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).

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Middle Palaeolithic open air sites in northern France

- Excellent Chronostratigraphic framework
- Different:
  - Biotopes
  - Cultures
  - Behaviours

<table>
<thead>
<tr>
<th>MIS 8</th>
<th>MIS 7</th>
<th>MIS 6</th>
<th>MIS 5</th>
<th>MIS 4</th>
<th>MIS 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 ka</td>
<td>243 ka</td>
<td>191 ka</td>
<td>130 ka</td>
<td>71 ka</td>
<td>57 ka</td>
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<tr>
<td>29 ka</td>
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</tbody>
</table>

* 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. Lochot)
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

- Quantity and density: problem of fragmentation and combustion

- Dots cloud VS Polygons

- Absolute coordinates or not

Screenshot: Computer Assisted Drawing

Bones combustion experiment (Hérisson et al., 2013)
Activity area: different archaeological data

Red Deer antler (P. Auguste, 2010)

Faunal remains
Subsistence behaviours

Butchery activity area

Lithic artefacts
Technical behaviours

Knapping workshop

Site’s function

Drawing from B. Clarys

Discoïde nucleus (J.L. Locht, 1998)
Activity area: different archaeozoological data

- Cranial skeleton
- Axial skeleton
- Limbs
- Autopods

- Interpretative framework
- 6 anatomical groups

Specific butchery activity area

Modified by August, 1995
Activity area: different **archaeozoological** data

- Interpretative framework
- 3 groups by Food Utility Index

Specific butchery activity area

Food Utility Index

- ≥ 40
- 20-40
- ≤ 20

Modified by August, 1995
The site of **Caours** (level 4)

- Excavation area: **680 m²**
- 4 archaeological levels
- Three main species → **Red Deer, Roe deer, Aurochs**
- B**urned bones**

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

**Level 4: 1499 faunal remains**

- **Deer** 22.65%
- **Roe deer** 9.83%
- **Cervids** 29.49%
- **Other vertebrates** 18.80%
- **Rhinoceros** 5.98%
- **Aurochs** 5.98%
- **Boar** 2.56%
- **Wolf** 0.43%
- **Elephant** 0.85%

**Level 4: 672 lithic artefacts**

*Photos from P. Auguste*

*Antoine et al., 2006*
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
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
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
- 0.40
- 0.80
- 0.80
- 0.80
- 0.80

Excavation area
- 2005-2010
- 2015
- 2016

→ 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
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- Faunal remains
- Channels

Excavation area:
- 2005-2010
- 2015
- 2016
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
Excavation area
2005-2010
2015
2016

→ Objectivity
Specific activity area

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

Site of Caours: Faunal remains of archaeological layer 4

→ Human 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
Fractured faunal remains
☐ 0.00

388.81
9.50

Site of Caours: Faunal remains of archaeological layer 4

→ Butchery activity area
Conclusion

Mesh analysis

K-mean Clustering
  ➢ Determine number of cluster

Kernel Density Estimation
  ➢ Fracturation
  ➢ Combustion
  ➢ Food Utility

Highlight:
  ➔ Human activity area
  ➔ Butchery activity area
  ➔ Combustion zone

Confirm:
  ➔ Butchery site
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
Next steps: lithic artefacts refitting

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

Excavation area

<table>
<thead>
<tr>
<th>81.22</th>
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</thead>
<tbody>
<tr>
<td>Number of faunal remains with combustion traces per meter squared</td>
</tr>
<tr>
<td>Number of faunal remains with fracturation traces per meter squared</td>
</tr>
<tr>
<td>Number of artefacts per layer</td>
</tr>
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</table>
Future work

System

- Fragmentation
- Prey processing

Knapping workshop

Precise site function

Characterize Neanderthal groups
Thank you for your attention

Site of Caours (2008)

Thanks to Jean-Luc Locht, Marylène Patou-Mathis, Patrick Auguste et Noémie Sévêque for give us access to numerous data of this two sites.

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