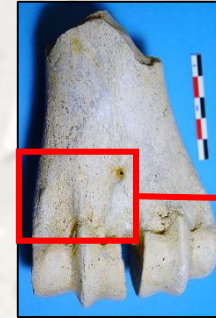# Middle Palaeolithic open air sites in **northern France**
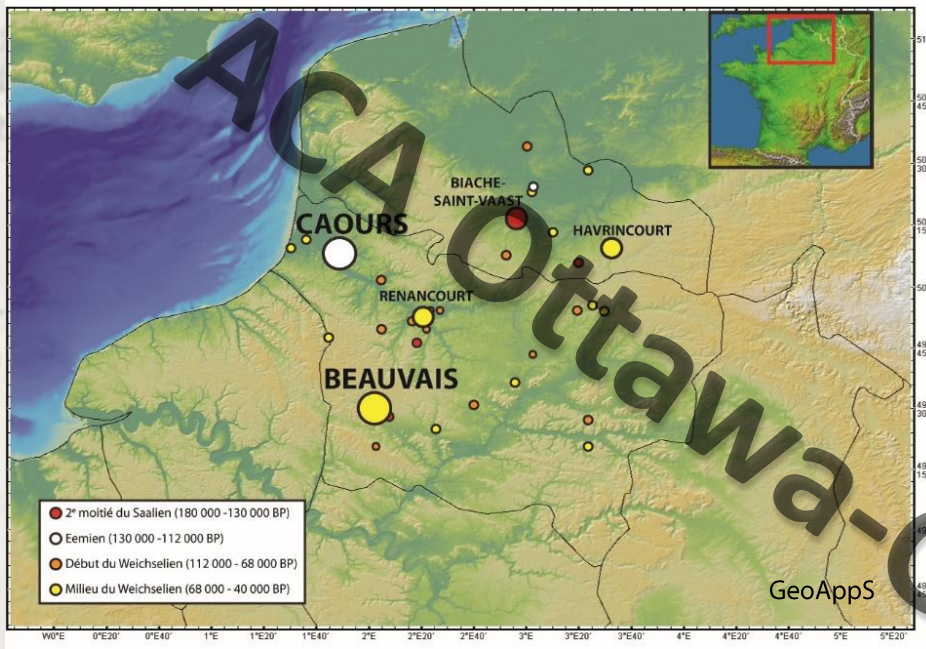
- ➢ Excellent Chronostratigraphic framework

- ➢ Different:
  - Biotopes
  - Cultures
  - Behaviours

Locht *et al.*, 2015
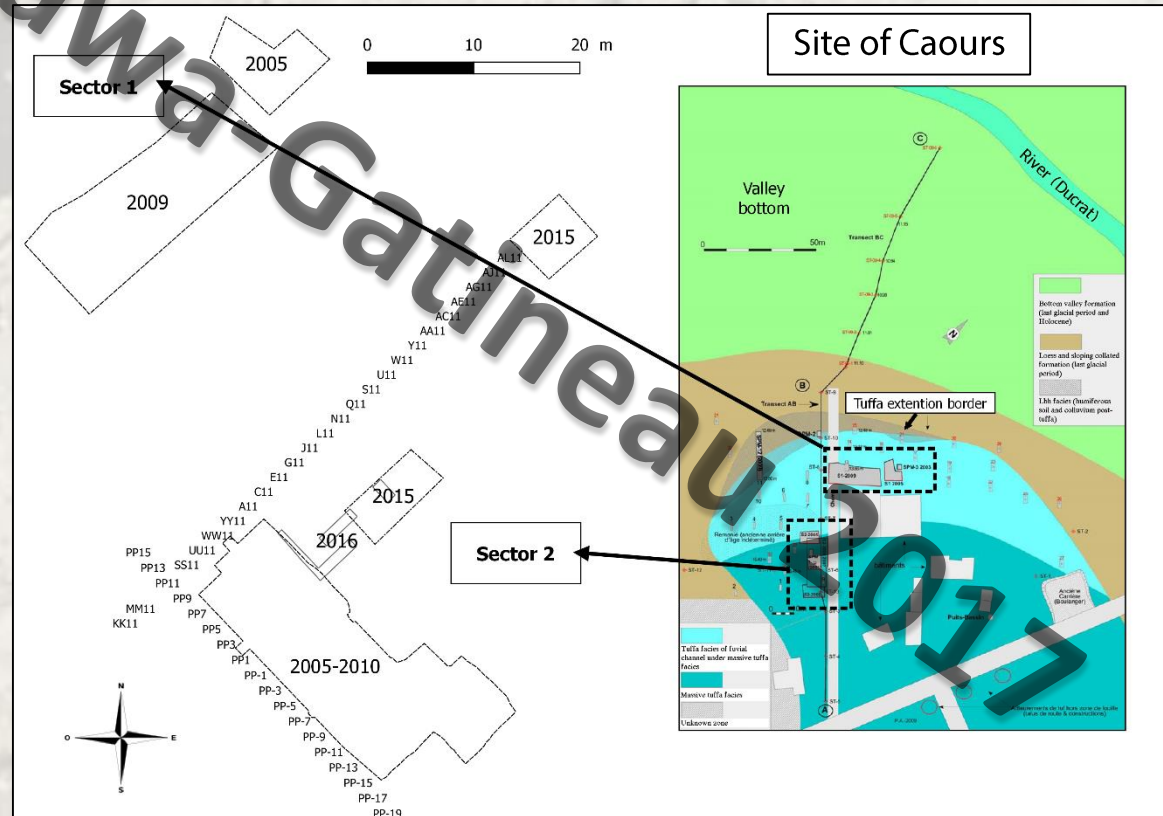

* Sites with radiometric datations
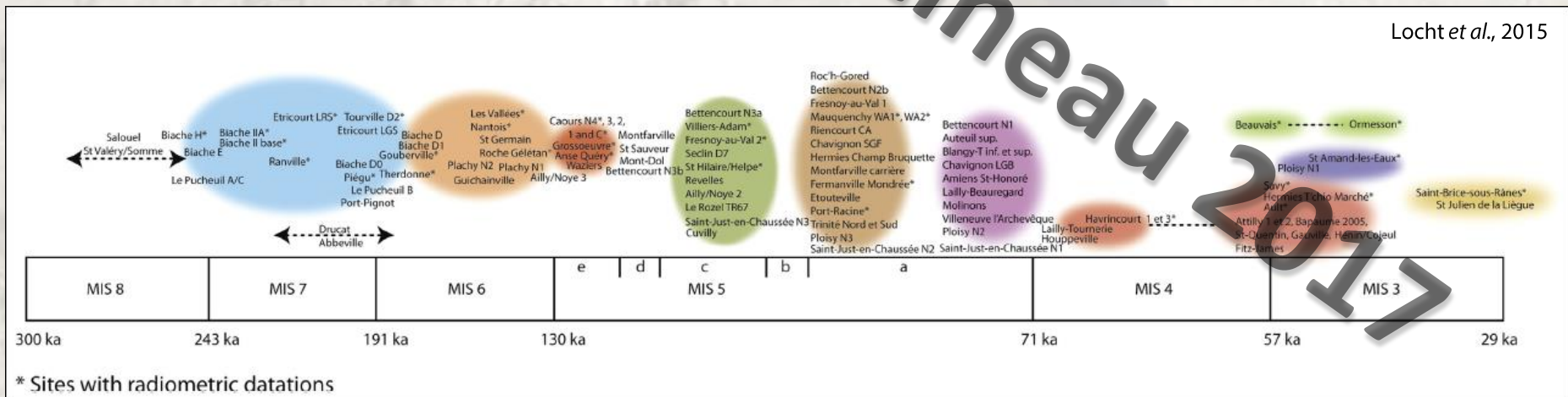
Middle Palaeolithic **open air sites** in northern France

