Multi-scale exploration of the archaeological site of Puig Ciutat (Oristà, Catalonia)

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1. Geographical and geomorphological situation
2. Previous works
3. Scales, Objectives and Tools

2. First explorations

1. Field walking
2. Assessment of the site
3. Geophysical prospection
4. Excavations and sections
5. Main conclusions
6. Defining new objectives

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1. Exploration of the surroundings
2. Description of the constructive structures
3. Understanding the stratigraphy
4. More excavations
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1. Produced data
2. Covered areas
3. Data integration
4. Perspectives

Introduction

1. Geographical and geomorphological situation
2. Previous works
3. Scales, Objectives and Tools

Puig Ciutat – County of Lluçanes – Province of Barcelona – Catalonia

North of Catalonia

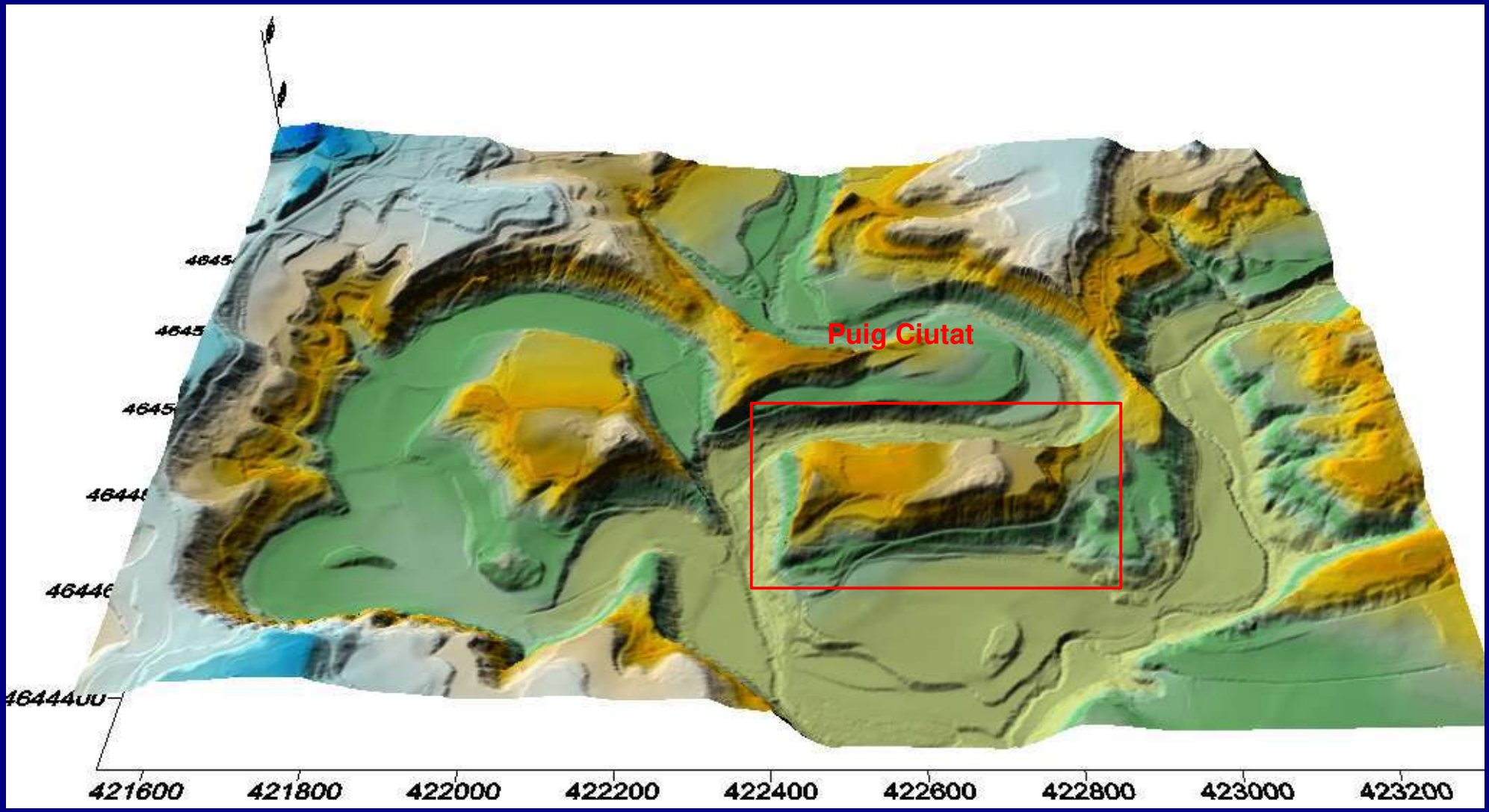
Puig Ciutat – County of Lluçanes – Province of Barcelona – Catalonia

