



CHECK OBJECT INTEGRITY  
**CAA 2019**  
KRAKÓW 23-27 April



Session 31:  
In pursuit of social space. Detecting activity  
areas in Palaeolithic contexts

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# A spatial analysis protocol to detect human's activity areas of Middle Palaeolithic open air sites from Northern France.

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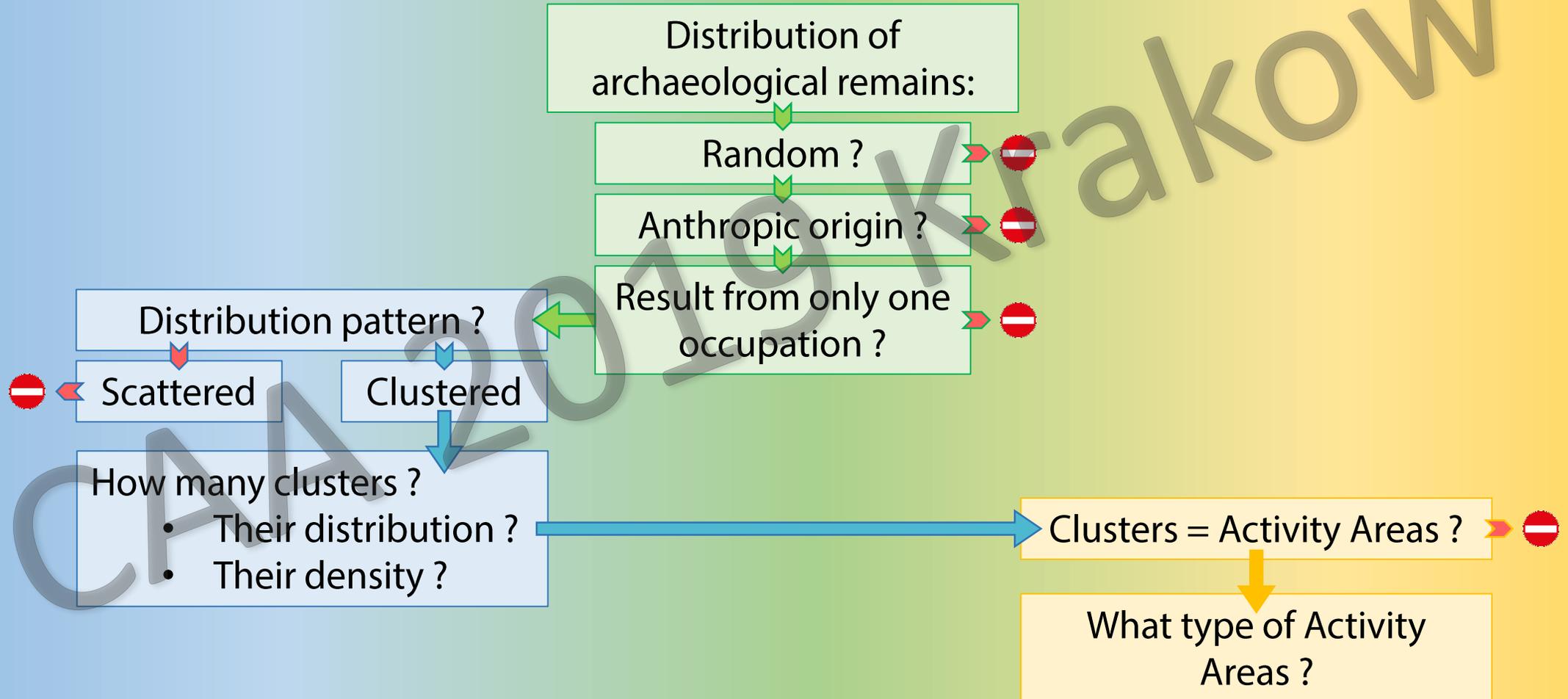
*3: National Institute of Preventive Archaeological Research, (Inrap, France)*



# Detect Activity Areas : an equation with two unknowns

Geomatics

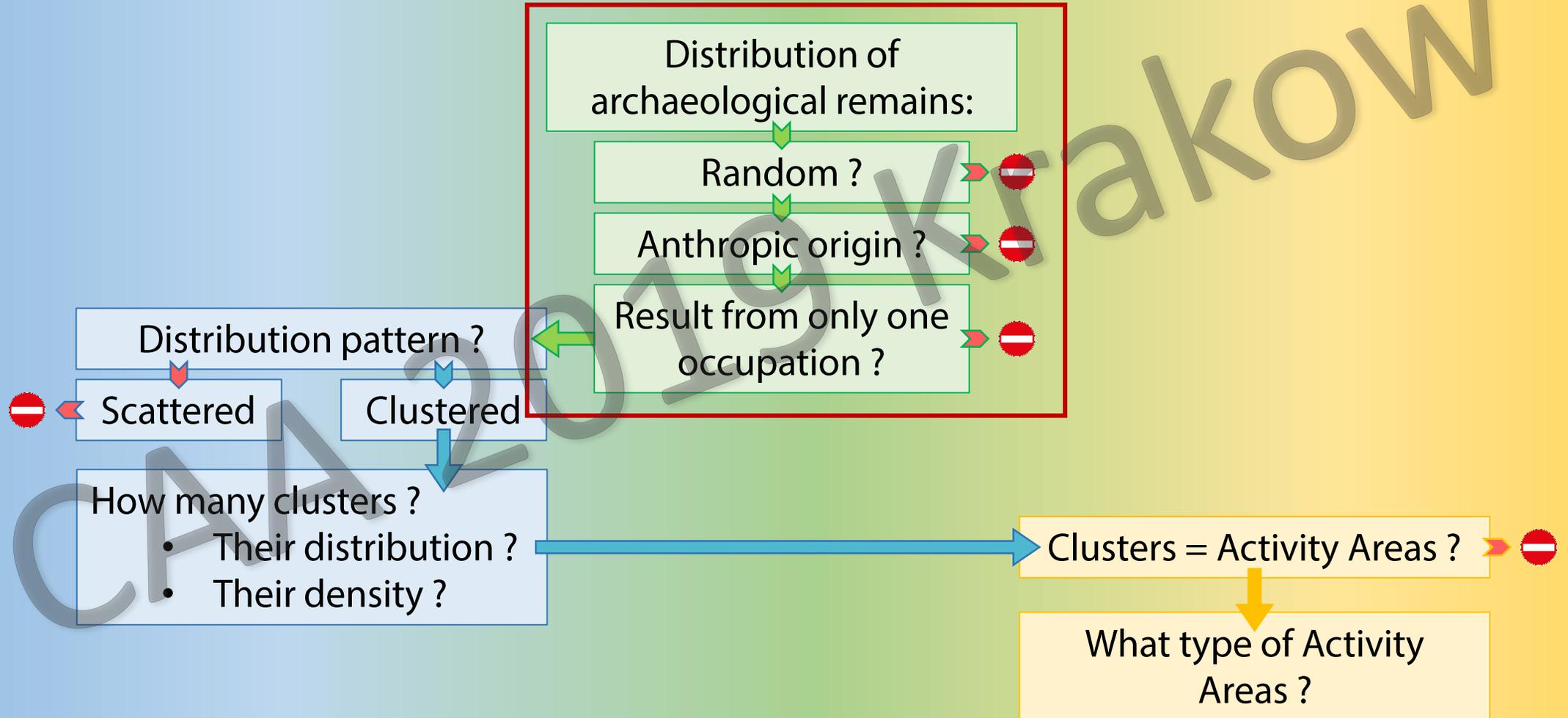
Archaeology



# Detect Activity Areas : an equation with two unknowns

Geomatics

Archaeology

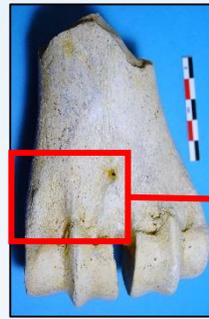


# Archaeological context: readability of spatial data ?

## Caours and Beauvais



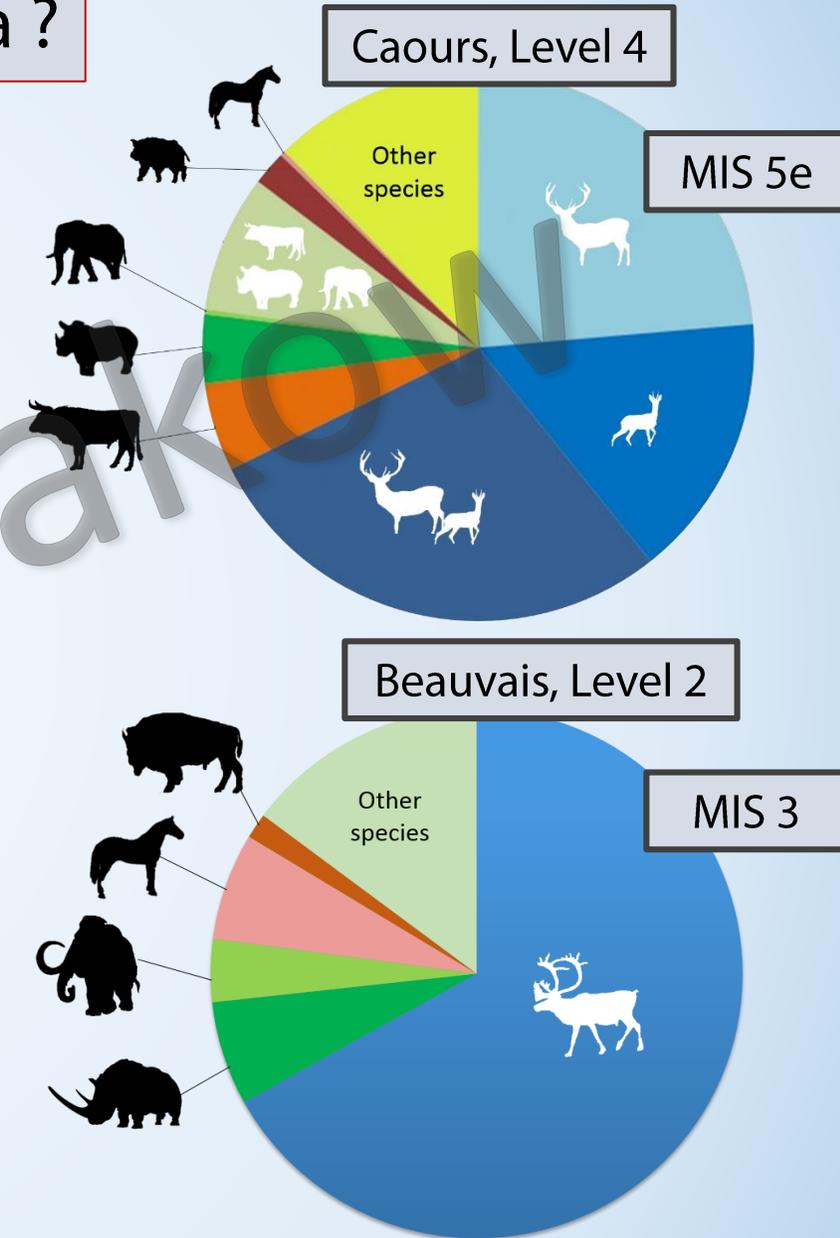
- Excellent preservation of archaeological layers
- Preservation over a large superficies
- Important number of faunal and lithic remains
- Precise description of archaeological remains available
- Fire traces