> Exceptional preservation, superficies and faunal remains abundance :

- Sedimentation : calcareous, fine, quick
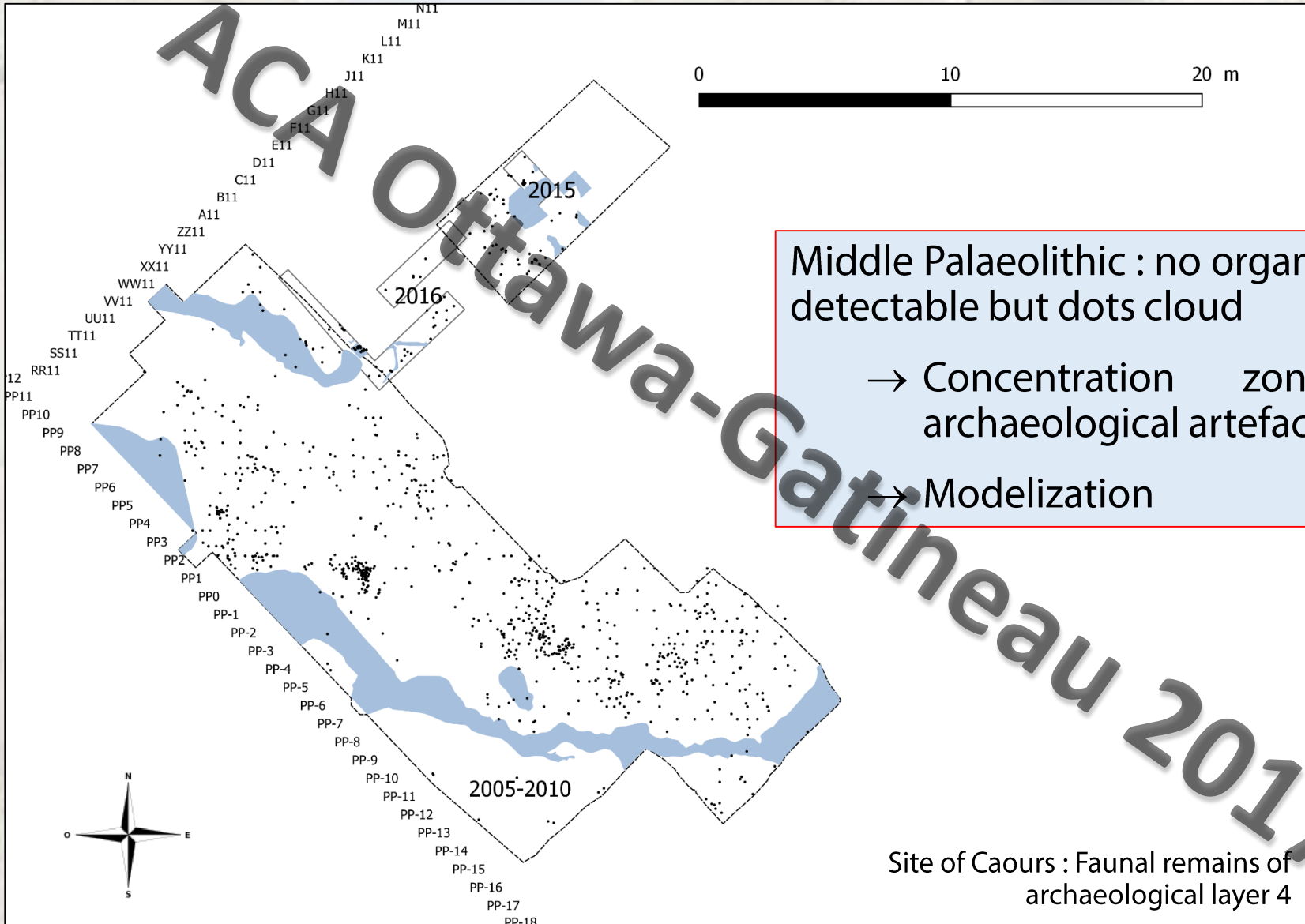- No alteration of layers

Cut marks on Aurochs bone
(Photos: P. Auguste)

Aurochs mandible and fractured bones (Photos: J.L. Locht)

Site of Caours

Middle Palaeolithic open air sites in northern France

Middle Palaeolithic : no organisation detectable but dots cloud

→ Concentration zone of archaeological artefact

→ Modelization

Site of Caours : Faunal remains of archaeological layer 4

Activity area : different **spatial** data

Screenshot: Computer Assisted Drawing

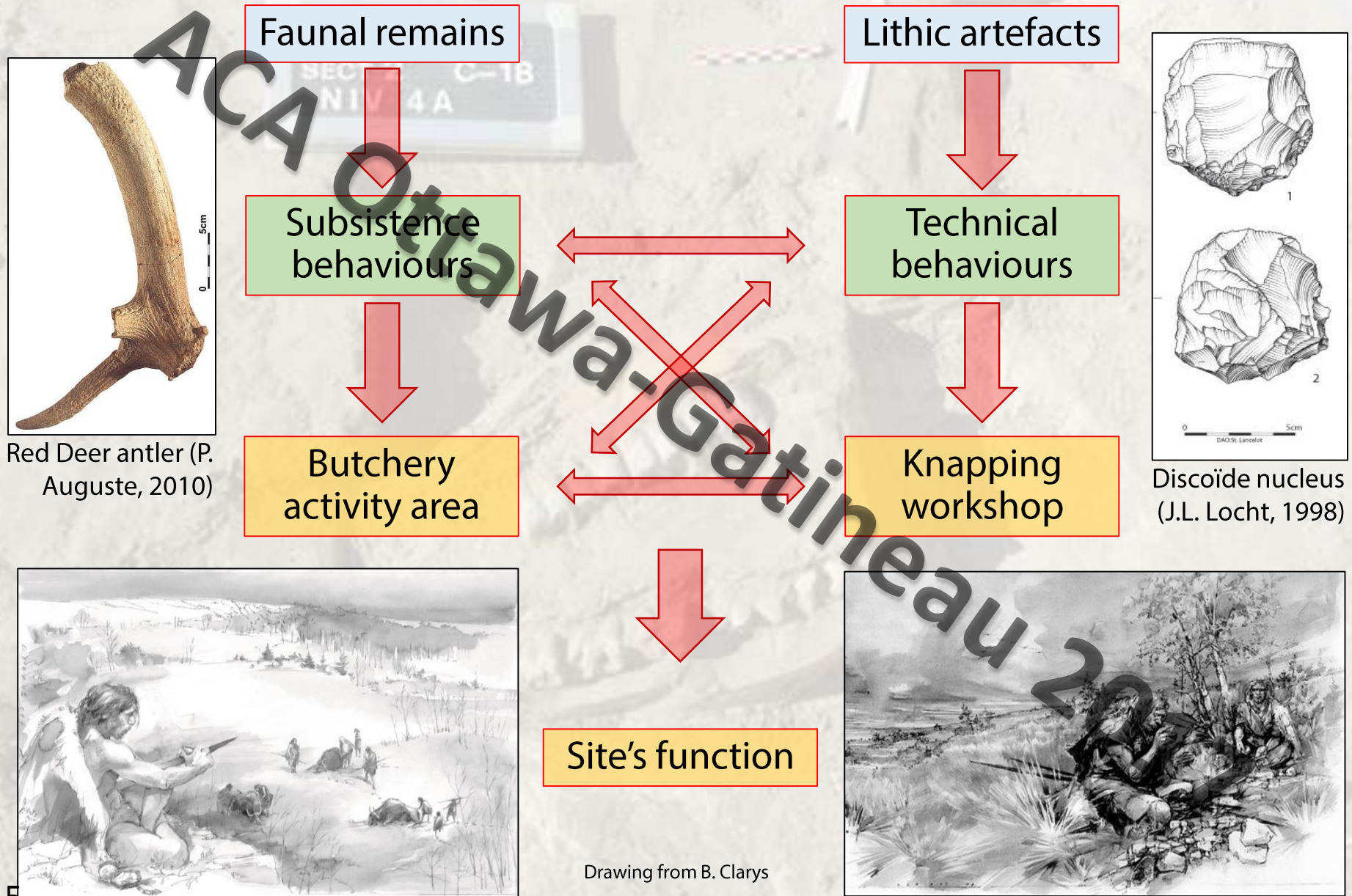> ➢ Quantity and density : problem of fragmentation and combustion