Area of Lluçanes

Map generated from the ICC server, Institute of Cartography of Catalonia

Puig Ciutat – County of Lluçanes – Province of Barcelona – Catalonia

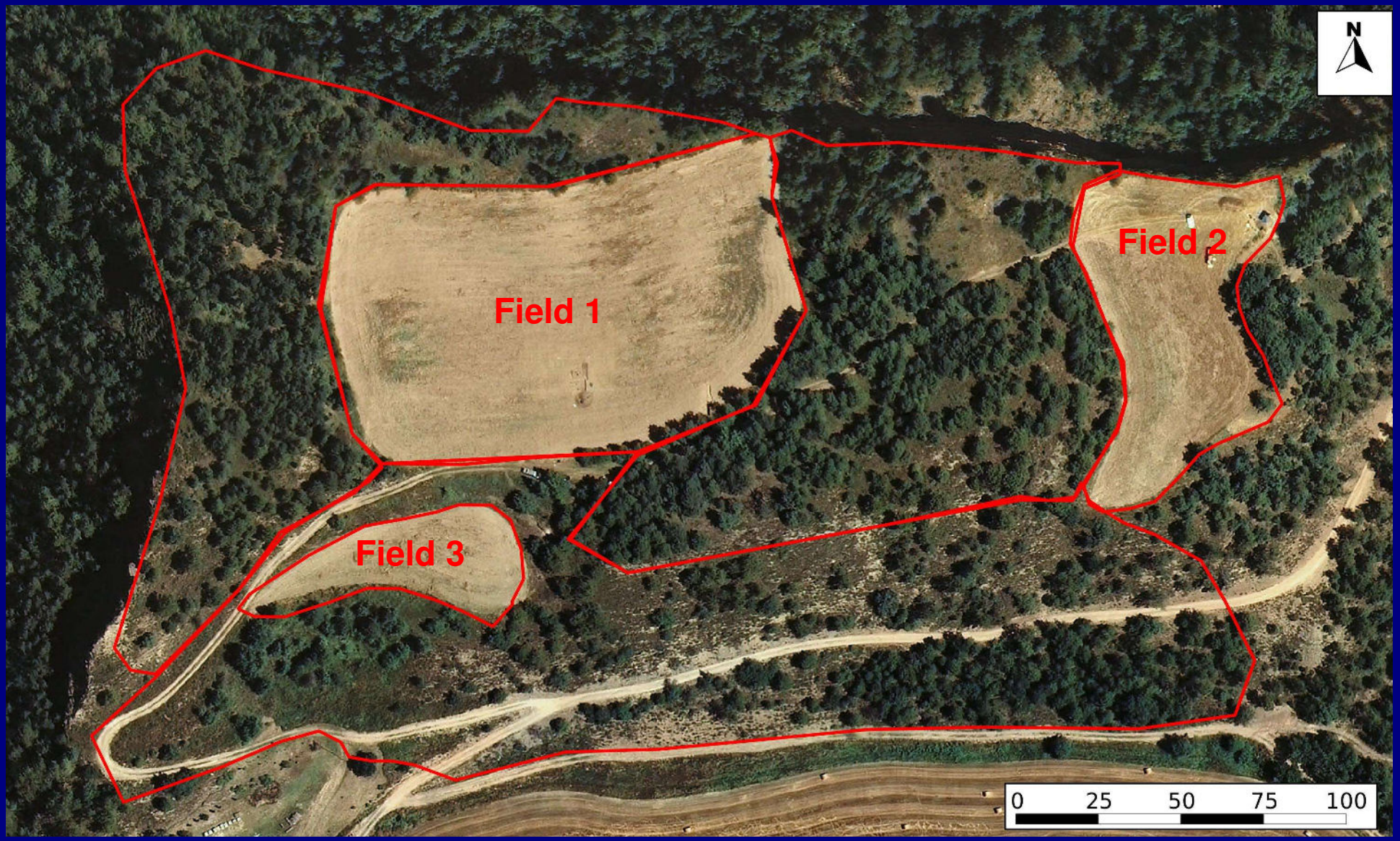
Elevated platform within a meander system



2x2m LIDAR data delivered by the ICC, Institute of Cartography of Catalonia

Puig Ciutat – County of Lluçanes – Province of Barcelona – Catalonia

5Ha 3.5 of woods and 1.5 of farming lands



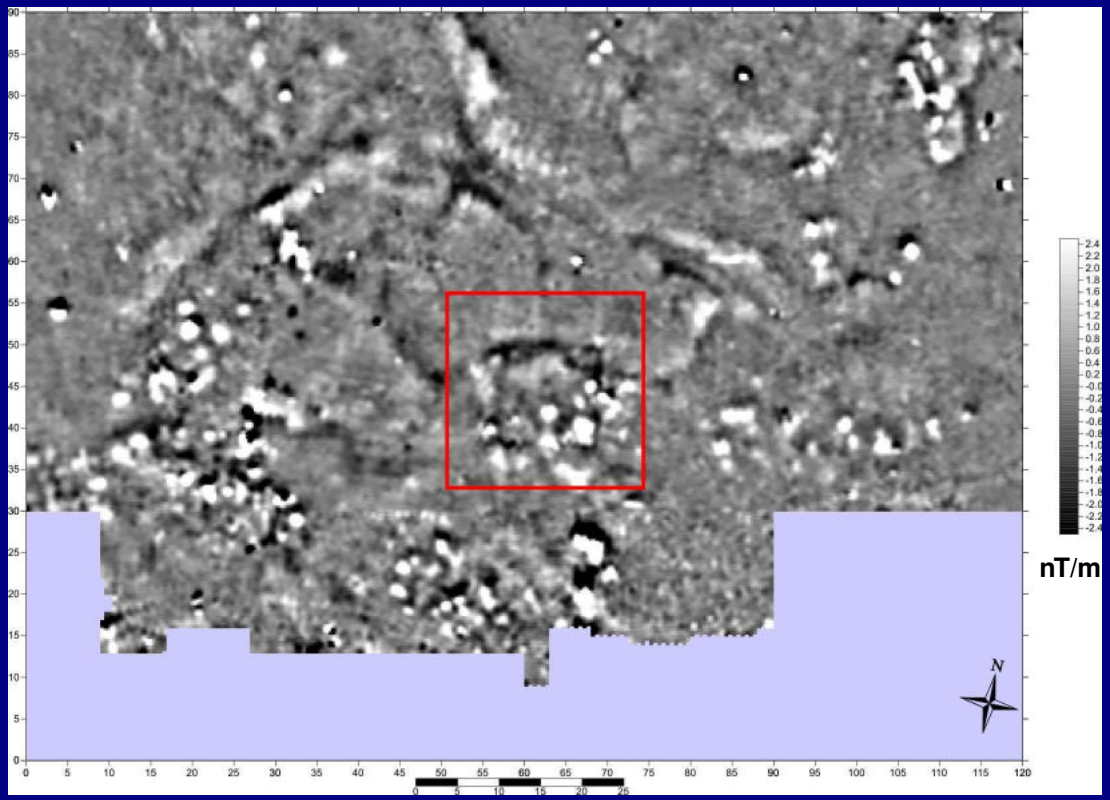
Zonification of the site on the ICC 2010 aerial photography displayed with QGIS

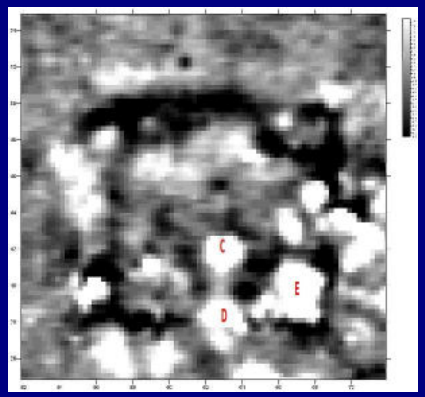
Puig Ciutat – Iberian settlement with middle-age occupation?