Cut marks on Aurochs bone



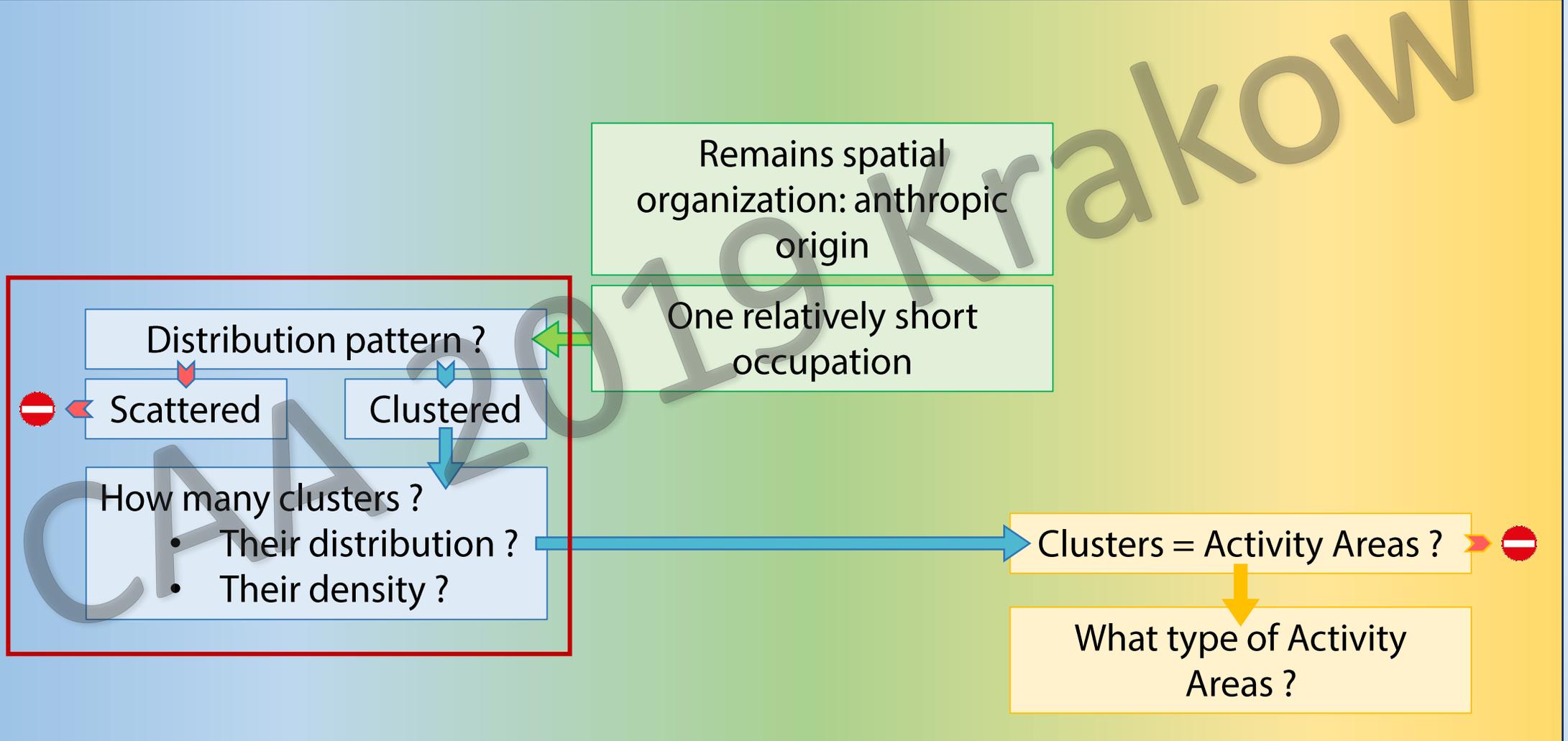
Burned bones  
(Photos: P. Auguste)



# Detect Activity Areas : an equation with two unknowns

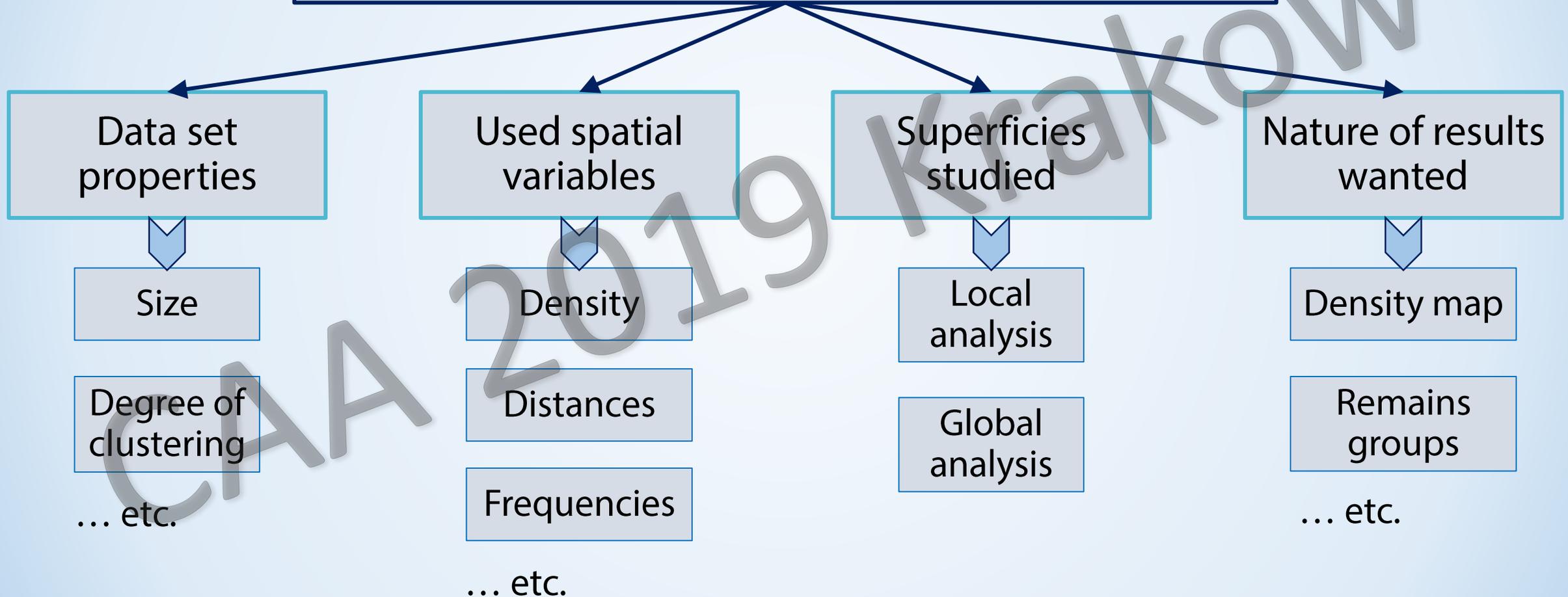
Geomatics

Archaeology



# Intrasite spatial analysis : a method to rule them all ?

## How to choose the right Spatial Analysis ?



# Our Spatial Analysis Protocol

## 1. Kernel Density Estimation

Based on:

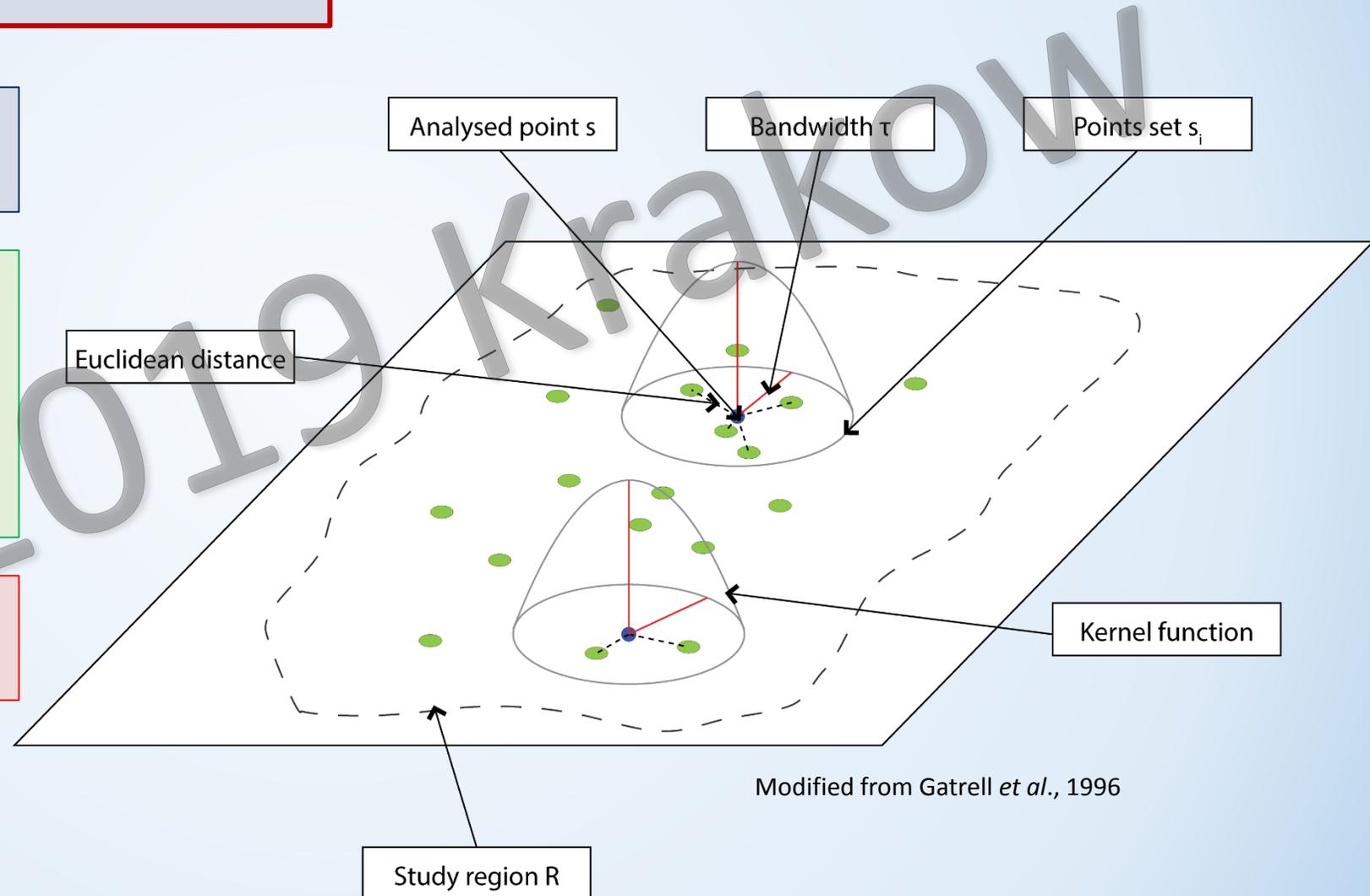
- Density and frequencies

Results:

- Model of distribution of concentration zones
- Density of concentration zones

Limits:

- Research bandwidth to fixe



# Our Spatial Analysis Protocol

## 2. K-means Clustering

Based on:

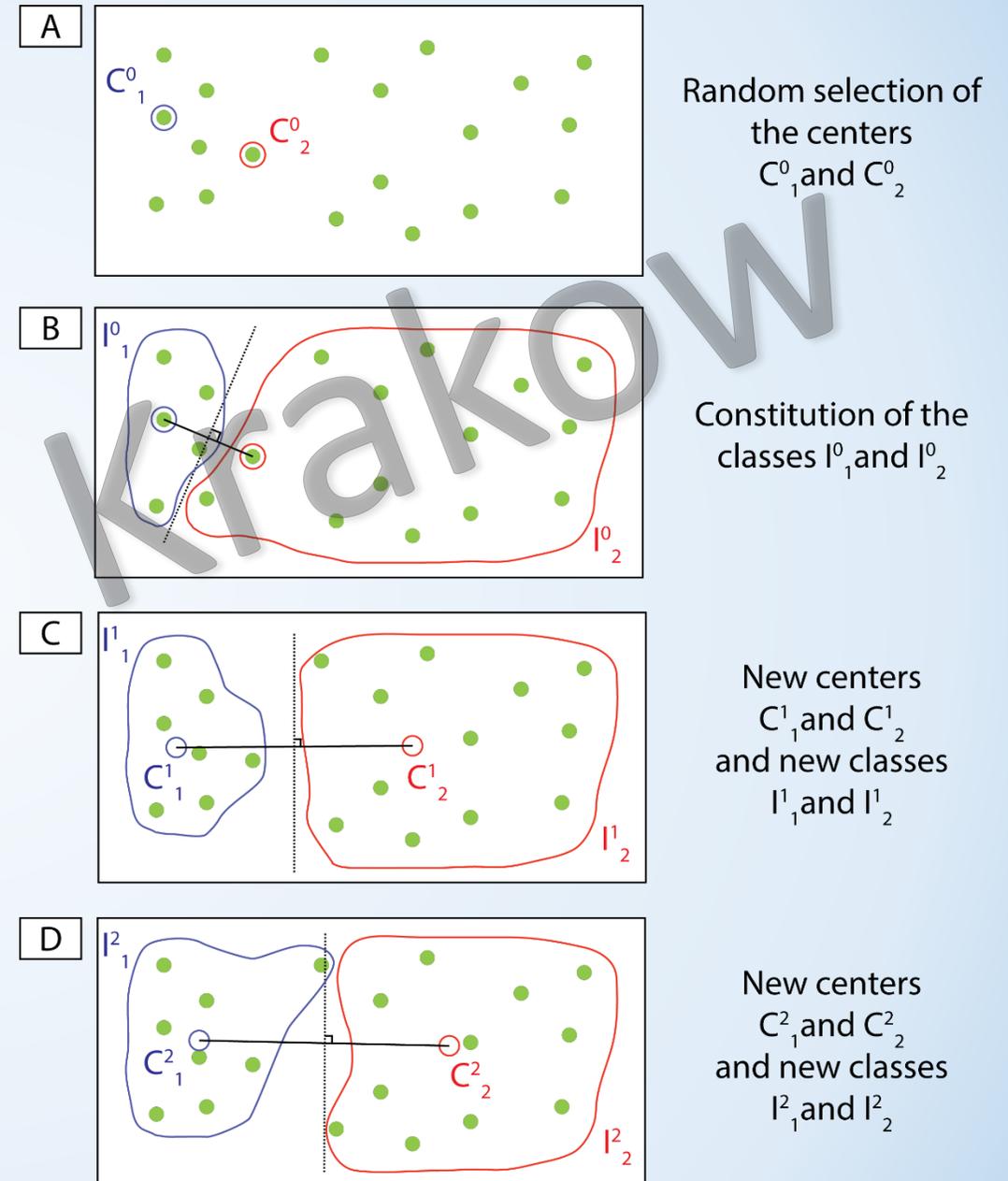
- Distances between remains

Results:

- Repartition of every remains into a define number of groups (Clusters)

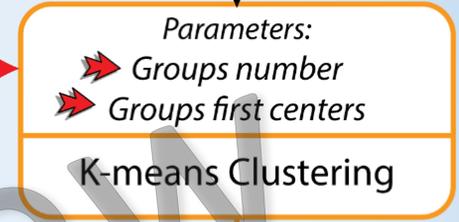
Limits:

- Groups number to fixe
- First groups centres

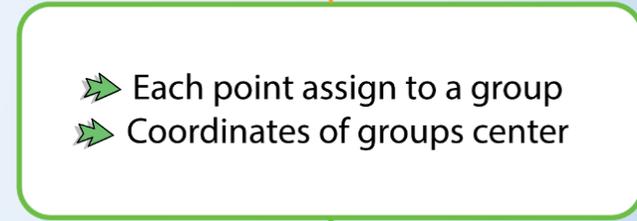
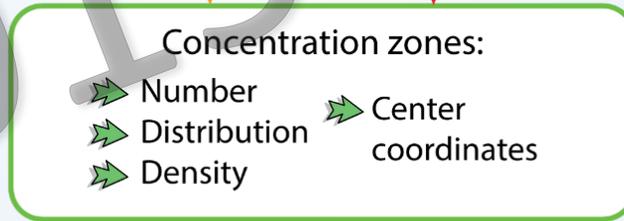


# Our Spatial Analysis Protocol

Automatic selection method:  
Scott's rule of thumb



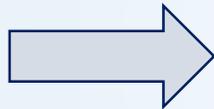
Local maxima extraction:  
Mean Shift Clustering



Comparison of the centers positions for the two methods  
Comparison between concentrations zones and groups distribution

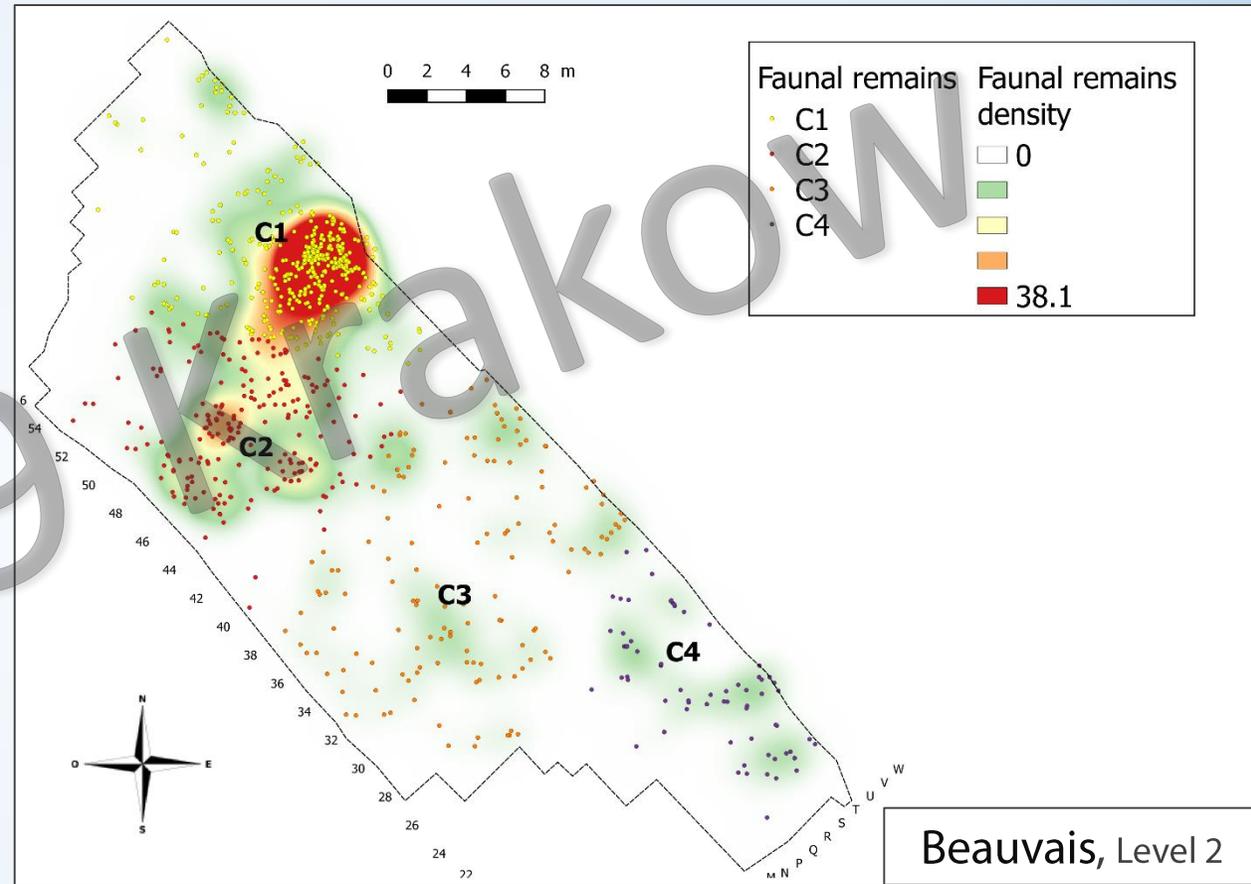
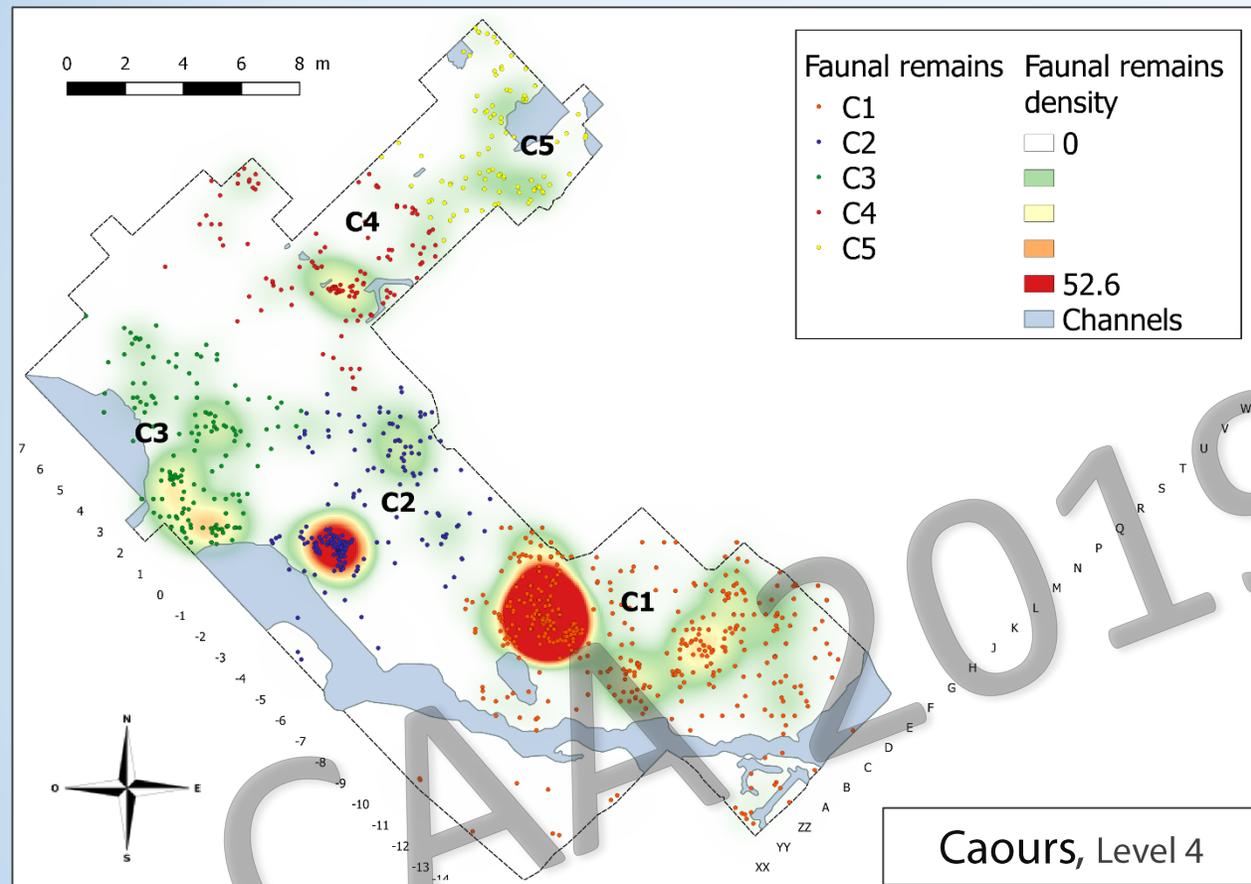
Concentration zones distribution model

Two crossed methods



CAA 2019 Krakow

# Results: Kernel Density Estimation combined with K-means Clustering



- Similar results between Kernel Density Estimation and K-means Clustering
- Spatial organisation of faunal remains as clusters