> ➢ Dots cloud VS Polygons

> ➢ Absolute coordinates or not

Bones combustion experiment
(Hérisson et al., 2013)

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Activity area : different **archaeological** data

Faunal remains → Subsistence behaviours ↔ Technical behaviours ← Lithic artefacts

Subsistence behaviours → Butchery activity area

Technical behaviours → Knapping workshop

Butchery activity area ↔ Knapping workshop

→ Site's function

Red Deer antler (P. Auguste, 2010)

Discoïde nucleus (J.L. Locht, 1998)

Drawing from B. Clarys

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Activity area : different **archaeozoological** data

Cranial skeleton
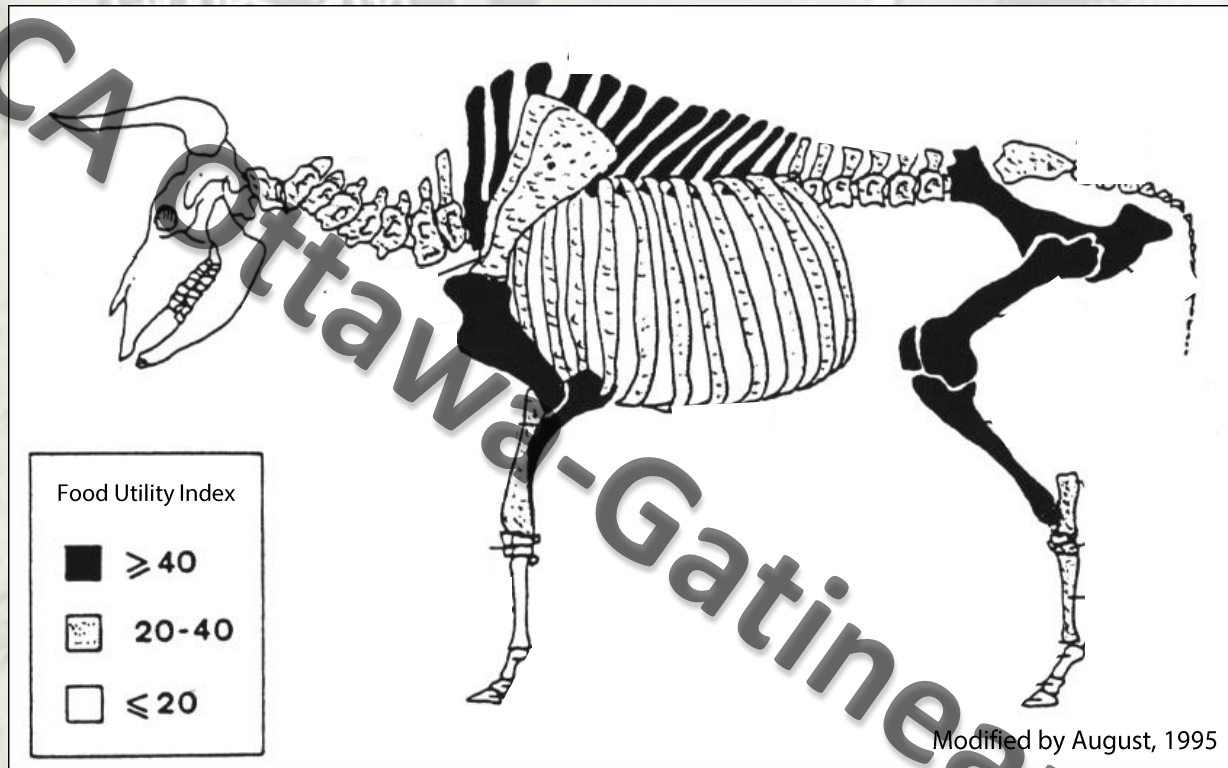
Axial skeleton

Limbs

Autopods

Modified by August, 1995
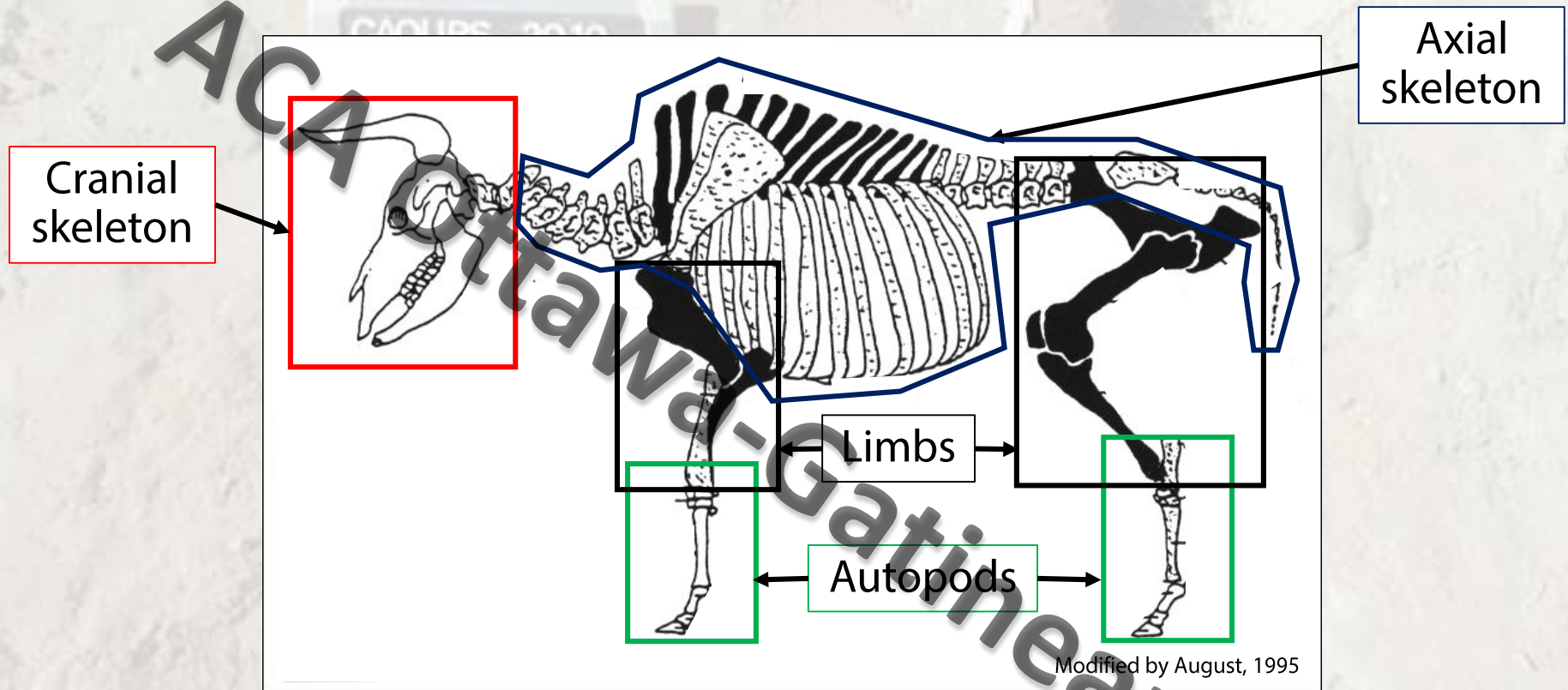
- ➢ Interpretative framework
- ➢ 6 anatomical groups