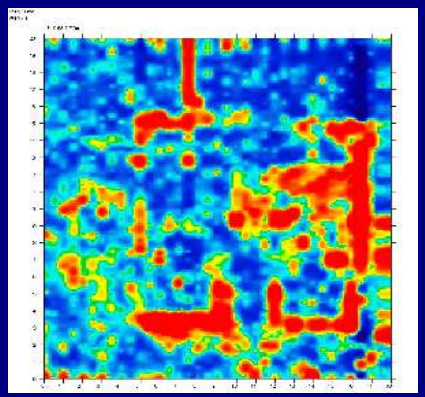
First references in publications by M.D.Molas in 1975 and 1982 assessing the site as highly important based on pottery recollection

Earthworks in the 1980s put into evidence archaeological remains

First evaluation of the site in 2005 using gradiometer and GPR acquisitions (SOT Prospection) and additional GPR acquisition in 2007 in a wooden area







Depth included between 0.50 and 0.70m

A multi-scale approach

SCALES	OBJECTIVES	TOOLS
Regional Context	Main paths near Puig Ciutat	Spatial analysis using DEM: easiest paths
Local Area	What other locations could be in relation with Puig Ciutat	Accessibility, Paths between points of interest, Aerial photography, Metal detectors, Geophysics
The Site	Extension, Occupation and Use of the site	Geophysics, Logs, Analysis of visibility, Control area
Excavation Units	Chronology and Use of each unit	Excavation, Sections, Analysis (soil, coal, fauna, pottery...)

First explorations

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Hypothesis: Puig Ciutat is not an isolated settlement

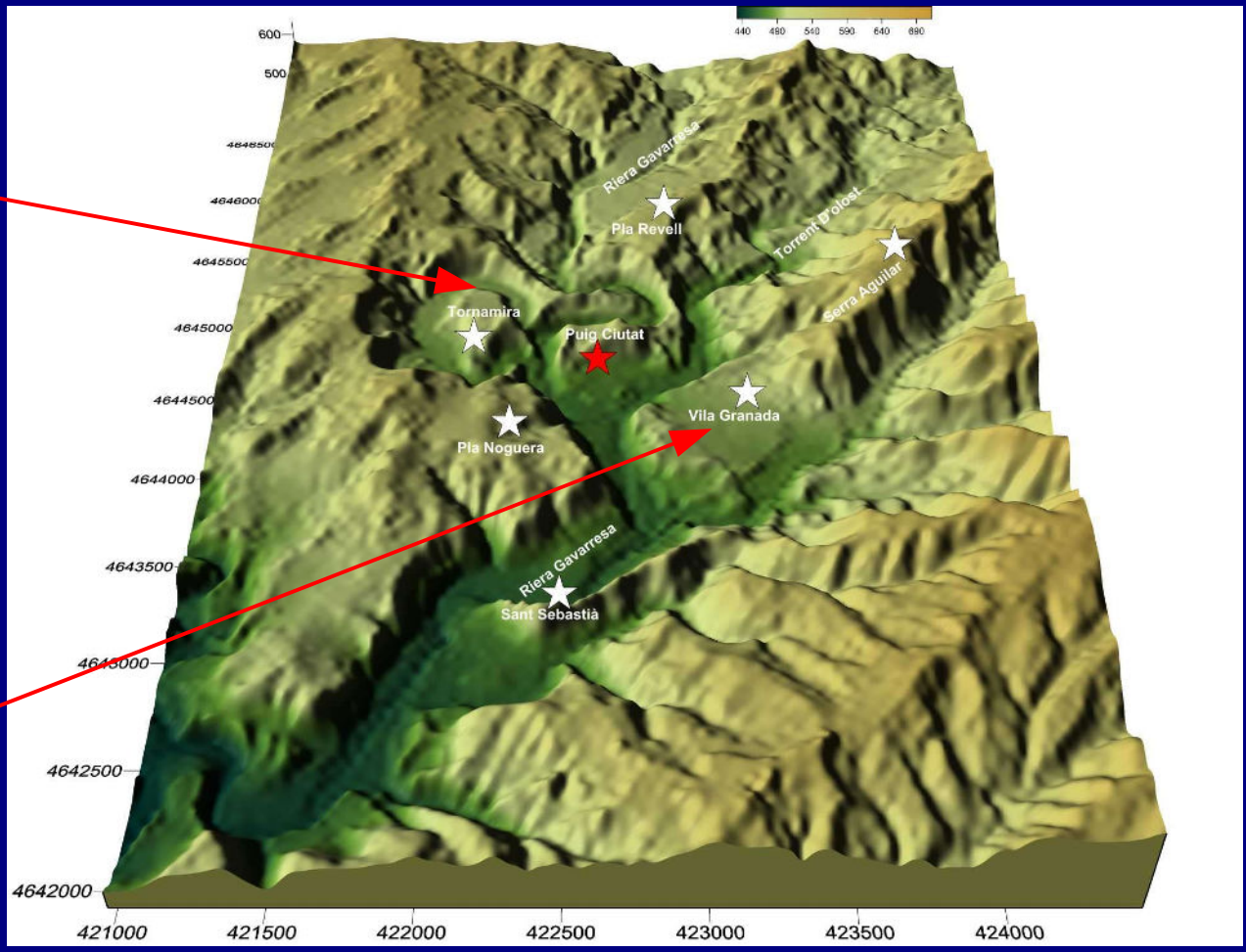
Qualitative assessment of the possible targets using aerial photography and a Terrain Digital Model (15x15m)