# Detect Activity Areas : an equation with two unknowns

Geomatics

Archaeology

Kernel Density Estimation



K-means clustering



Clustered

Remains spatial organization: anthropic origin

One relatively short occupation

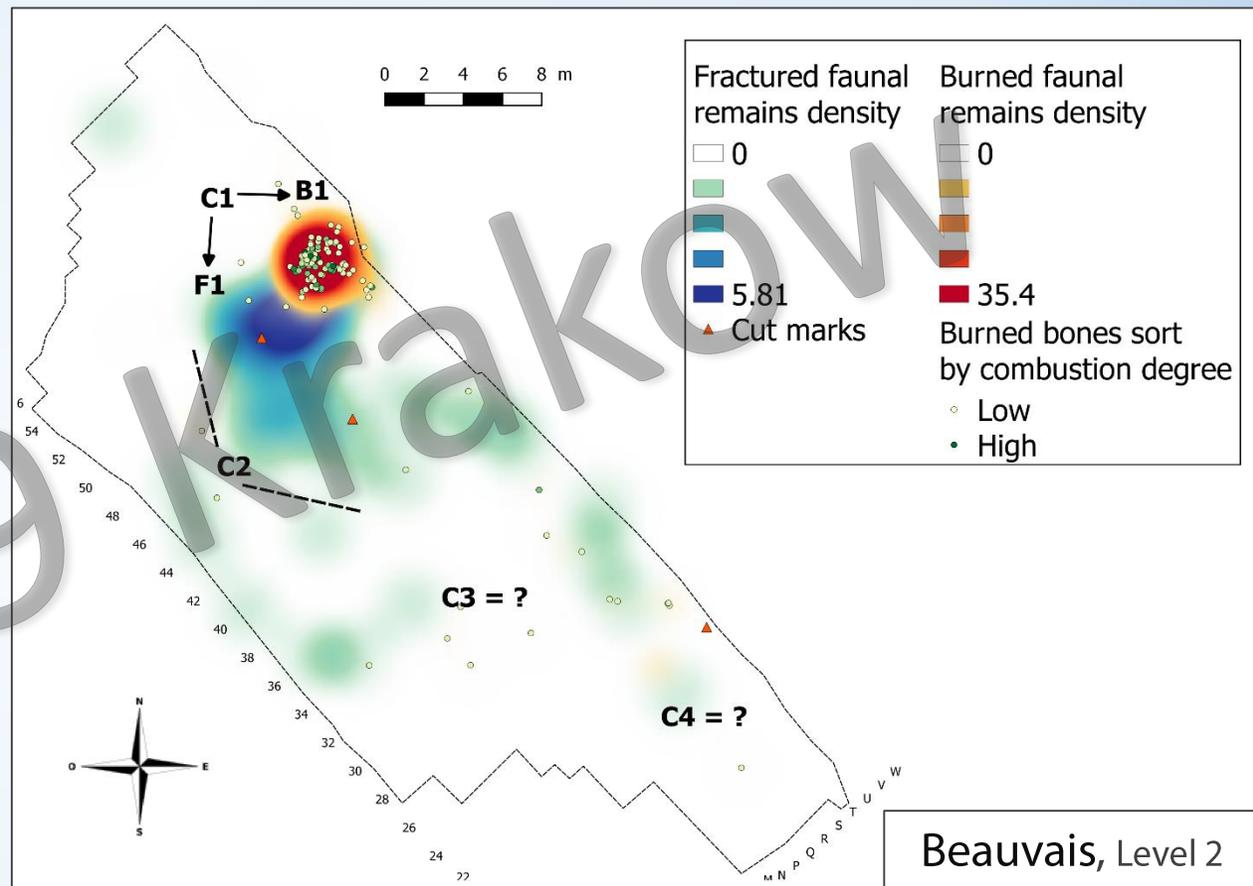
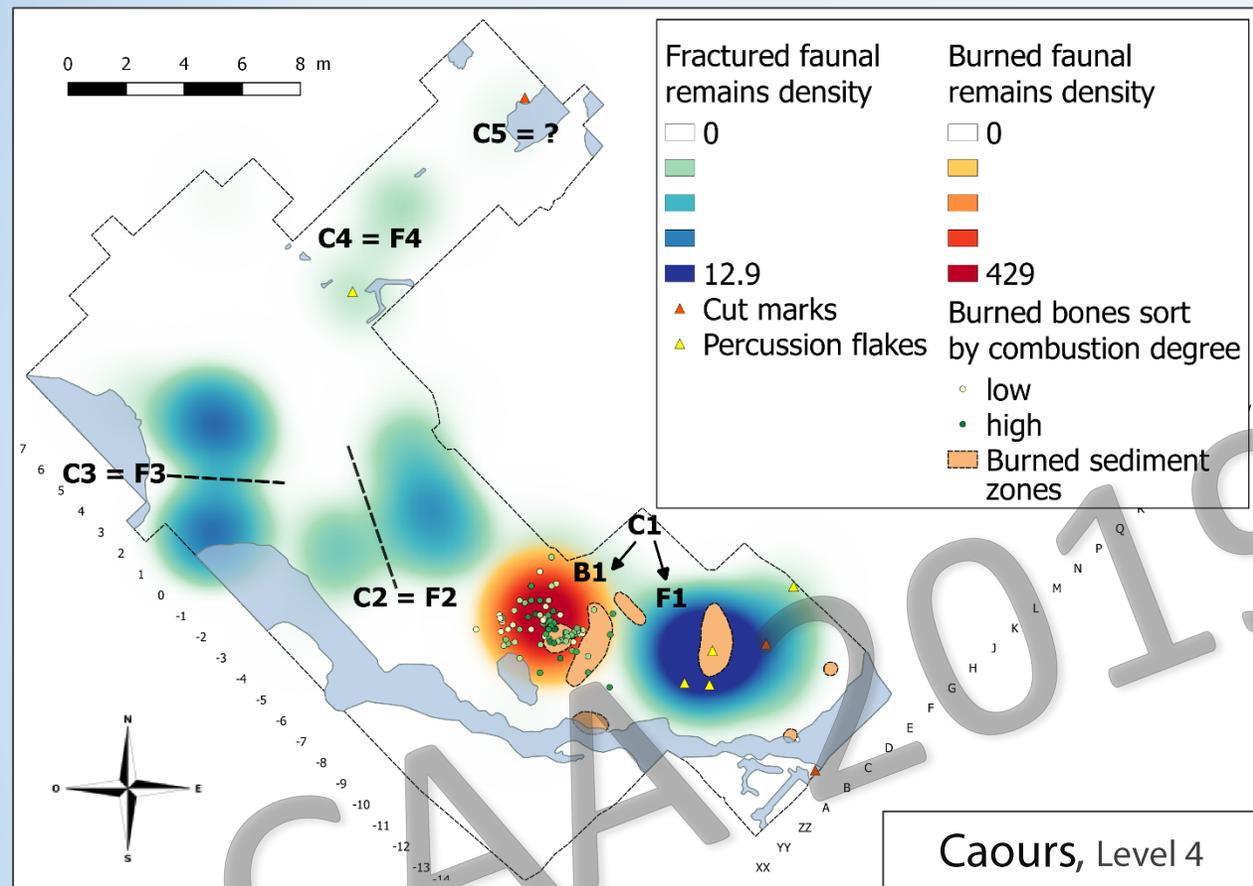
Clusters = Activity Areas ?



What type of Activity Areas ?



# Results: Human Activity Areas ?



- Several concentration of fractured remains
- One concentration of burned remains

- One main concentration of fractured remains
- One concentration of burned remains

➤ Faunal remains clusters = Human Activity Areas (butchery and combustion zone)