Specific butchery activity area

Activity area : different **archaeozoological** data

Food Utility Index

■ ≥ 40

▨ 20 - 40

□ ≤ 20

Modified by August, 1995

- ➤ Interpretative framework
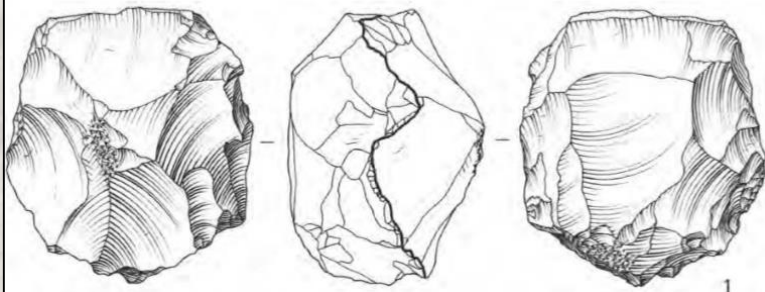- ➤ 3 groups by Food Utility Index

➡ Specific butchery activity area

The site of **Caours** (level 4)

- ➤ Excavation area: 680 m^2
- ➤ 4 archaeological levels

- ➤ Three main species → Red Deer, Roe deer, Aurochs
- ➤ Burned bones

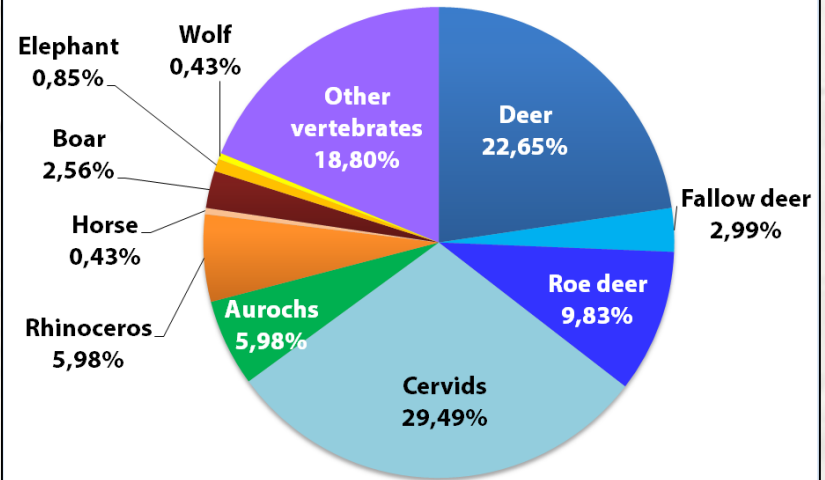- ➤ Five lithic series associated with fauna
- ➤ Discoid knapping
- ➤ Unretouched tools (J.L. Locht)

Level 4: 1499 faunal remains

Elephant 0,85%
Wolf 0,43%
Boar 2,56%
Horse 0,43%
Rhinoceros 5,98%
Aurochs 5,98%
Other vertebrates 18,80%
Deer 22,65%
Fallow deer 2,99%
Roe deer 9,83%
Cervids 29,49%

From Auguste's data

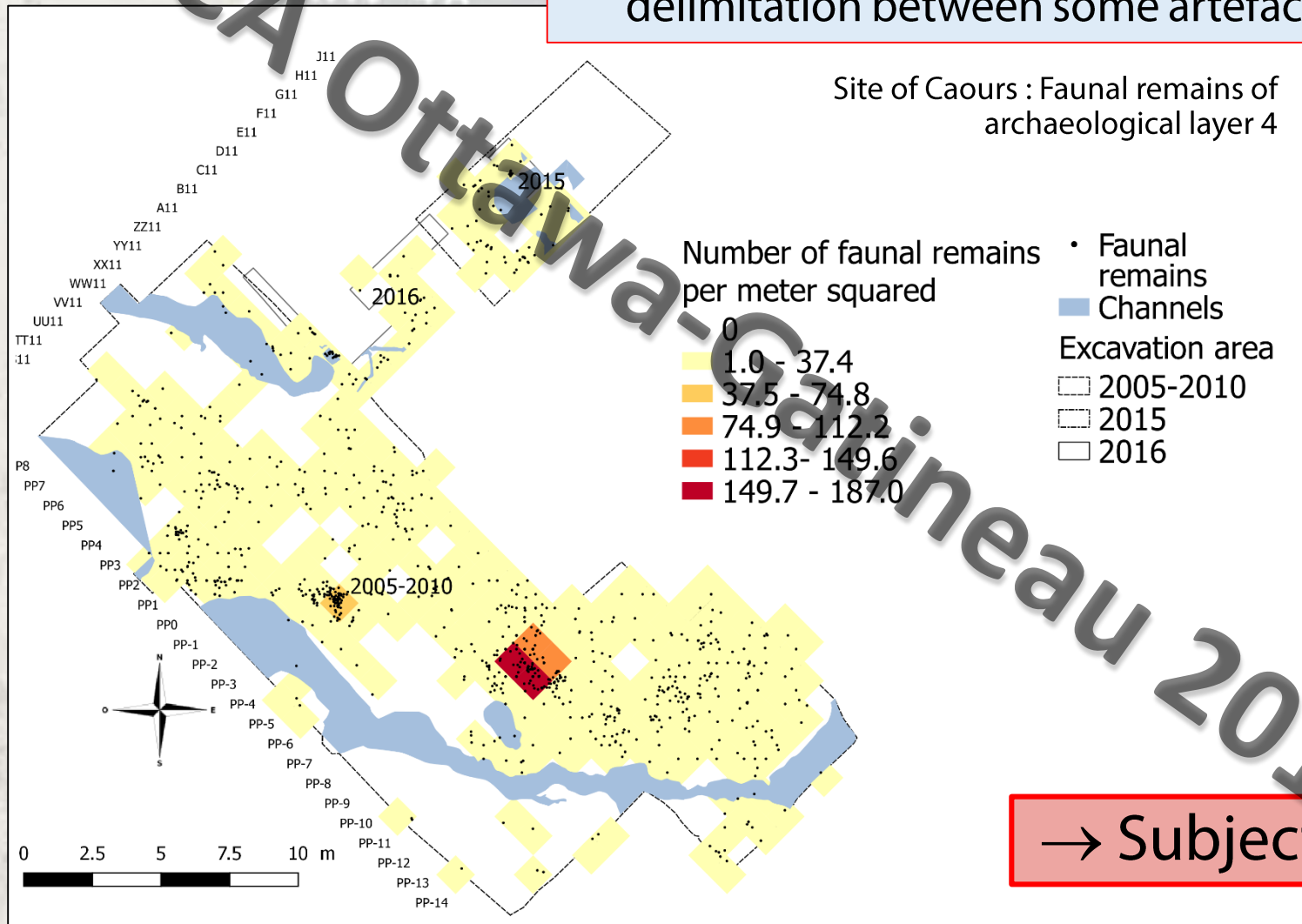Level 4: 672 lithic artefacts

Antoine *et al.*, 2006

Photos from P. Auguste

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Activity area : Mesh analysis

- ➤ Effective per mesh
- ➤ Arbitrary subdivision → arbitrary spatial delimitation between some artefacts