Field walking exploration of strategic points of the surroundings of the site

Pottery evidence found in most of the places

ICC 2008 aerial photographies

ICC 15x15m model terrain



Extension and Occupation of the site

OPERATIONS

Vegetation cleaning in selected wood areas

Superficial material recollection

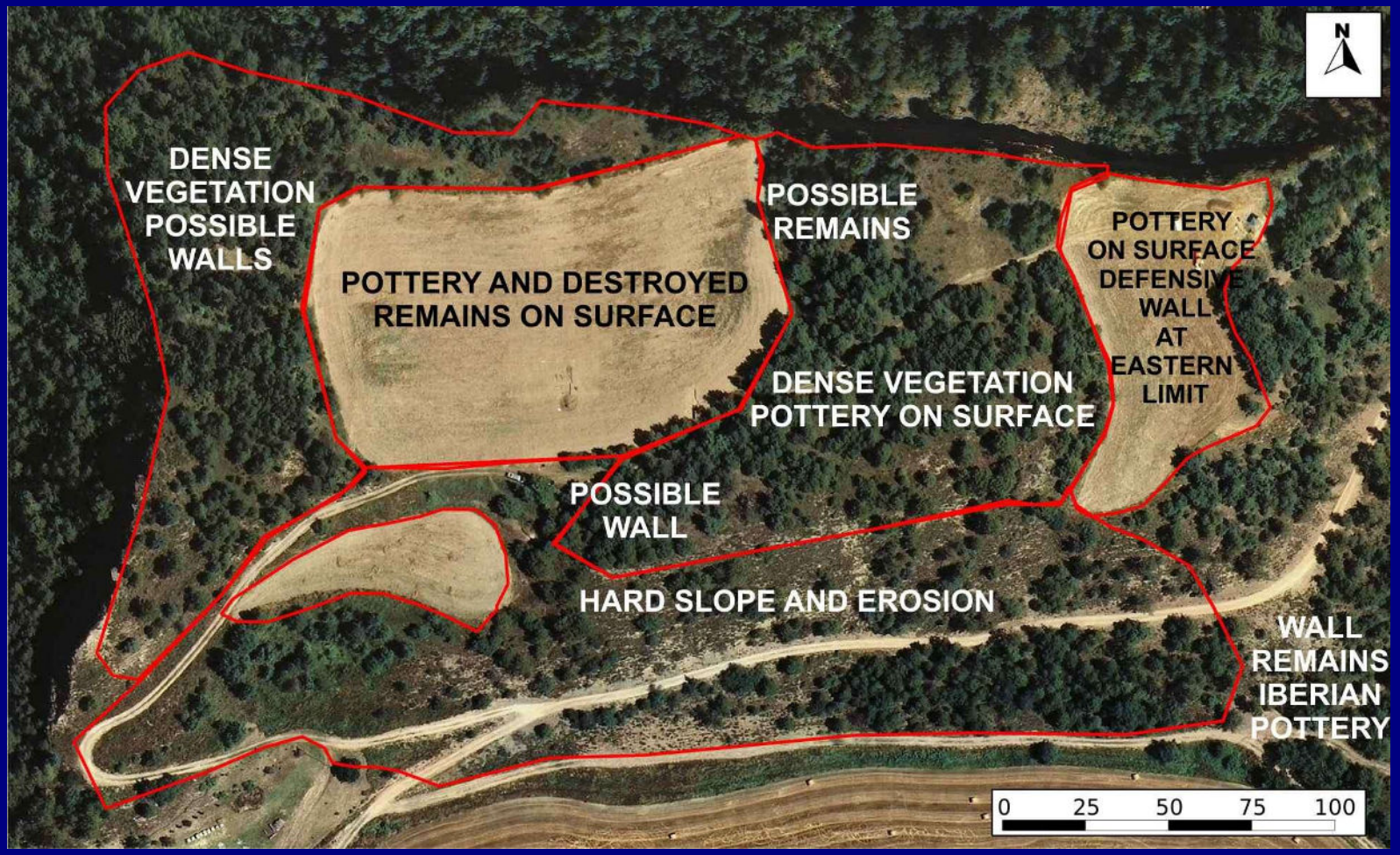
Sections digging in points of interest

MAIN RESULTS

A part of a defensive wall is found

Pottery indicates a roman occupation

Vegetation cleaning puts in evidence possible constructive structure in the wooden areas