# Results: What kind of Activity Areas ?

## Food Utility

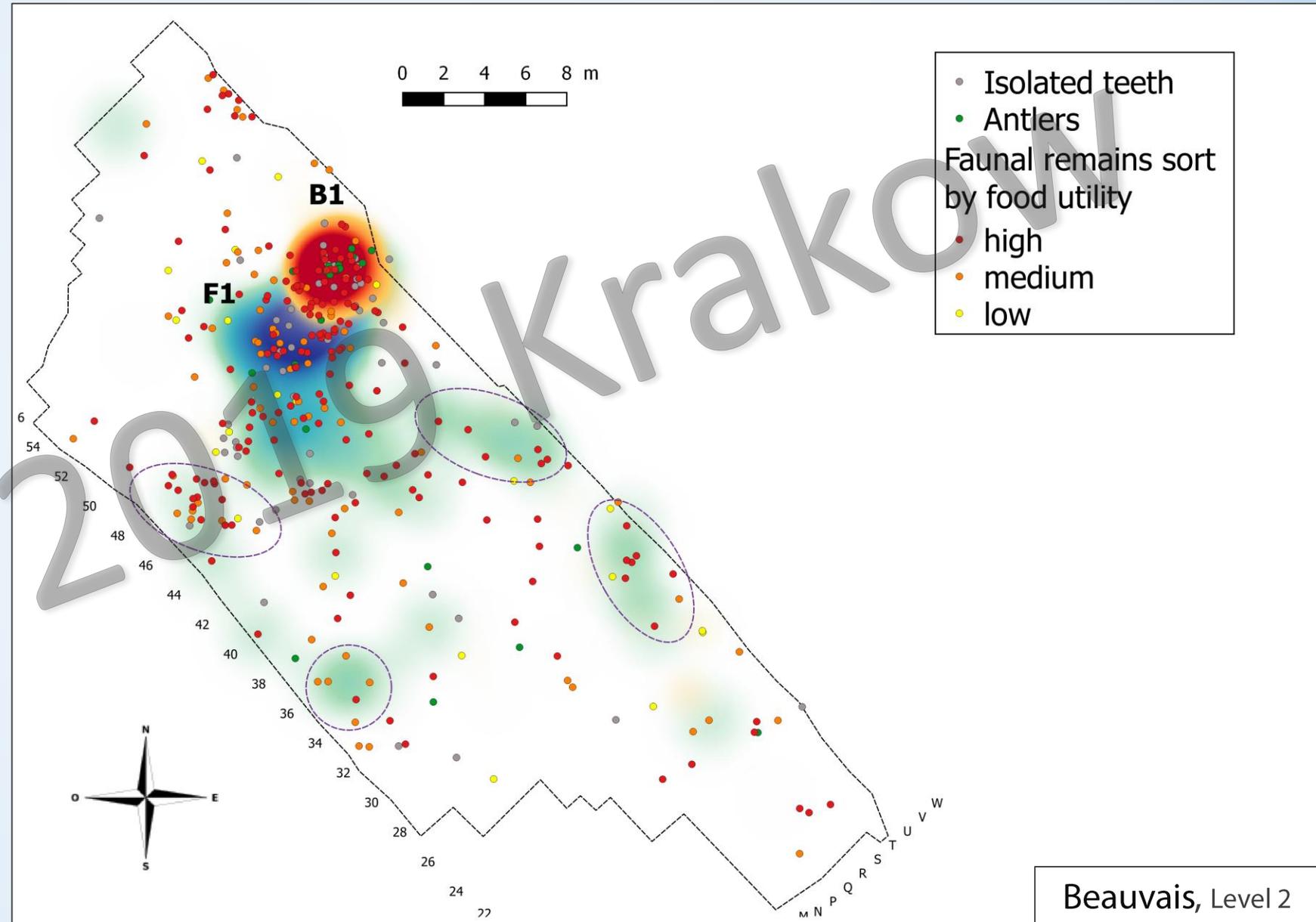
Fractured zones



Combustion zone



High food utility remains



# Results: What kind of Activity Areas ?

## Species

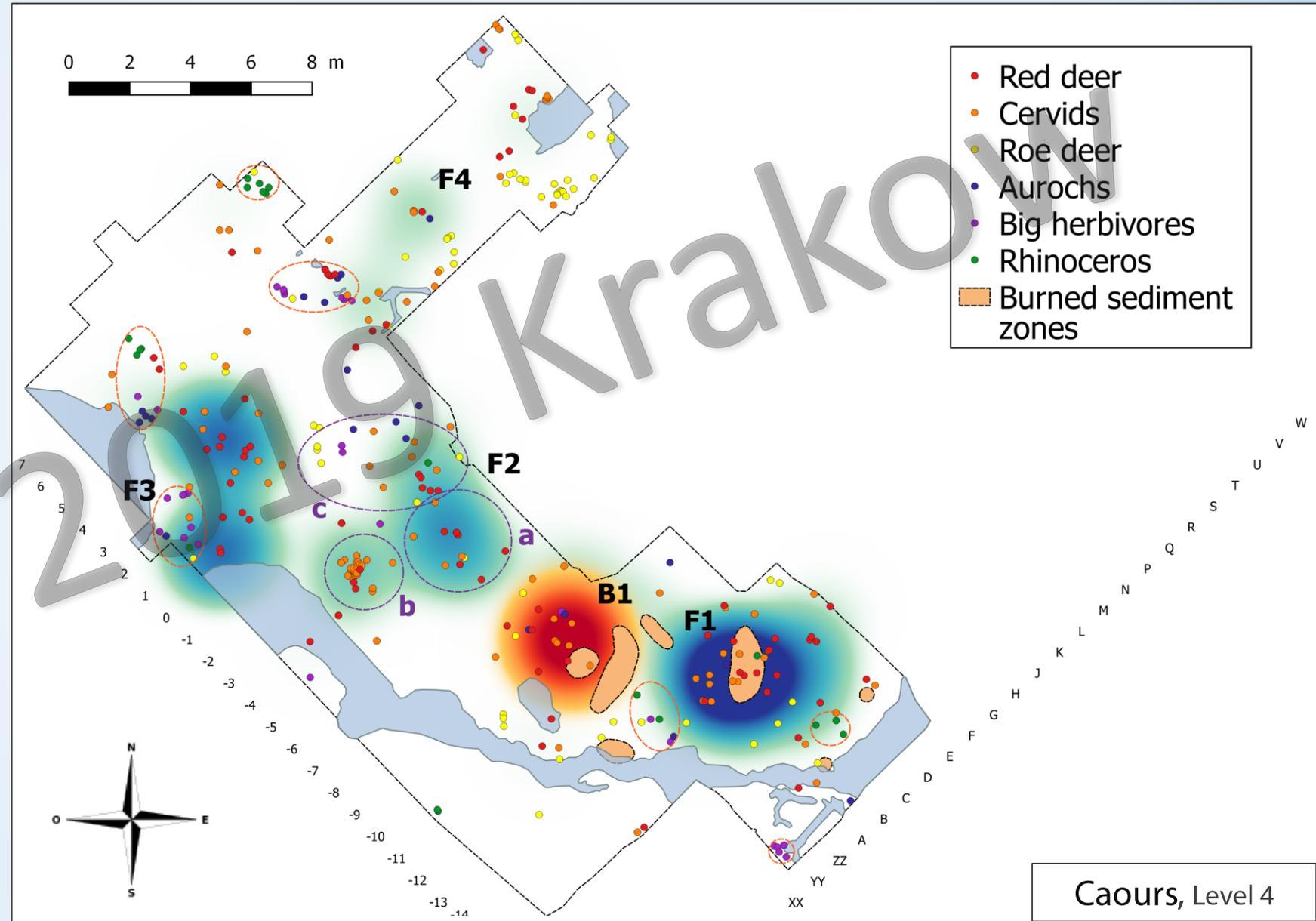
Fractured and  
Combustion zone

Mainly Red deer  
remains

Periphery of  
fractured zone

Big and Mega-  
herbivores remains

Roe deer remains



# Results: What kind of Activity Areas ?

## Species

Fractured zone

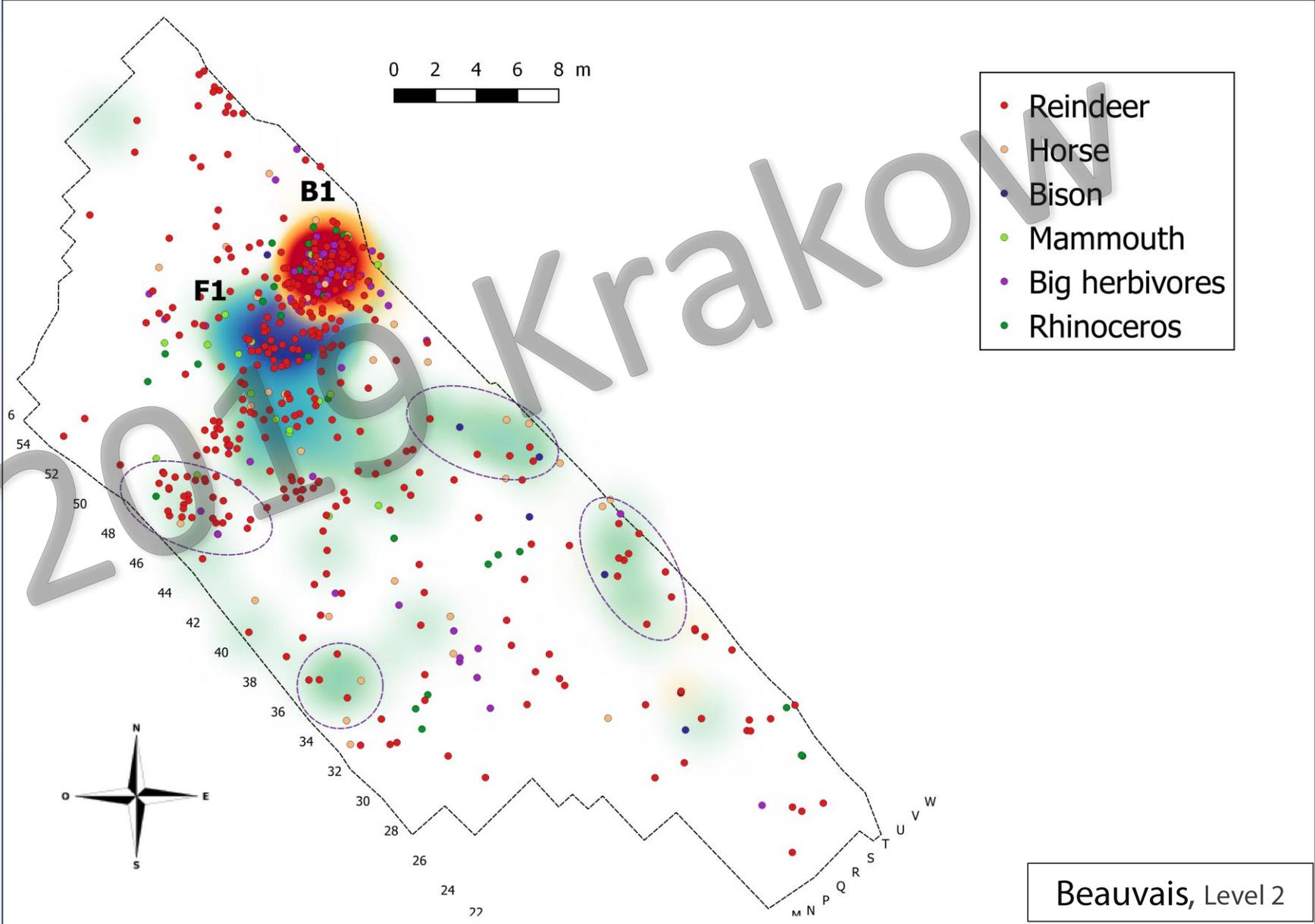


Mainly Reindeer remains

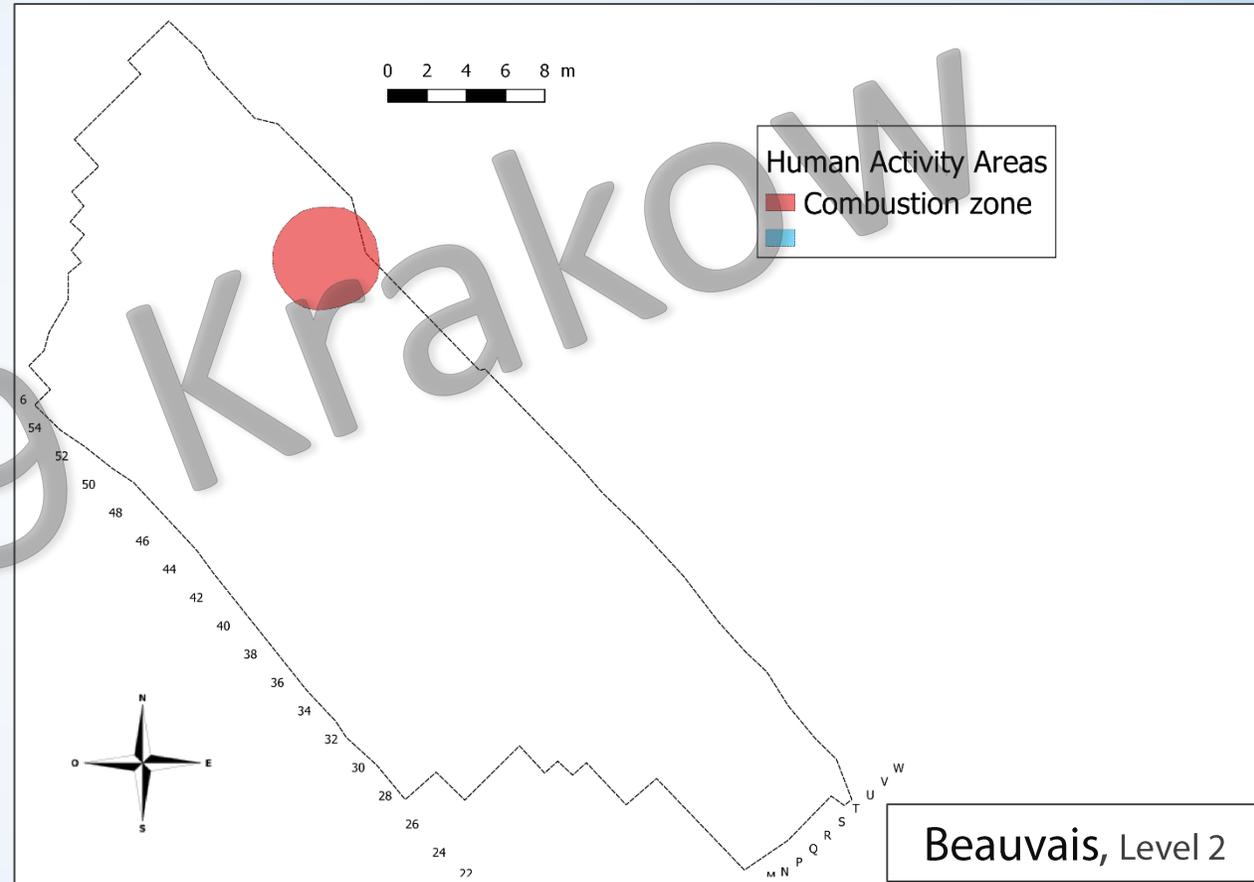
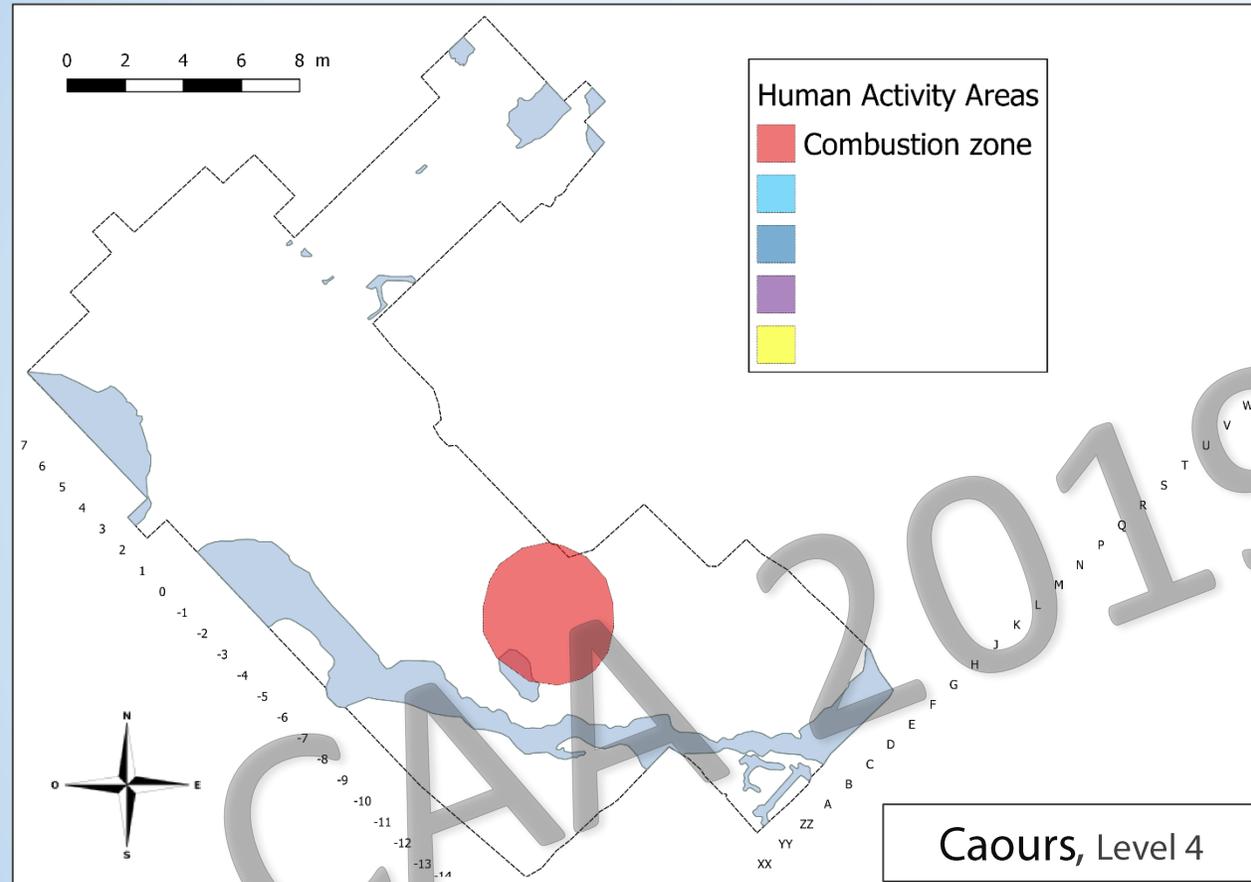
Combustion zone