Site of Caours : Faunal remains of archaeological layer 4

Number of faunal remains per meter squared

- 0
- 1.0 - 37.4
- 37.5 - 74.8
- 74.9 - 112.2
- 112.3- 149.6
- 149.7 - 187.0

- • Faunal remains
- Channels

Excavation area
- 2005-2010
- 2015
- 2016

→ Subjectivity

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Activity area : K-mean Clustering
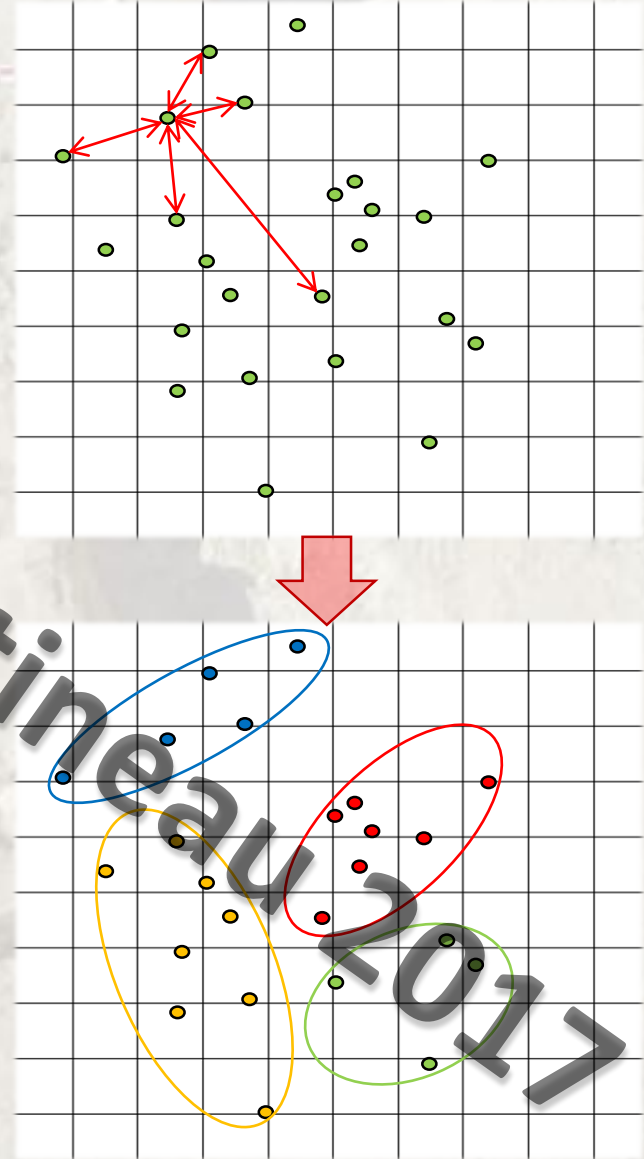
Method:

➢ Classification of raw data per distance between artefacts
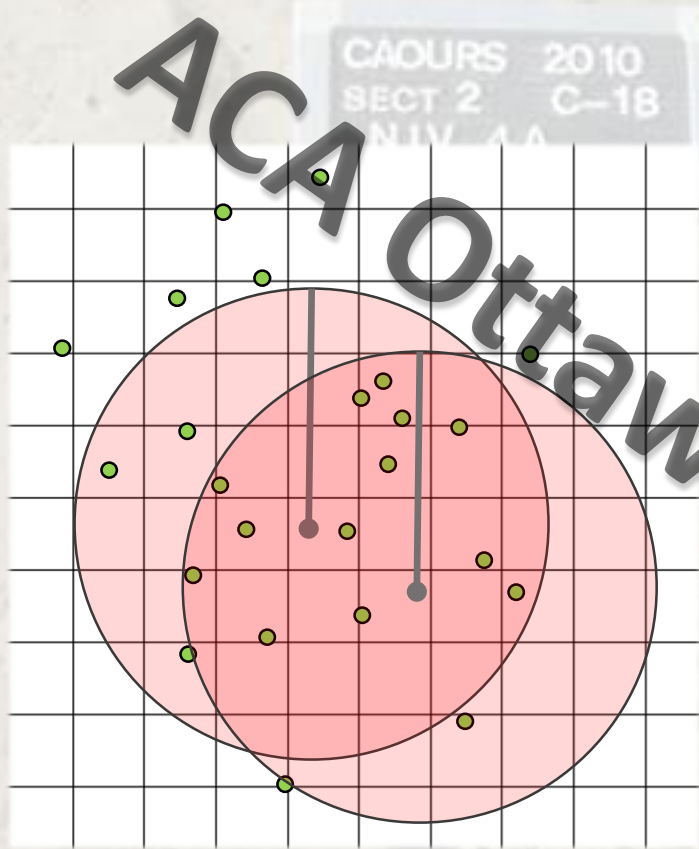
Results:

➢ Spatial organisation as concentration zones

➢ Number of concentration zones (Cluster)

Limits:

➢ Can't define the perimeter of concentration zones and their density

Activity area : Kernel Density Estimation

Method:

➢ Modelization: calculate a density map based on artefacts density and distance between artefacts
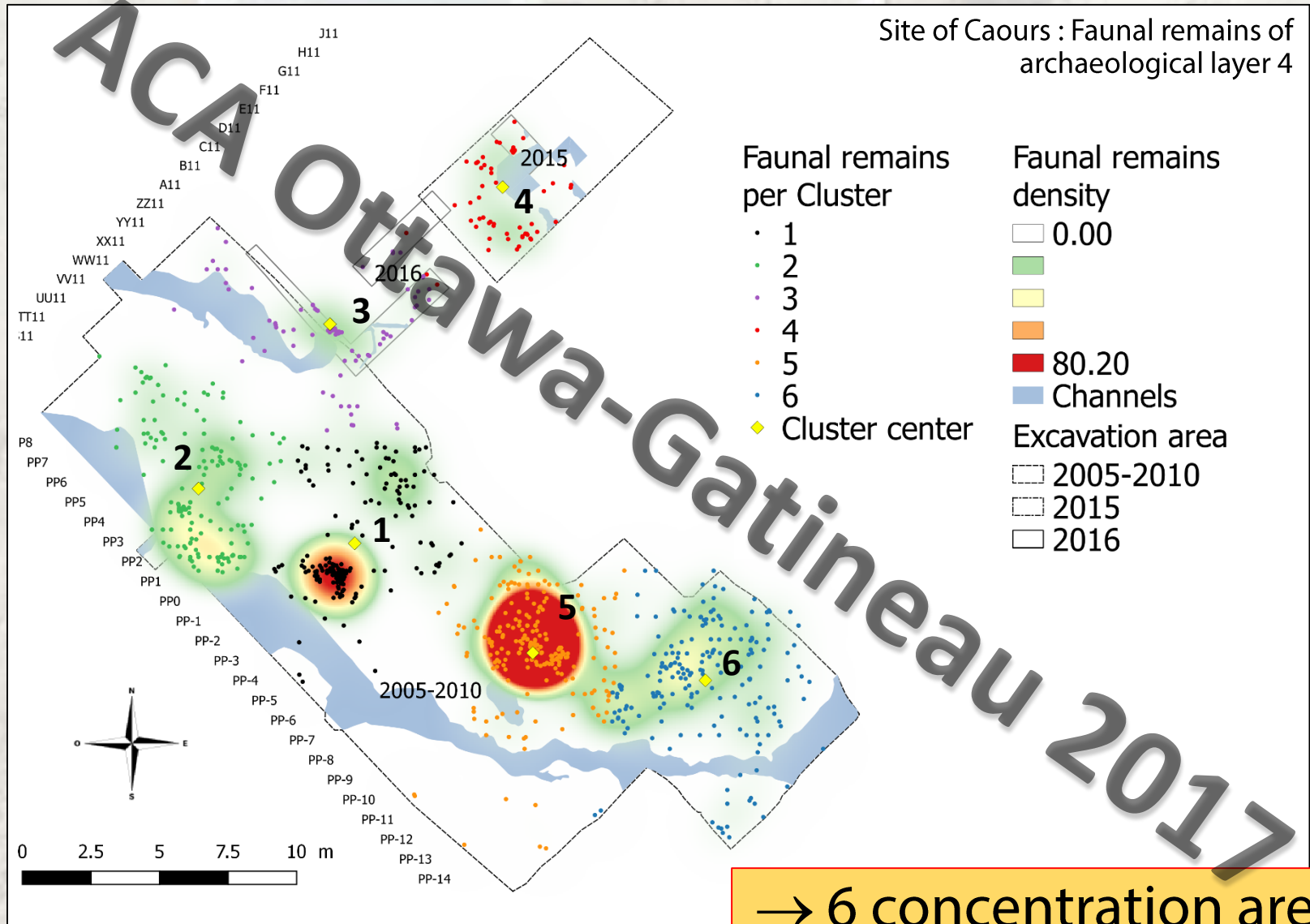
Results:

➢ Model of distribution of concentration zones

➢ Density of concentration zones

Limits:

➢ Not a proof of the existence of the spatial organisation

➢ Research bandwidth to fixe

Legend:
- Raster cell
- Artefact
- Bandwidth

Activity area : Kernel Density Estimation combine with K-mean Clustering

Site of Caours : Faunal remains of archaeological layer 4

→ 6 concentration areas

Activity area : Mesh analysis

Site of Caours : Faunal remains of archaeological layer 4

Number of faunal remains per meter squared
- 0
- 1.0 - 37.4
- 37.5 - 74.8
- 74.9 - 112.2
- 112.3 - 149.6
- 149.7 - 187.0

- Faunal remains
- Channels

Excavation area
- 2005-2010
- 2015
- 2016

→ Subjectivity

Activity area : Kernel Density Estimation combine with K-mean Clustering

Site of Caours : Faunal remains of archaeological layer 4

Faunal remains per Cluster
- 1
- 2
- 3
- 4
- 5
- 6
- Cluster center

Faunal remains density
- 0.00
- 80.20
- Channels

Excavation area
- 2005-2010
- 2015
- 2016

→ Objectivity

Specific activity area

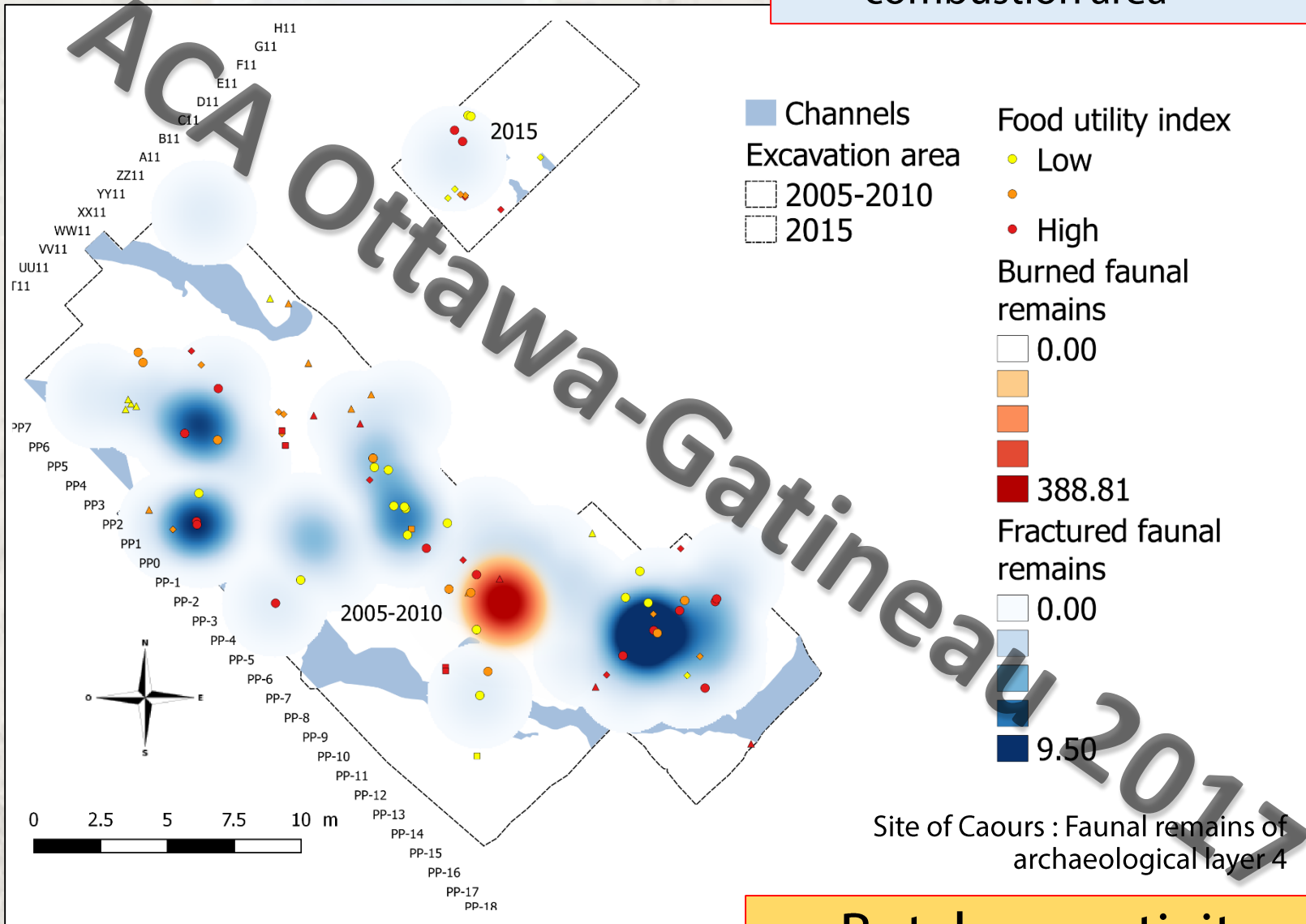Site of Caours : Faunal remains of archaeological layer 4