Zonification of the site on the ICC 2010 aerial photography displayed with QGIS

Global view of the open fields of the site

Occupation areas can be defined but with no clear geometry

ACQUISITIONS

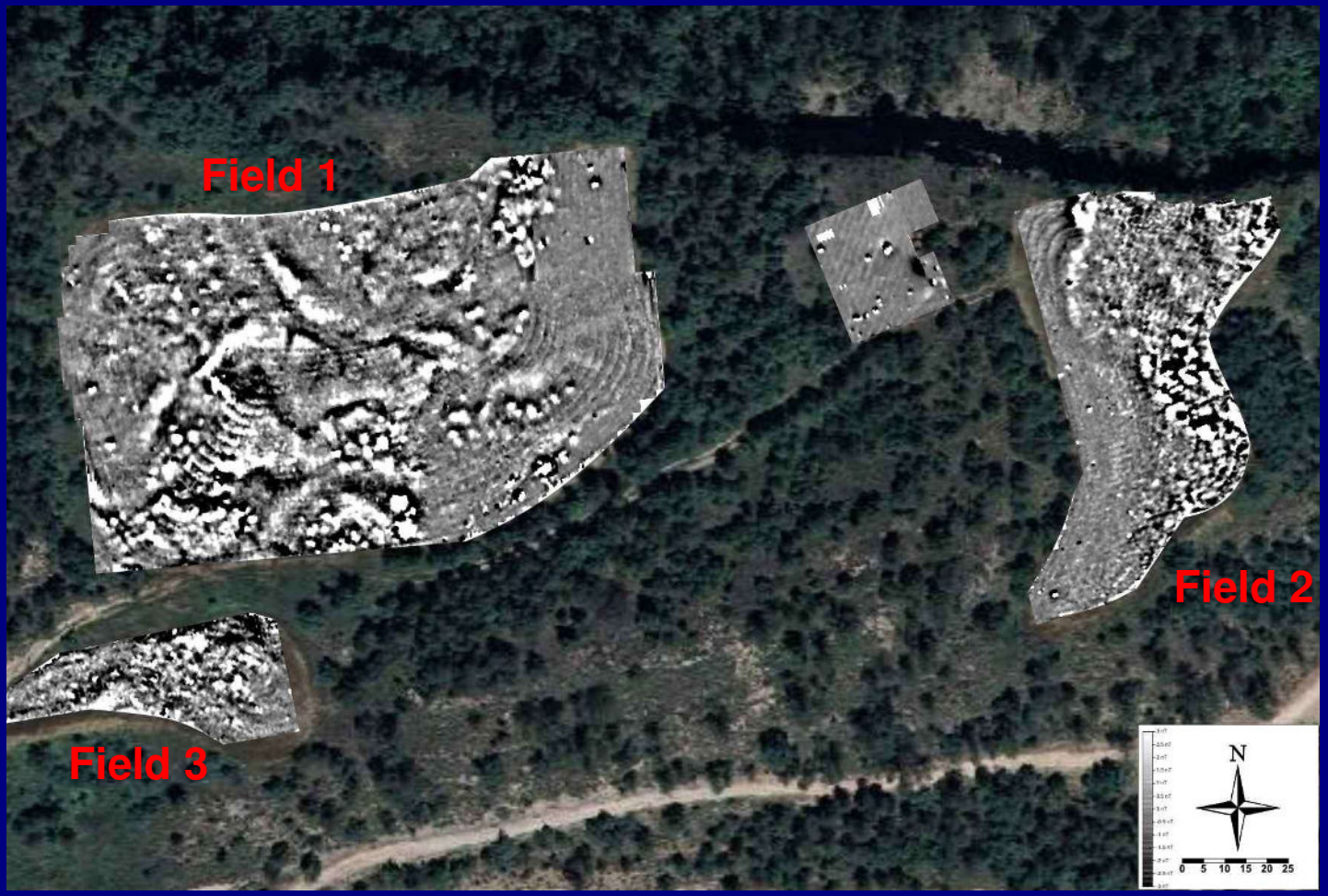
The main field is repeated with a gradiometer of higher sensitivity

3 other fields are explored

The main building detected in field 1 is explored with 3 different GPR systems in order to compare them

A small grid in the western wooden area is acquired with GPR

An experimental resistivity system was tested on the main building in field 1



Magnetic gradient results on the ICC 2008 aerial photography

Selection of sections and excavation areas

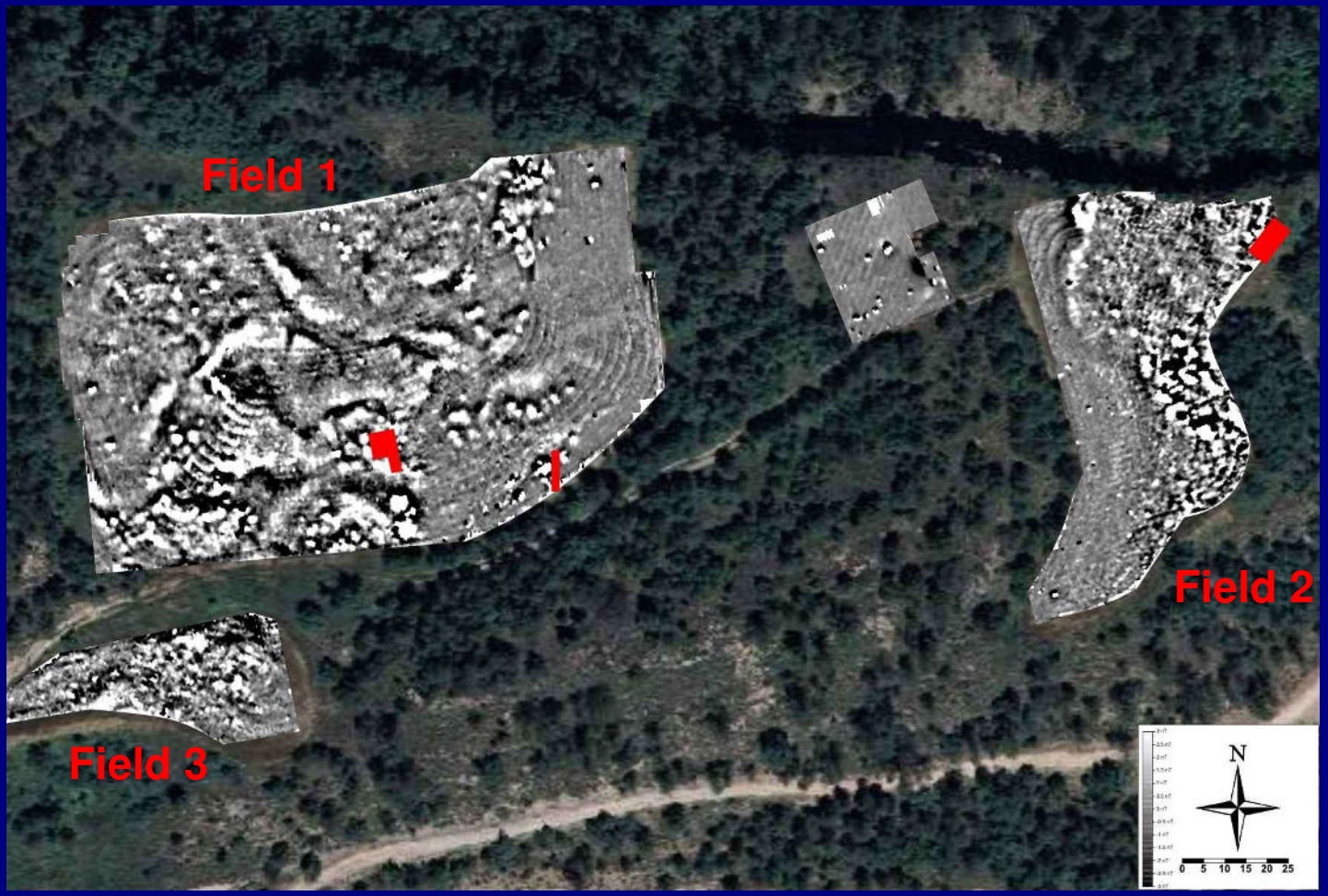
FIELD 1

Section around a selected area of the main building detected by geophysical prospection