Various species remains

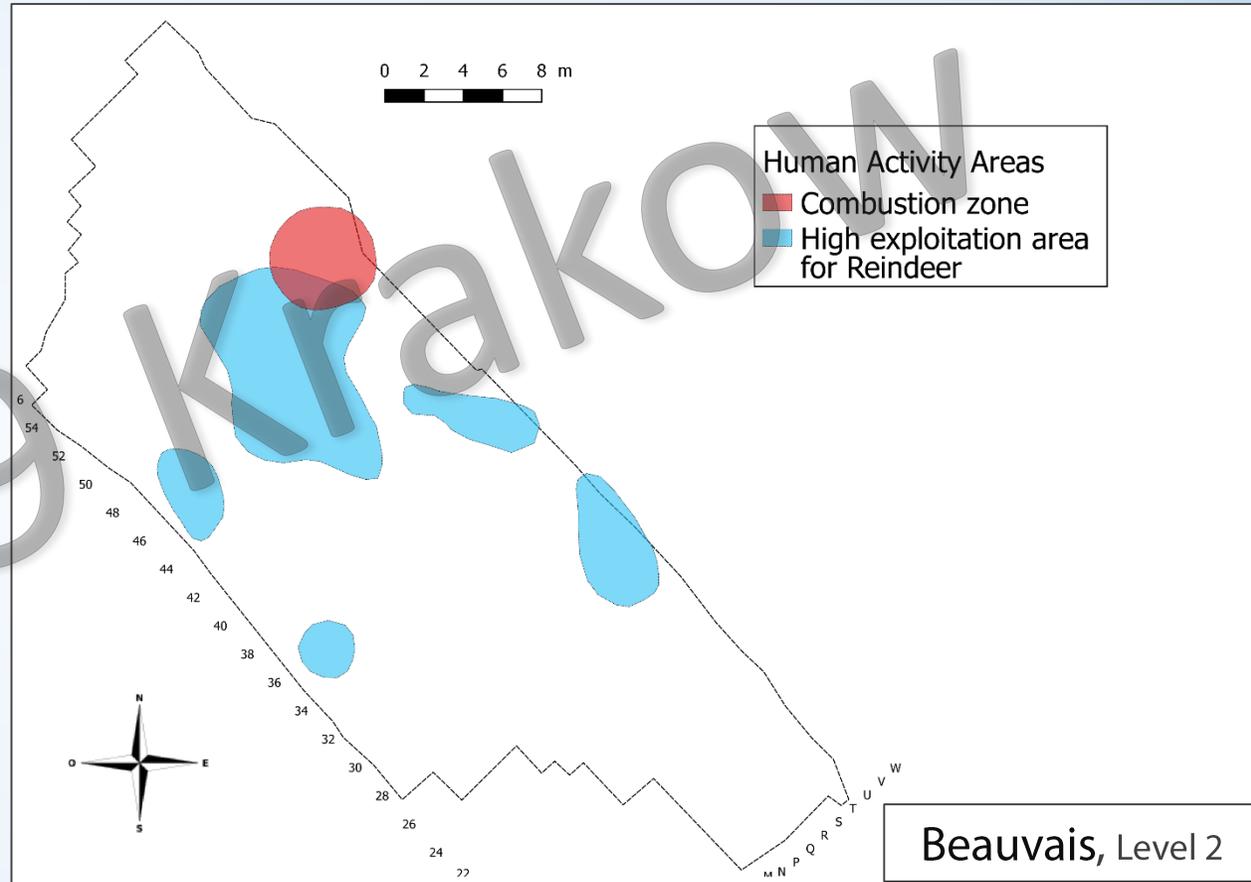
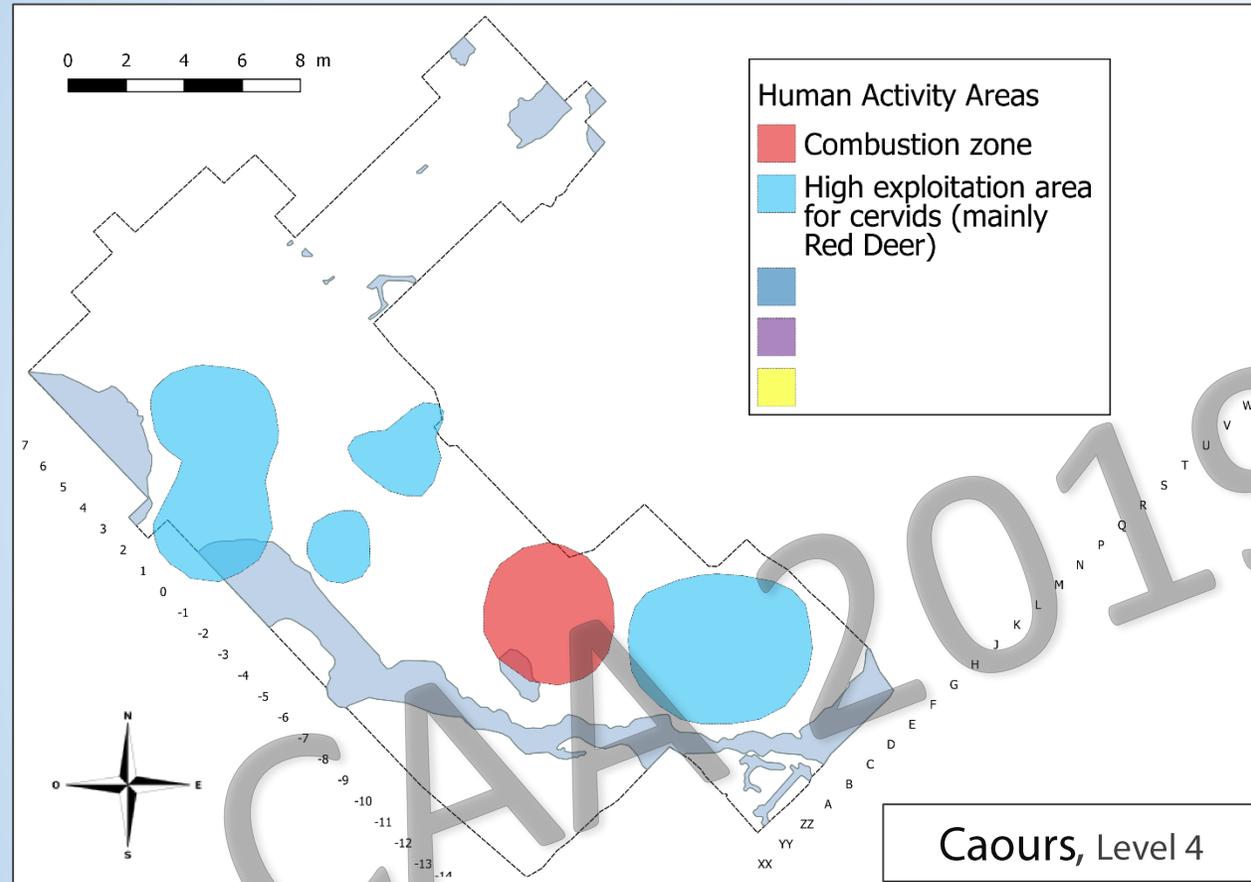