➢ Concentration zone of :
- Burned faunal remains
- Fractured faunal remains

→ Human activity area

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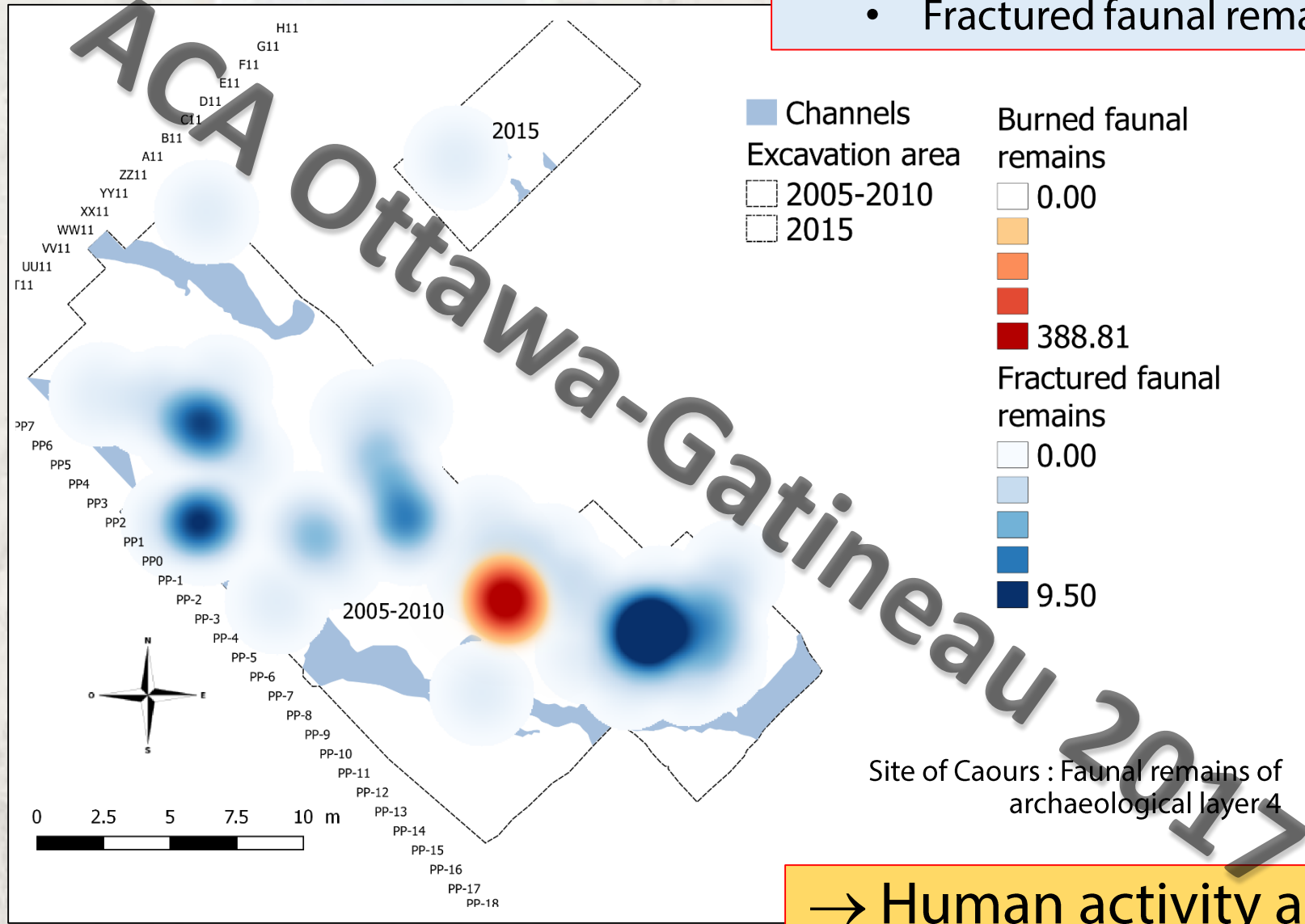
Specific activity area

➢ Remains with high food utility near fracturation and combustion area
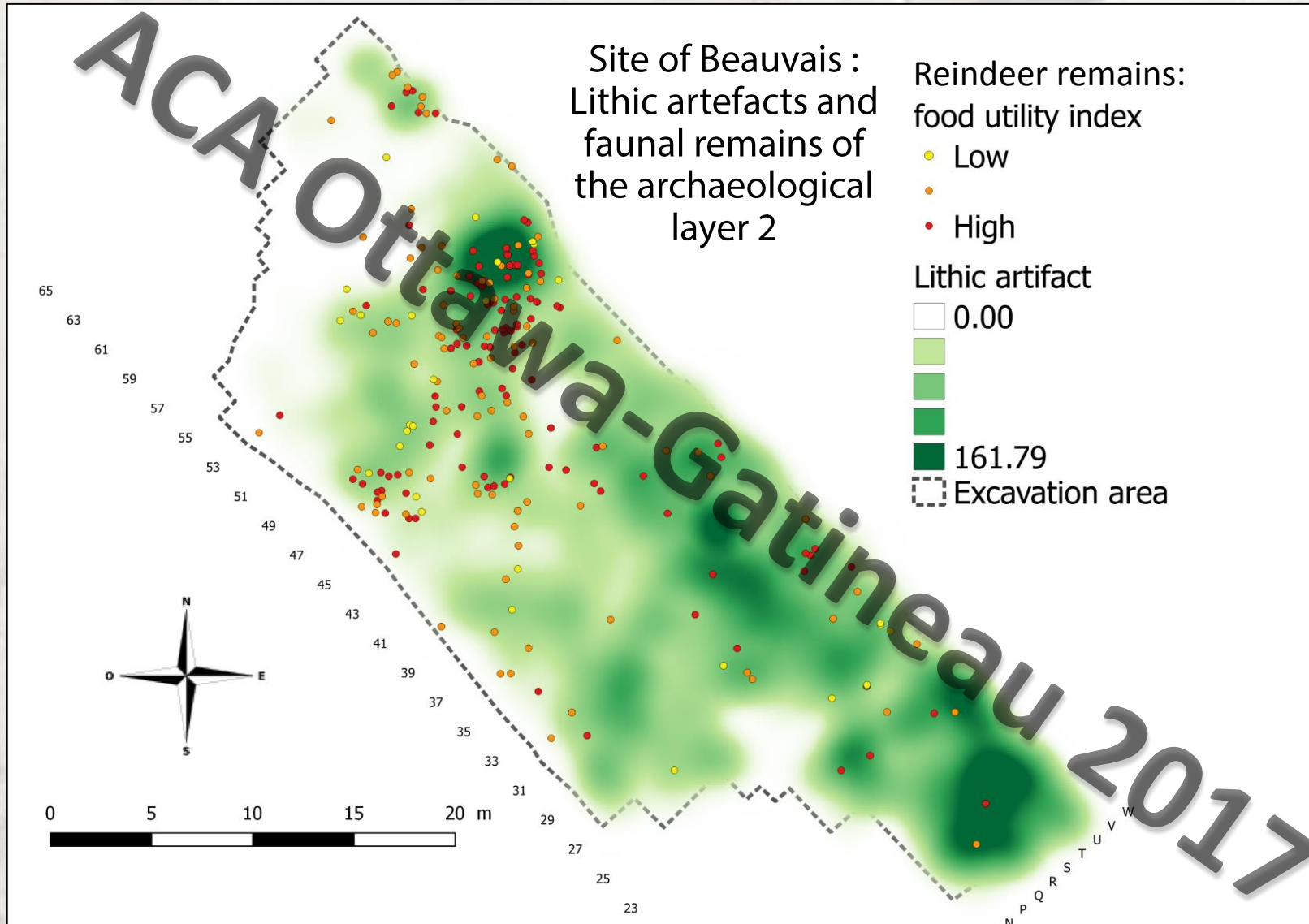
Channels
Excavation area
☐ 2005-2010
☐ 2015

