Importance of using Geographic Information System for extensive Middle Palaeolithic open air sites in northern France. The example of Caours (Somme, France) and Beauvais (Oise, France).

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Introduction : why Middle Palaeolithic open air sites in northern France ?

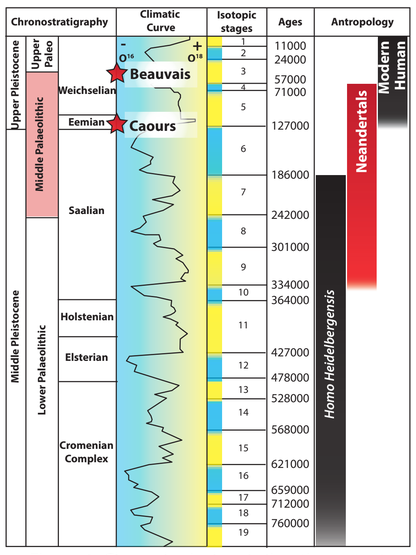


Figure 1: Chronological and climatic context (modified from [1])

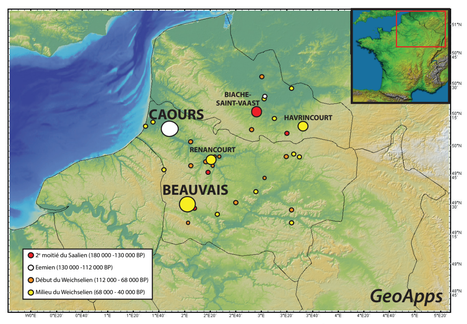


Figure 2: Geographic distribution of main Middle Palaeolithic open air sites in northern France.

In **Northern France**, during the Middle Palaeolithic, the human settlement was difficult because of the alternation between **glacial and interglacial periods [2]**. **Neandertal** had to struggle with important biotope and climate changes (Fig.1). His answer was an important **mobility [3]**, making regional study problematic.

But thanks to the work of Jean-Luc Locht, Pierre Antoine and the team, the **chronostratigraphic framework** of this region is **excellent and well describe** with an important number of sites on a large time and geographic scale [2] (Fig.2).

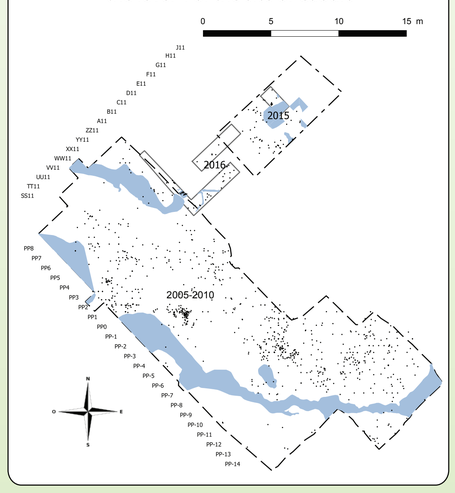
Most of the important sites in this region are **open air sites**. Some of them show an exeptional preservertion of archaeological levels in terms of **area and number of artefacts** (Fig. 3). Moreover, thanks to a fine **calcareous sedimentation**, the sites of **Caours** and **Beauvais**, at the center of our study, have **important faunal assemblages** - analysed by Patou-Mathis [4] and Auguste [5].

When a **Middle Palaeolithic** site is excavated, most of the time, we can't directly see structures. Like on the fourth figure we only have a **dots clound with artefact concentration area**. It's why we need Geographic Information System (**GIS**) to go further, to **modelization** method.

	Caours	Beauvais
Isotopique stage	Eemian	Wechselian
Climate	Interglacial	Glacial
Environment	Wooded	Steppe
Excavation area	680 m²	760 m²
Number of archaeological levels well preserved	5	2
Number of faunal remains	12 152	1 325
Number of lithic artefact	2 780	13 283

Figure 3: Comparison table between the sites of Caours and Beauvais (From Locht, Patou-Mathis [4] and Auguste [5] data)