# Take Home Message



One single combustion zone

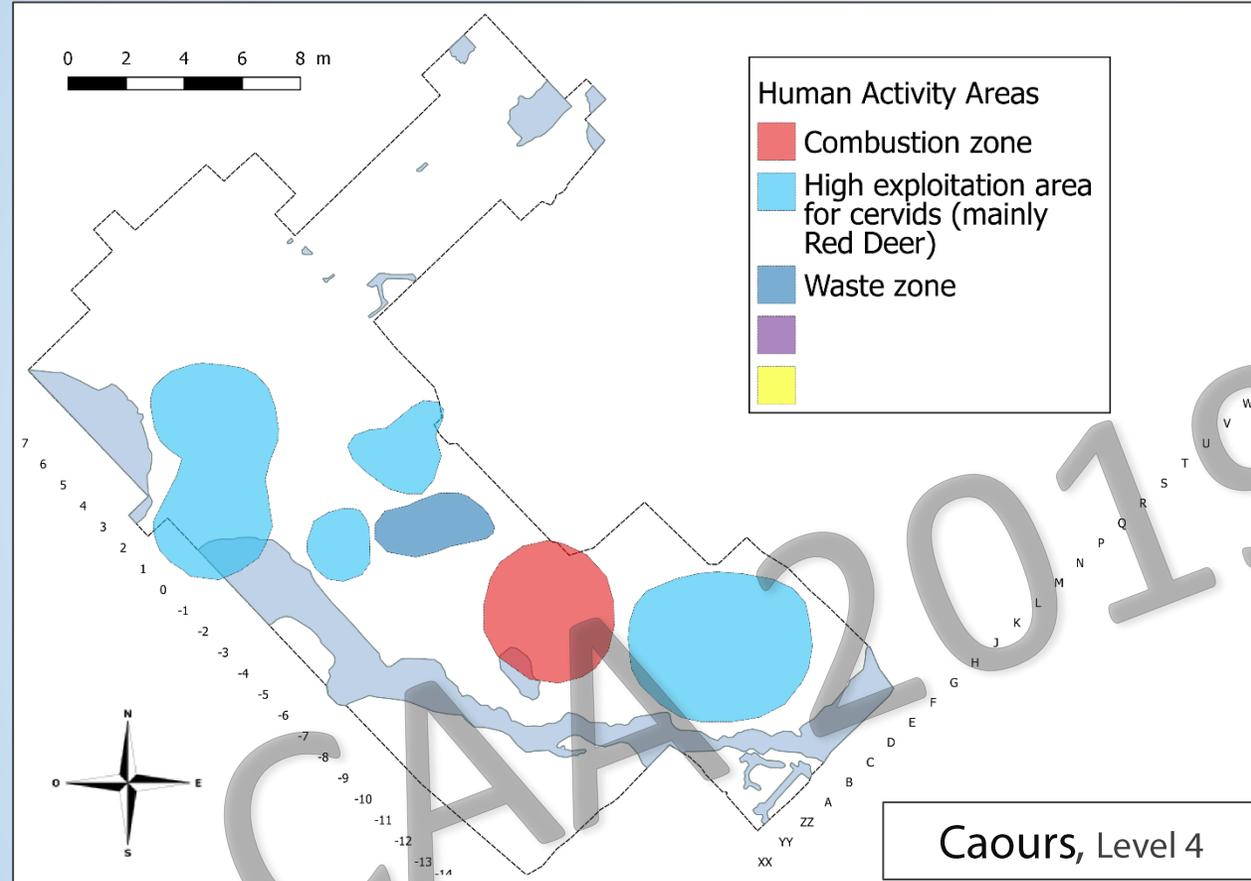
# Take Home Message



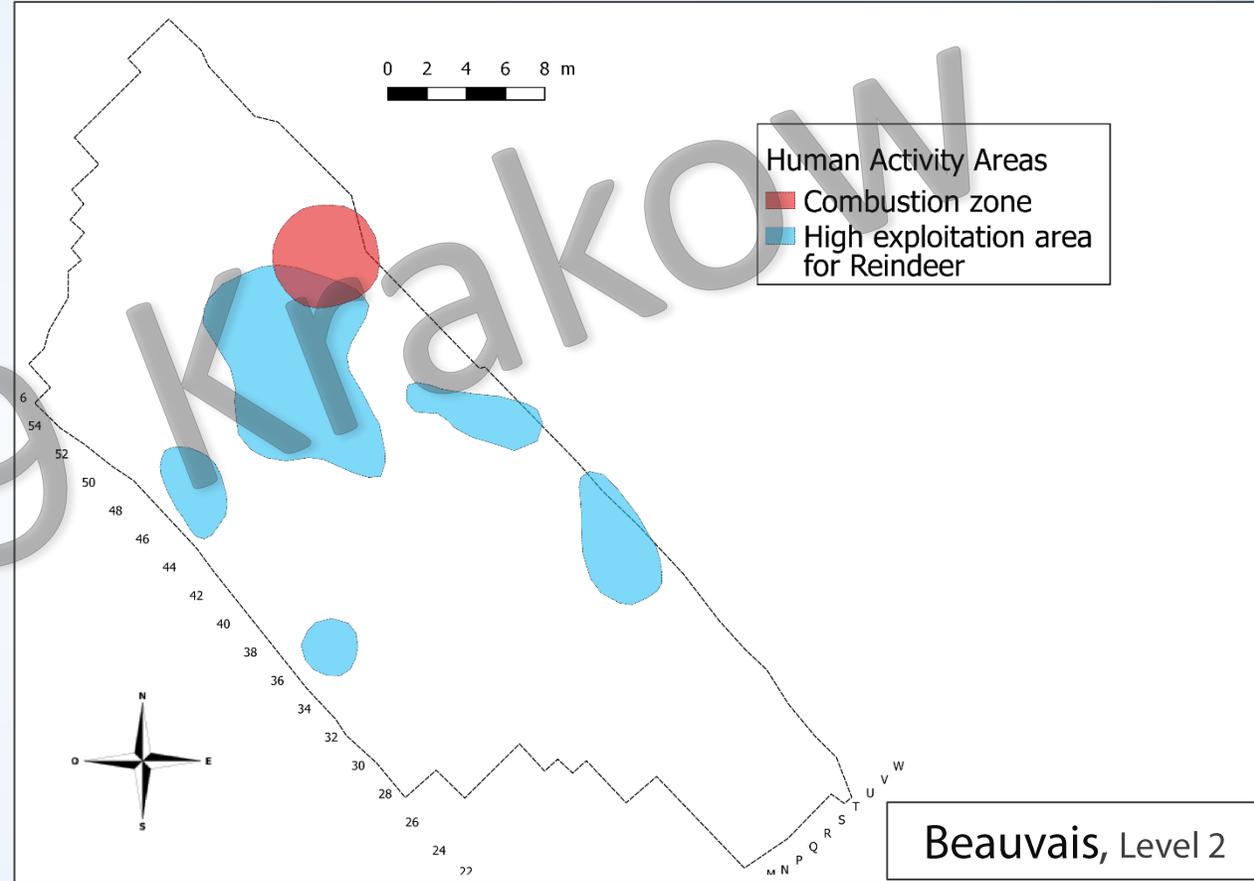
Several high exploitation areas for Red deer