Section evaluation in an area where archaeological structures were endangered by ploughing and where high values of magnetic gradient were acquired

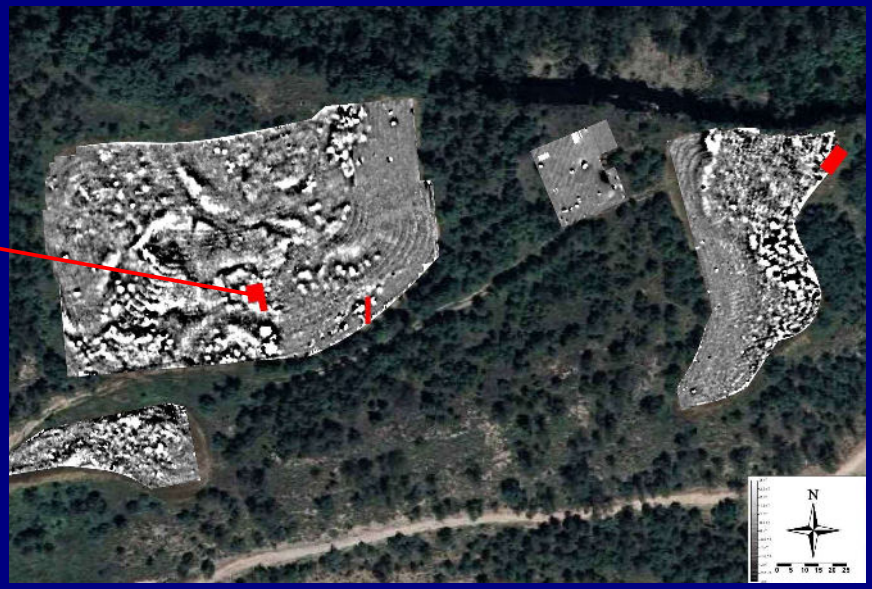
FIELD 2

Excavation of an area in contact with the defensive wall based on observations during the exploration of the site and the cleaning of vegetation



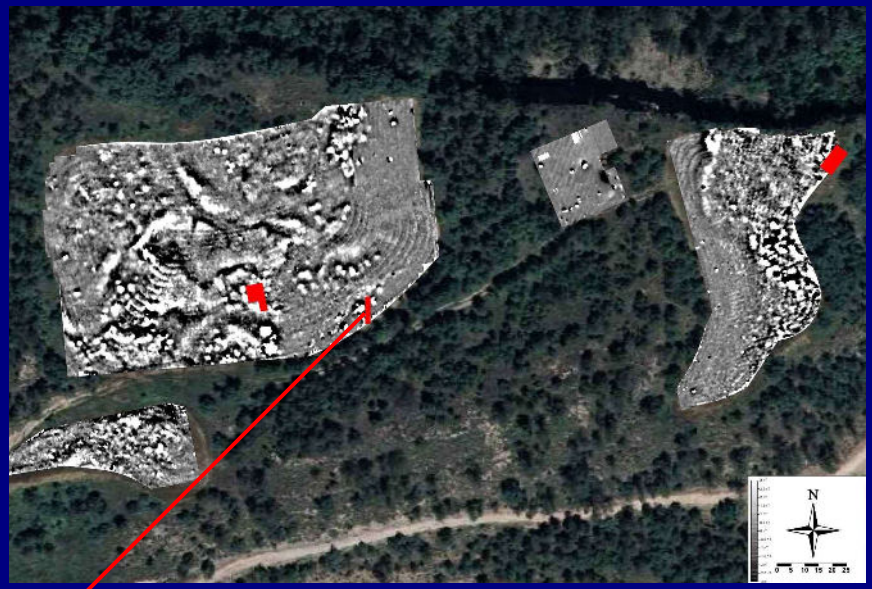
Magnetic gradient results on the ICC 2008 aerial photography

Results of the excavations



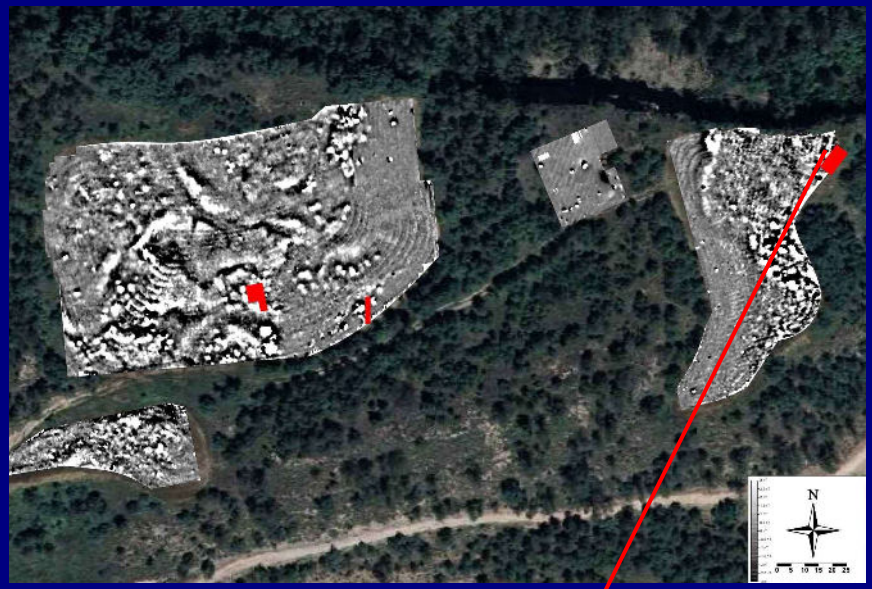
Excavation in field 1 showed fire traces and destructed pottery dated from the late Republican period.