Figure 4: Distribution of faunal remains from the level 4 of the site of Caours



Different archaeological and geographical data

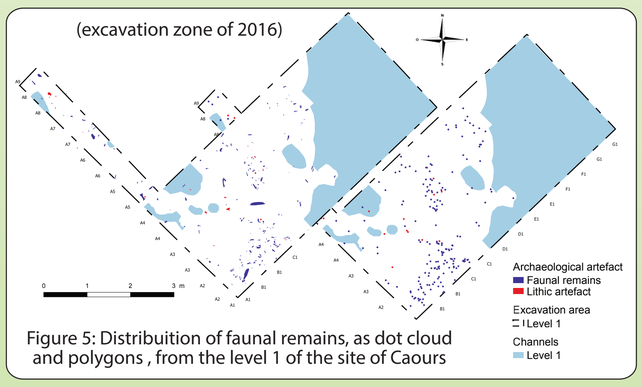


Figure 5: Distribuition of faunal remains, as dot cloud and polygons , from the level 1 of the site of Caours

- We can't have **absolute coordinate** for every small artefact, specially burned and fractured one, so we have to deal with it (Fig.5).
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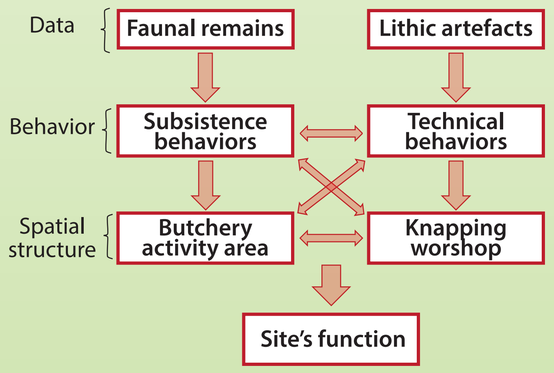
Different kind of artefact bring informations about different aspects of **Neandertal behaviour.**



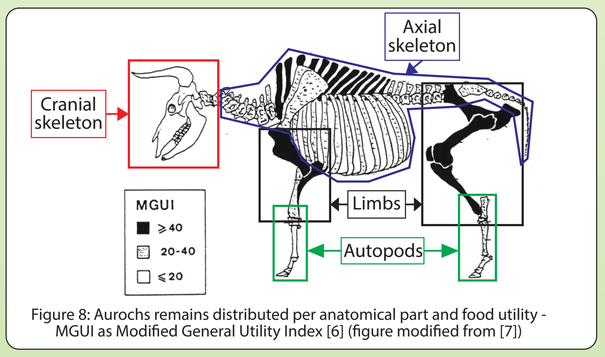


Figure 8: Aurochs remains distributed per anatomical part and food utility - MGUI as Modified General Utility Index [6] (figure modified from [7])

Interpretative framework: with faunal remains distributed per **anatomical part and food utility** we can define **specific butchery area** (Fig.8).

Spatial analysis protocol

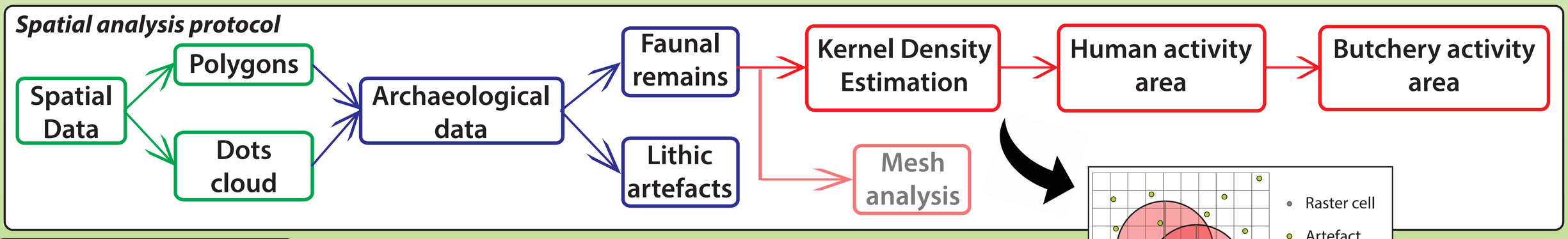
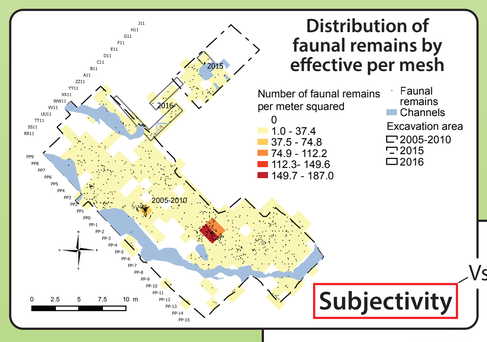


Figure 8: Kernel Density Estimation method



This method, commonly used by archaeologists, concist in a count per mesh of the number of artefact [8].
But there are some problems with it, like arbitrary choice of analysis mesh and subdivision by «invisible wall» between some artefact.