Food utility index
○ Low
●
● High

Burned faunal remains
0.00
388.81

Fractured faunal remains
0.00
9.50

Site of Caours : Faunal remains of archaeological layer 4

→ Butchery activity area

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Conclusion

Mesh analysis →

K-mean Clustering
- Determine number of cluster

+

Kernel Density Estimation
- Fracturation
- Combustion
- Food Utility

↓

Highlight :
→ Human activity area
→ Butchery activity area

↓

Confirm :
→ Butchery site

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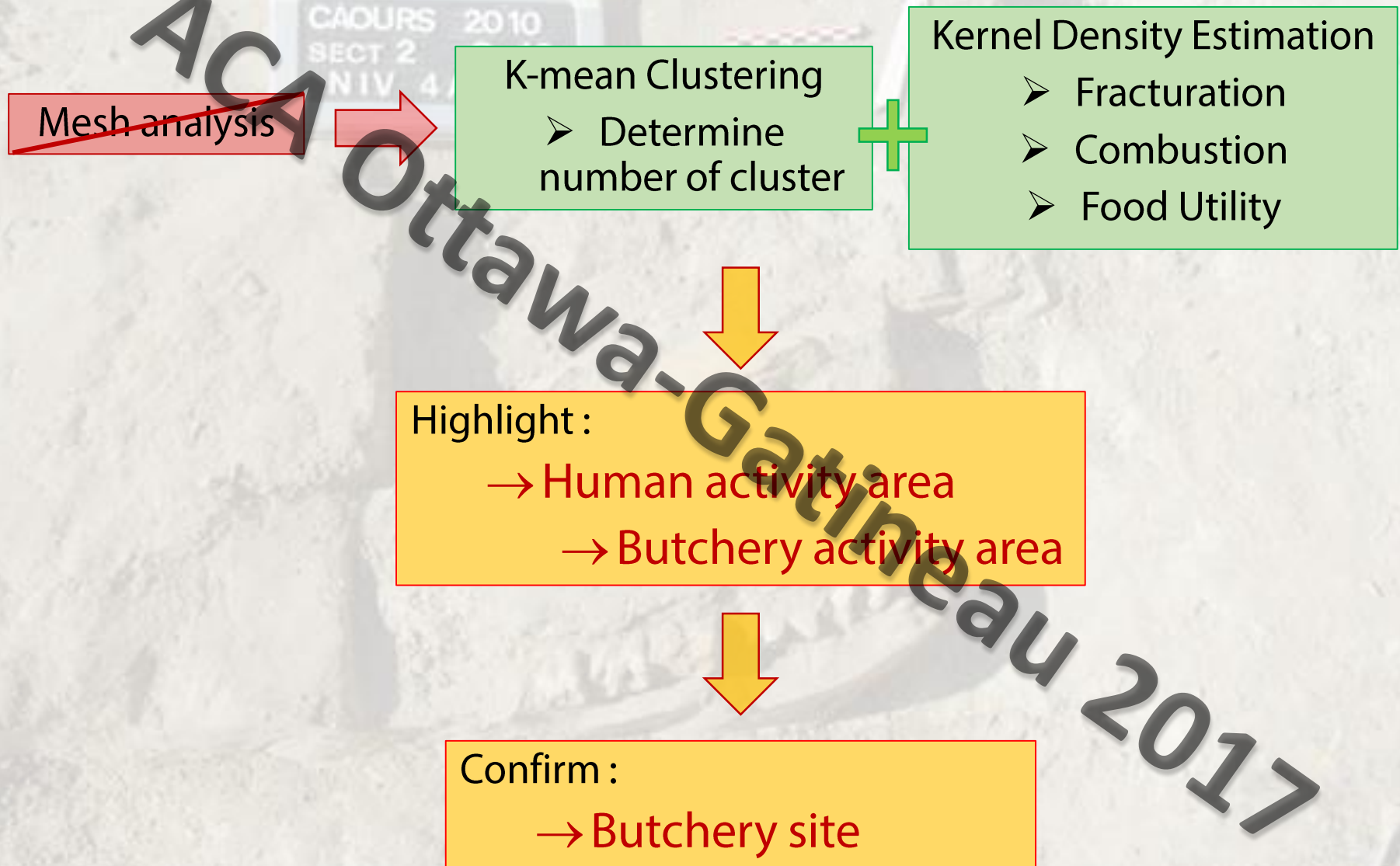
Next steps: distribution of lithic artefacts

Site of Beauvais : Lithic artefacts and faunal remains of the archaeological layer 2

Reindeer remains: food utility index
- Low
- High

Lithic artifact
0.00
161.79
Excavation area

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Next steps: lithic artefacts refitting

Site of Beauvais : Lithic artefacts and faunal remains of the archaeological layer 2

Number of faunal remains with fracturation traces per meter squared
- 0.00
- 4.64

Number of faunal remains with combustion traces per meter squared
- 0.00
- 81.22

Excavation area

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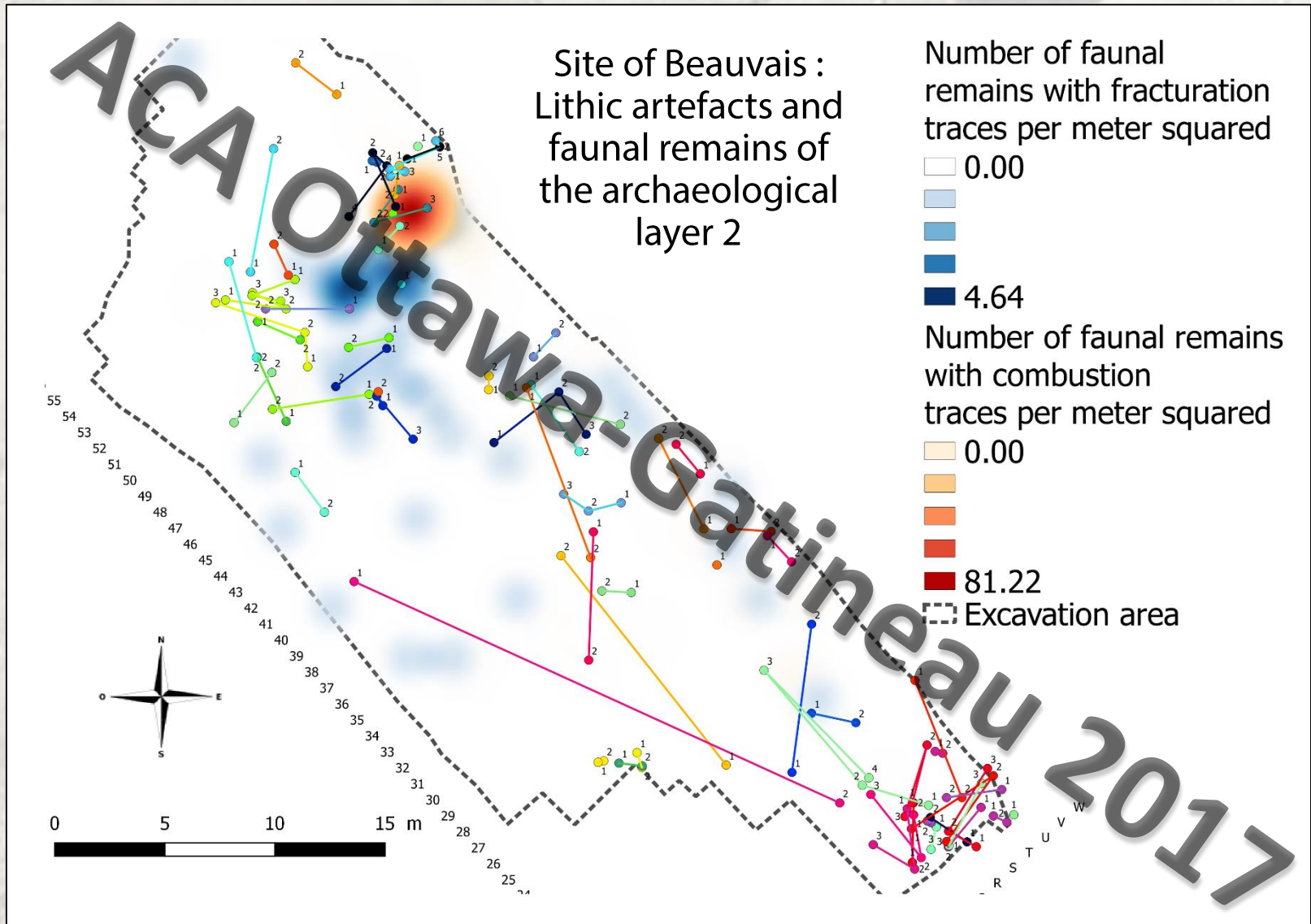
Future work

System

- Fragmentation
  Prey processing

- Knapping workshop

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Precise site function

↓

Characterize Neanderthal groups

Thank you for your attention

Site of Caours (2008)