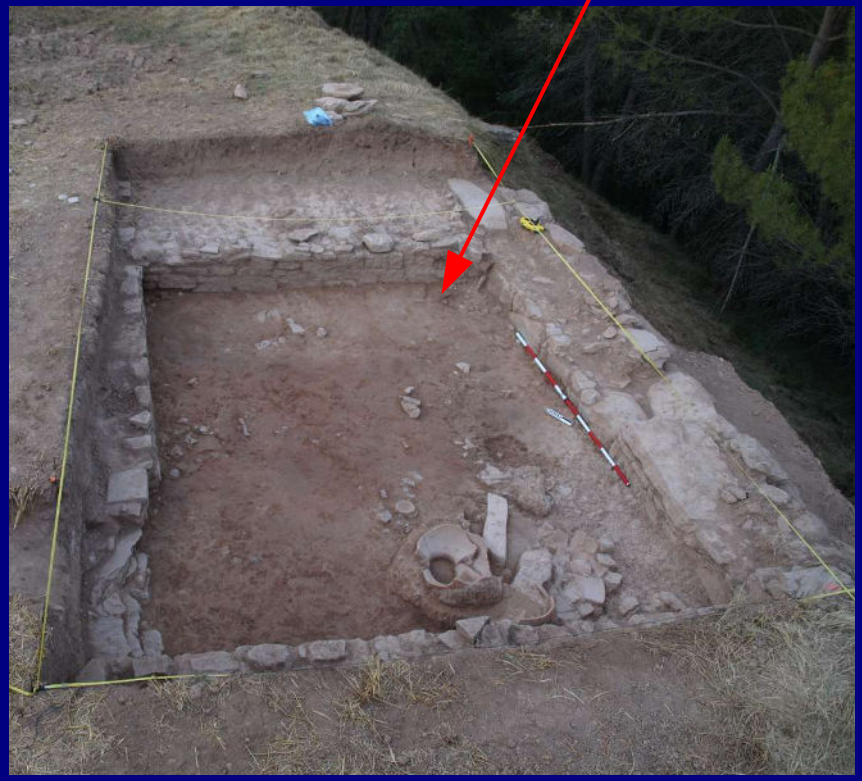
Results of the excavations



Section in field on confirmed the presence of constructive elements at a very shallow depth (0.30m). The values of magnetic gradient were explained by the detection of thermo-altered sediments.

Results of the excavations





In field 2, in contact with the defensive wall, a first room was partially detected. A layer of occupation with a profusion of abandoned or destructed material, traces of firing as well as weaponry was found.

Late republican site with traces of firing and weaponry

The results of the excavations showed several areas of firing and an important amont of weaponry.

The pottery found was examined and the profusion of campanian C gave a date of destruction included between 80 and 50 BC which corresponds to two civil wars: Sertorian and Cesarean.

The first results give new perspectives

With these results new objectives are defined:

The possible destruction of the site and its Roman chronology raise new questions: was the settlement under siege? If the site was attacked, from where was it attacked? where did the besiegers establish their camp?

The magnetic gradient map gave areas of interest but the thermo-alterations and the contrast do not allow having a description of the geometry of the constructive elements. Other technologies have to be applied in order to map the possible structures of interest.

The stratigraphy shows to be complex and have to be investigated.

Adapting to the new objectives

1. Exploration of the surroundings
2. Description of the constructive structures
3. Understanding the stratigraphy
4. More excavations
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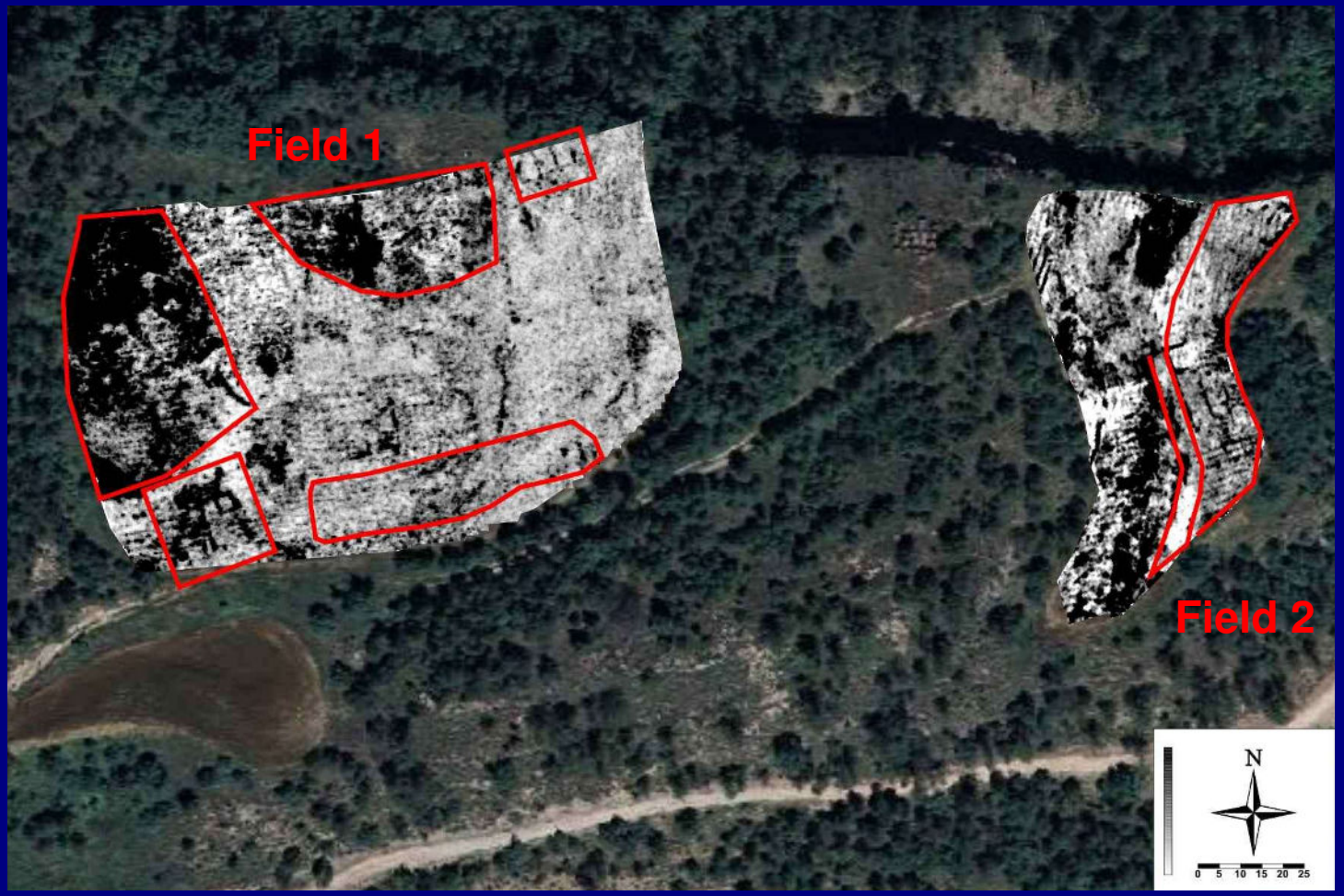
Was there a military camp or siege facilities around the settlement?