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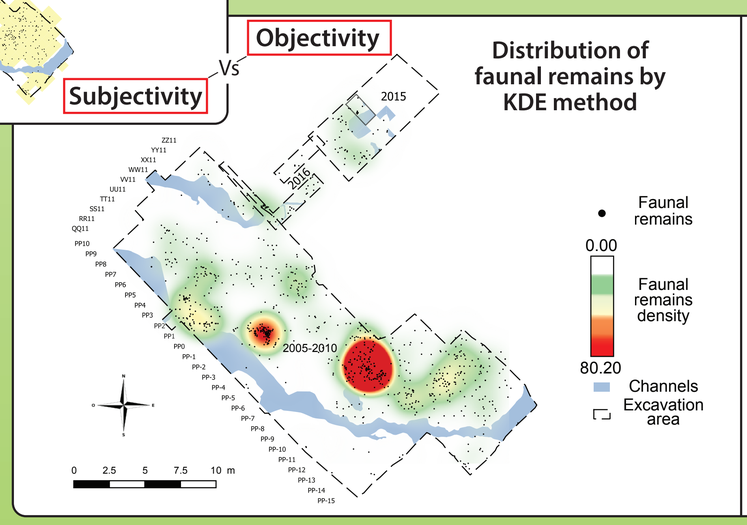
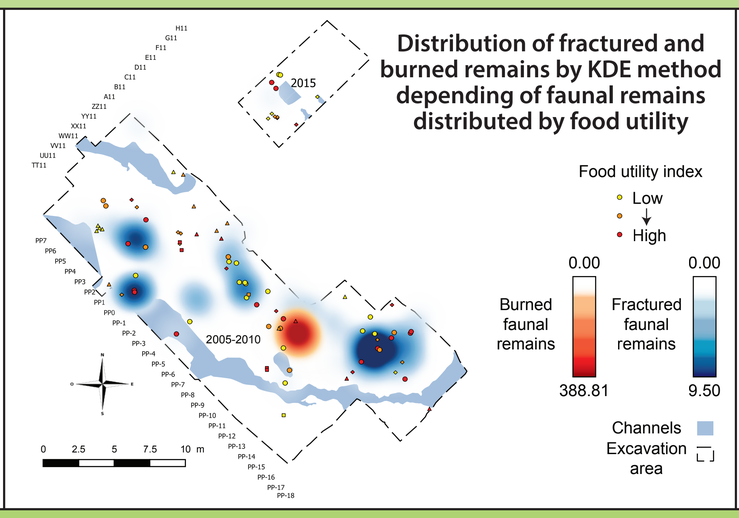
The **Kernel Density Estimation** is a **quantitative** method calculating the artifact density too. But it conciders also **distances between every artefact** [9] (Fig. 8).
In that way it takes into account the **spatiale relationship** between artefact.

Site of Caours: layer 4

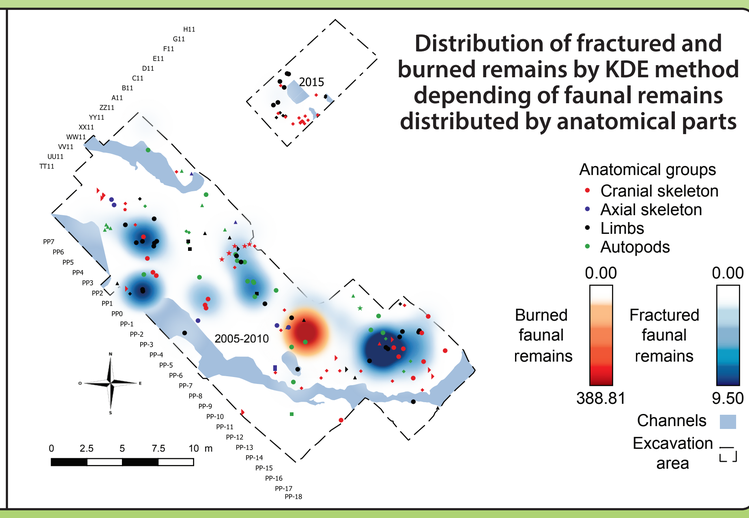
Objectivity Vs Subjectivity



The existence of **faunal remains concentration area** for the layer 4 of Caours. There are two main high density zones (in red on the map) and some of lower density.