One high exploitation area for Reindeer + smaller ones

# Take Home Message

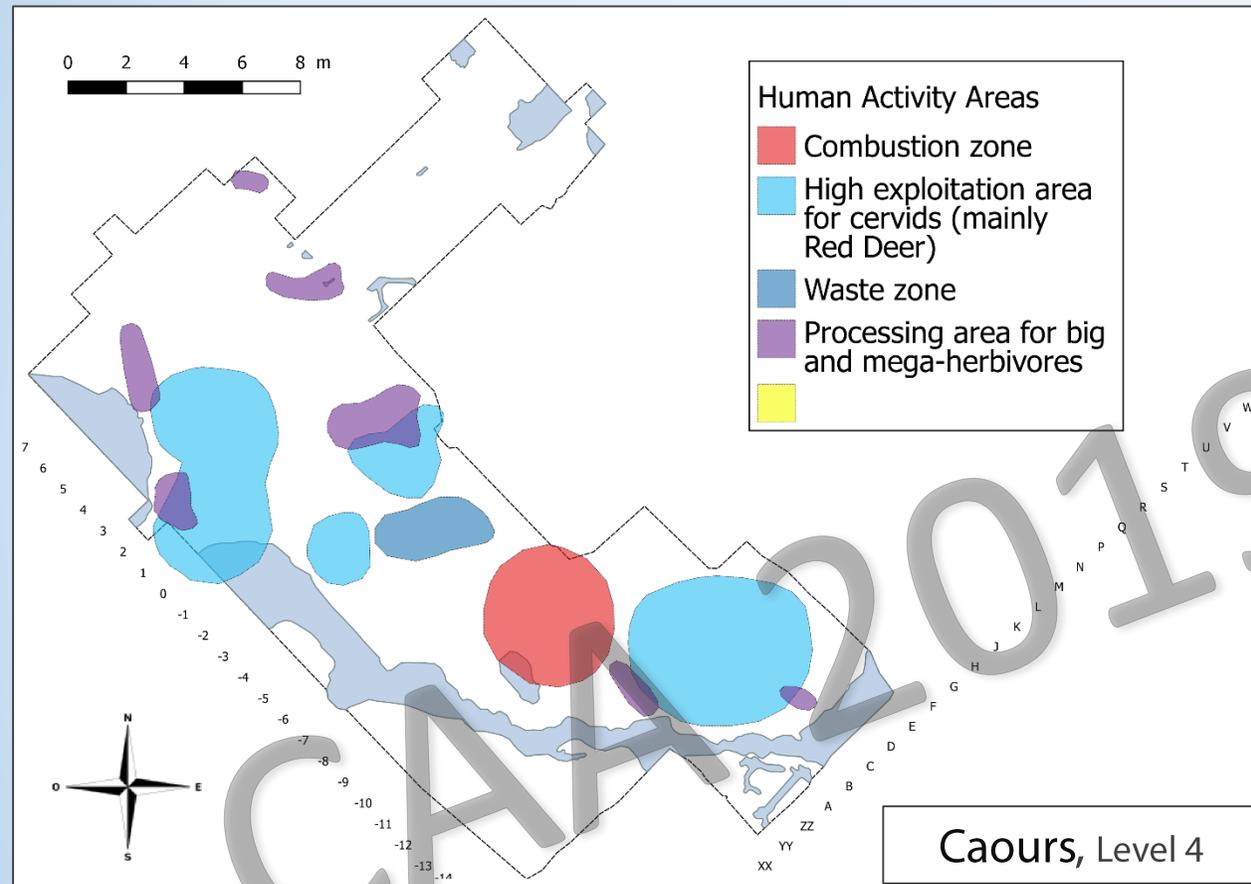


One possible waste zone

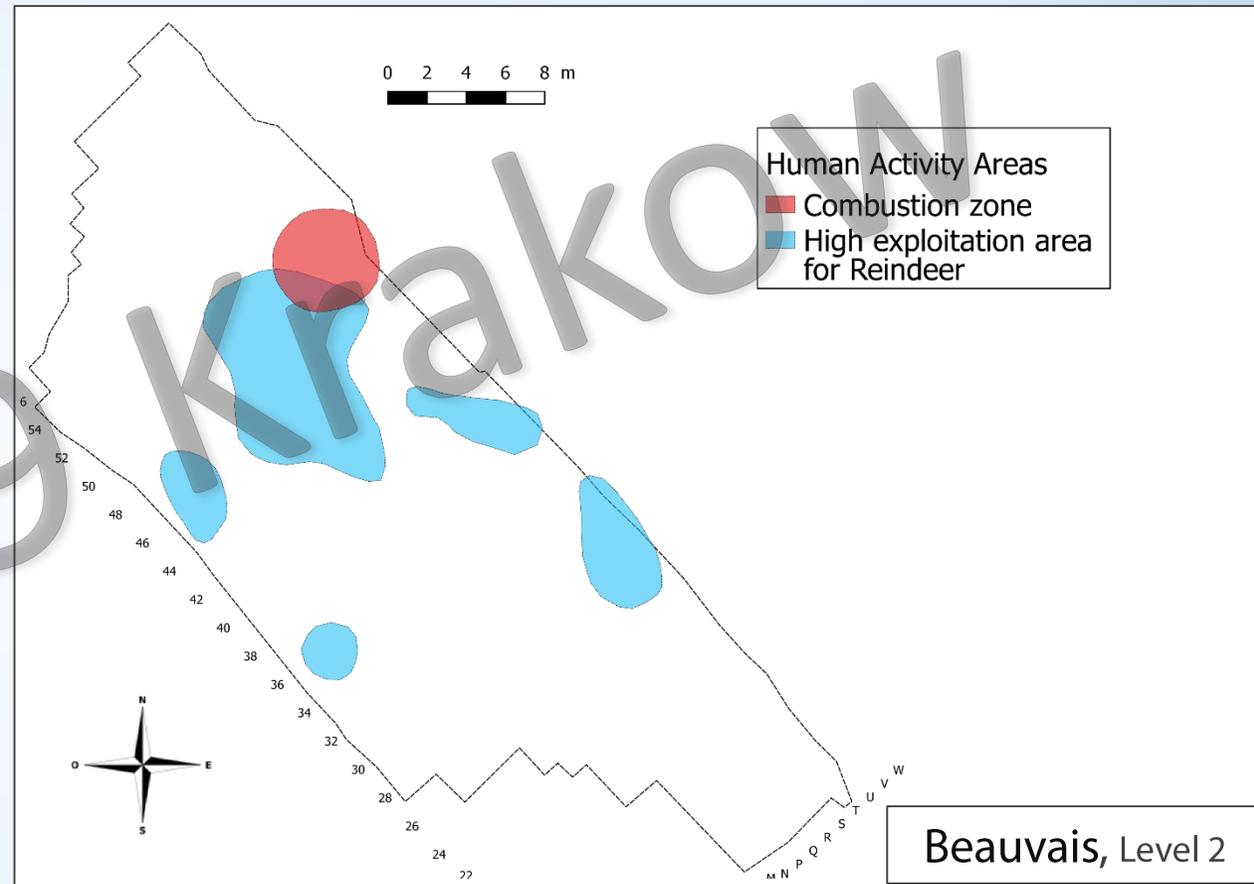


No identified waste zone

# Take Home Message

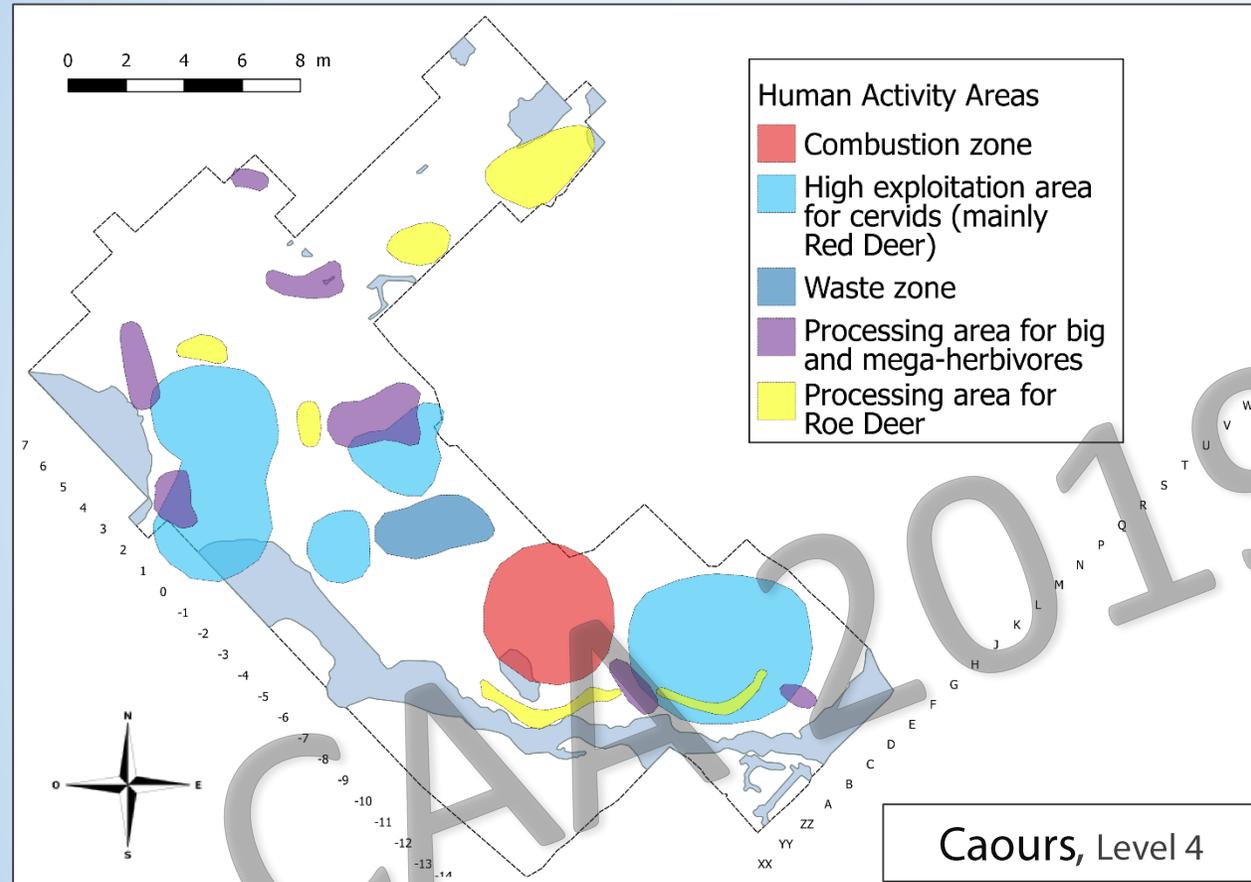


Several processing areas for big and mega-herbivores

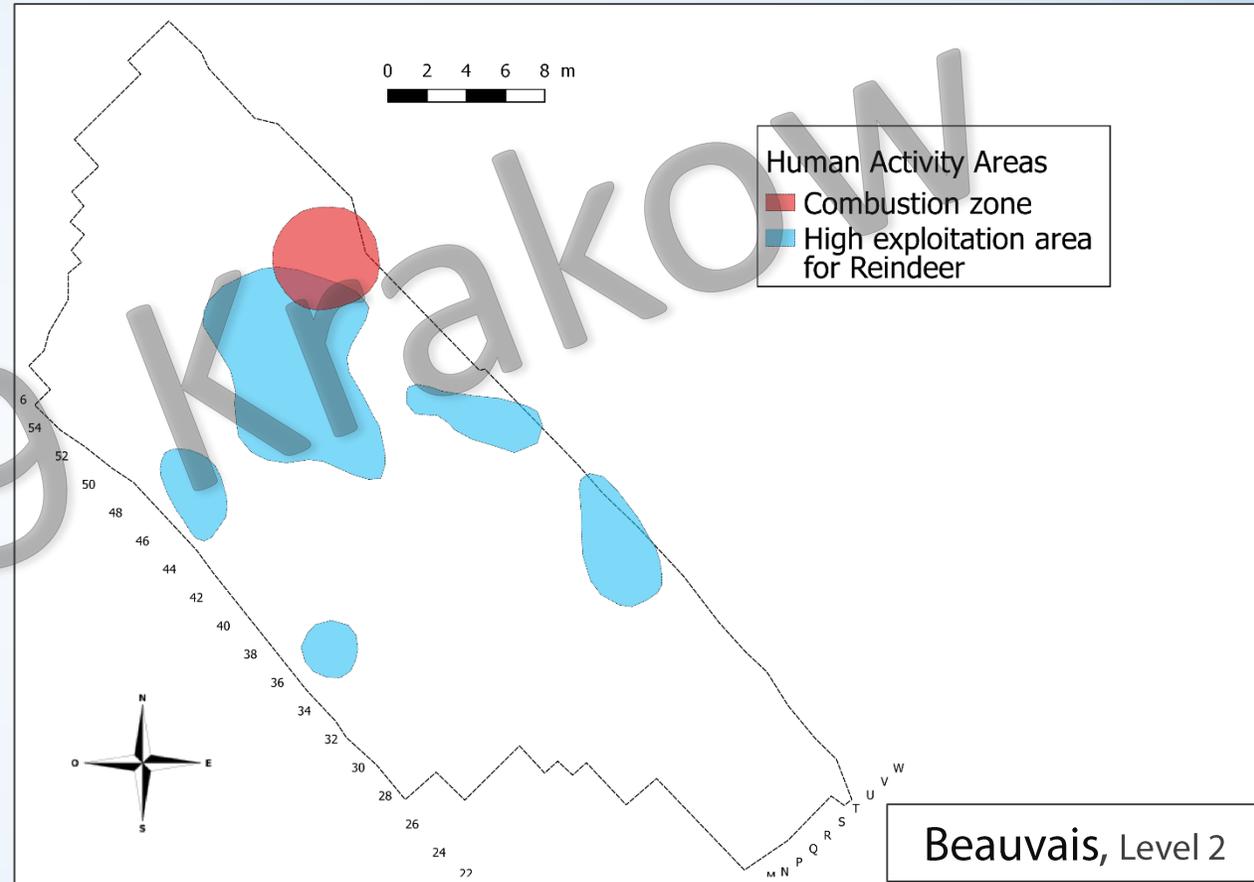


No identified processing areas for big and mega-herbivores

# Take Home Message



Several processing areas for Roe deer



No identified processing areas for Roe deer

# Conclusion

Geomatics

Archaeology

Remains spatial organization: anthropic origin

One relatively short occupation

Kernel Density Estimation



K-means clustering

Clustered

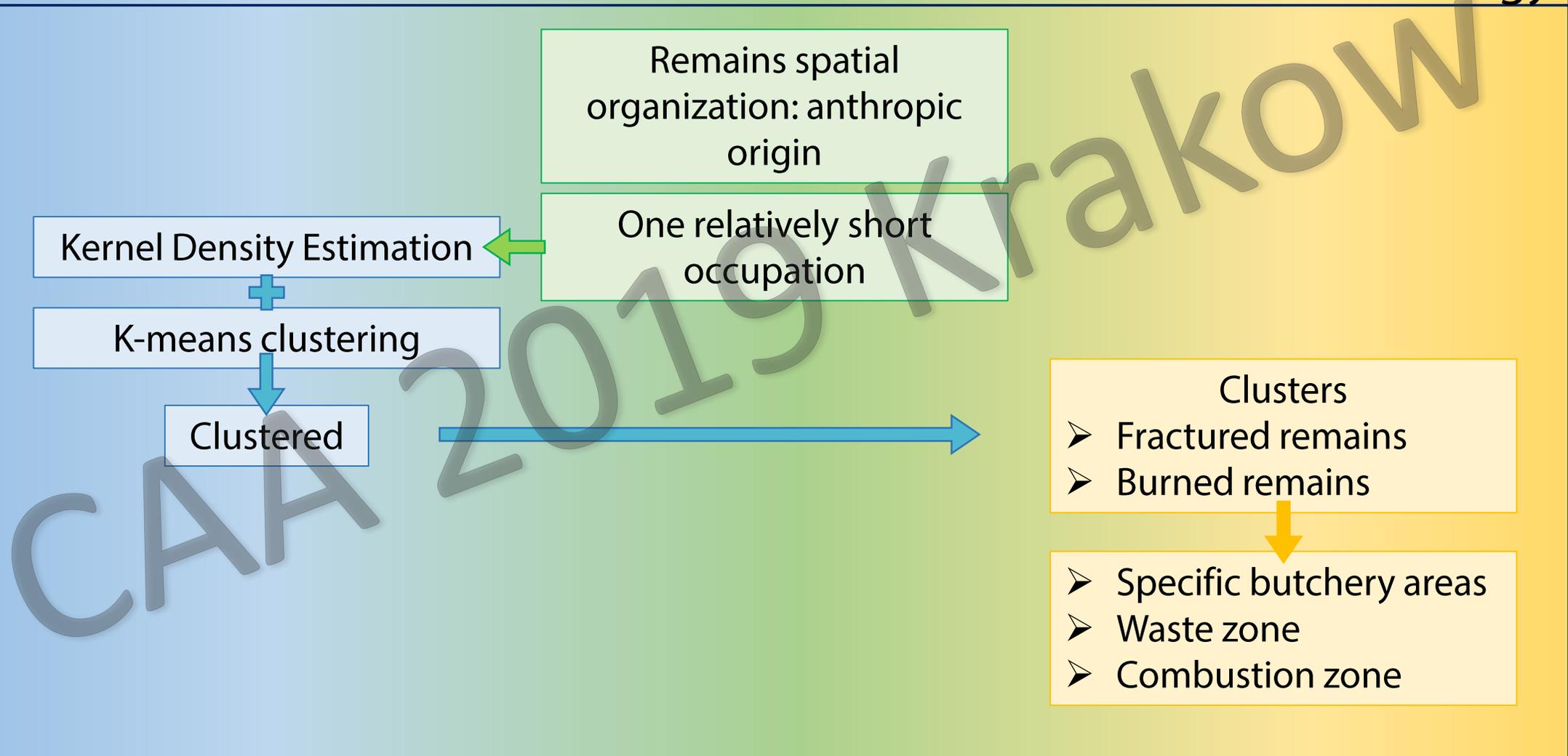
Clusters

- Fractured remains
- Burned remains

➤ Specific butchery areas

➤ Waste zone

➤ Combustion zone



# Thank you for your attention

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

Thanks to Jean-Paul Donnay, Yves Cornet, Caroline Fond et David Hérisson for their advices in the development of this spatial analysis protocol.



Site of Caours (2018)