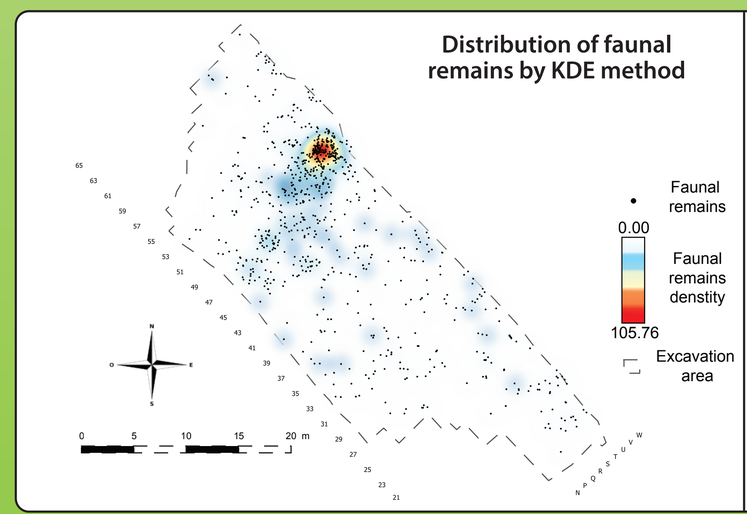


The important faunal remains concentration zones correspond to the high density of **burned and fractured remains.** Those zones are **human activity zones**. Furthermore, **high food utility remains** are concentrated in the fractured remains high density areas. Those areas are **butchery zones**.

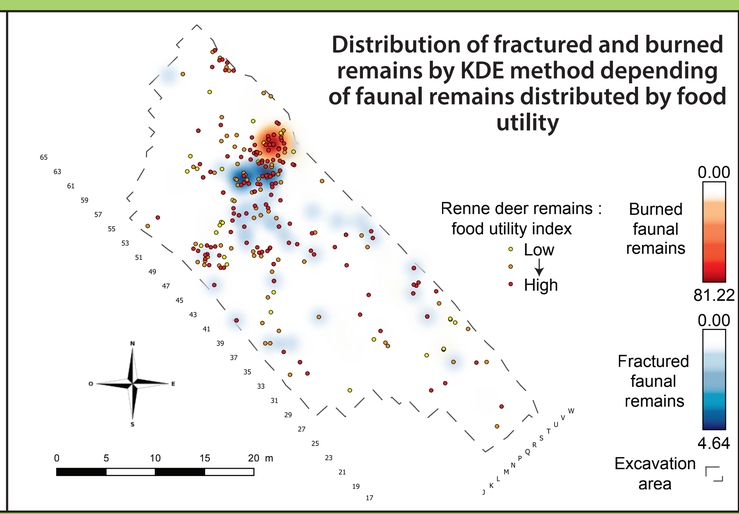


Some fractured remains zones regroup only cranial skeleton and limb bones, some others regroup only autopods bones. This suggests the existence of specific butchery area.

Site of Beauvais: layer 2



The existence of **faunal remains concentration area** for the layer 2 of Beauvais. There is one main high density zone at the north (in red on the map) and some of lower density.



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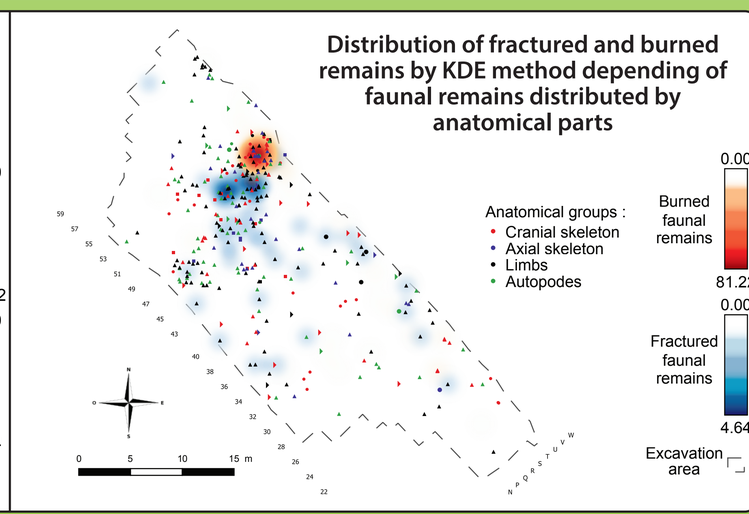

The main fractured remains zones regroup only cranial skeleton and limb bones and very few autopods bones. This suggests the existence of specific butchery area.

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