Description of the constructive structures

For the description of the constructive structures, a GPR acquisition was implemented using an IDS system with two central frequencies of 600 and 200 MHz allowing the acquisition of two vertical resolutions and depth of investigation at the same time.

GPR results on the ICC 2008 aerial photography

Description of the constructive structures



GPR results on the ICC 2008 aerial photography

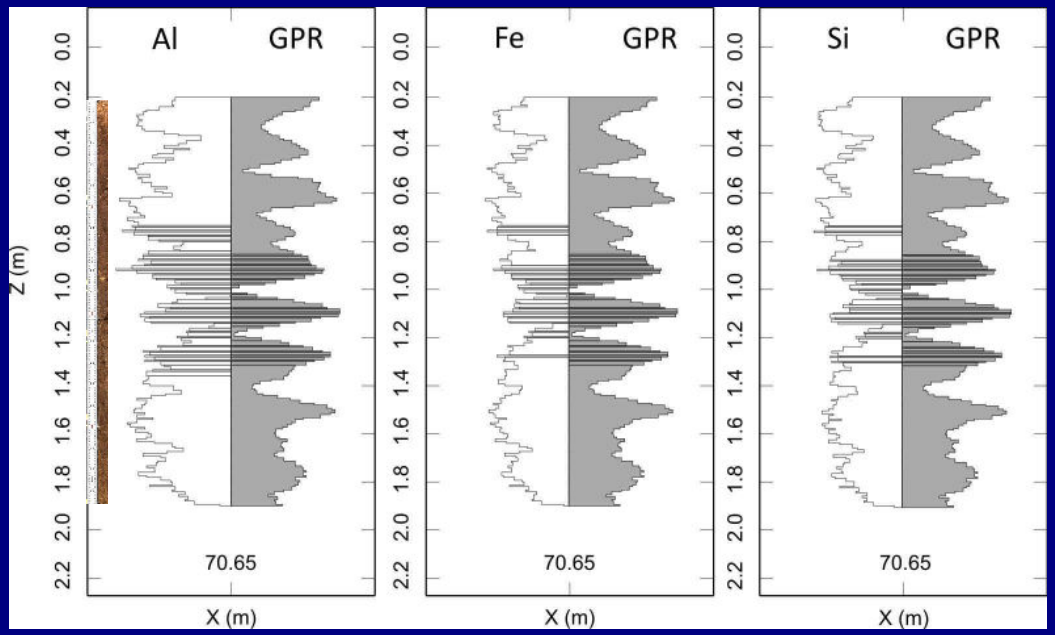
The contrast between the sediment and the bedrock being very low, some areas are poorly described.

Field 2 showed a complex stratigraphy

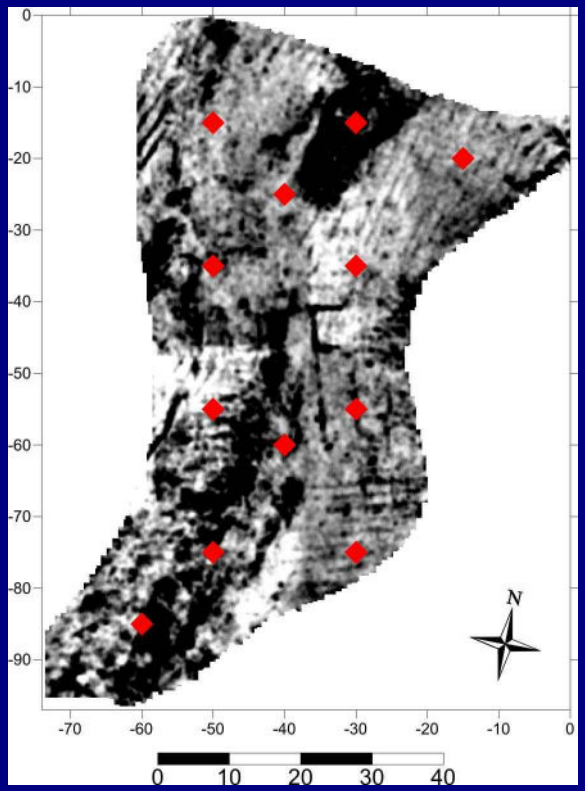
Calibration of the GPR results and XRF analysis

In order to describe the stratigraphy of the area, 12 logs were performed with a regular spacing of 20m.

XRF analysis will be performed on 4 of the cores selected for their length and presence of anthropic layers



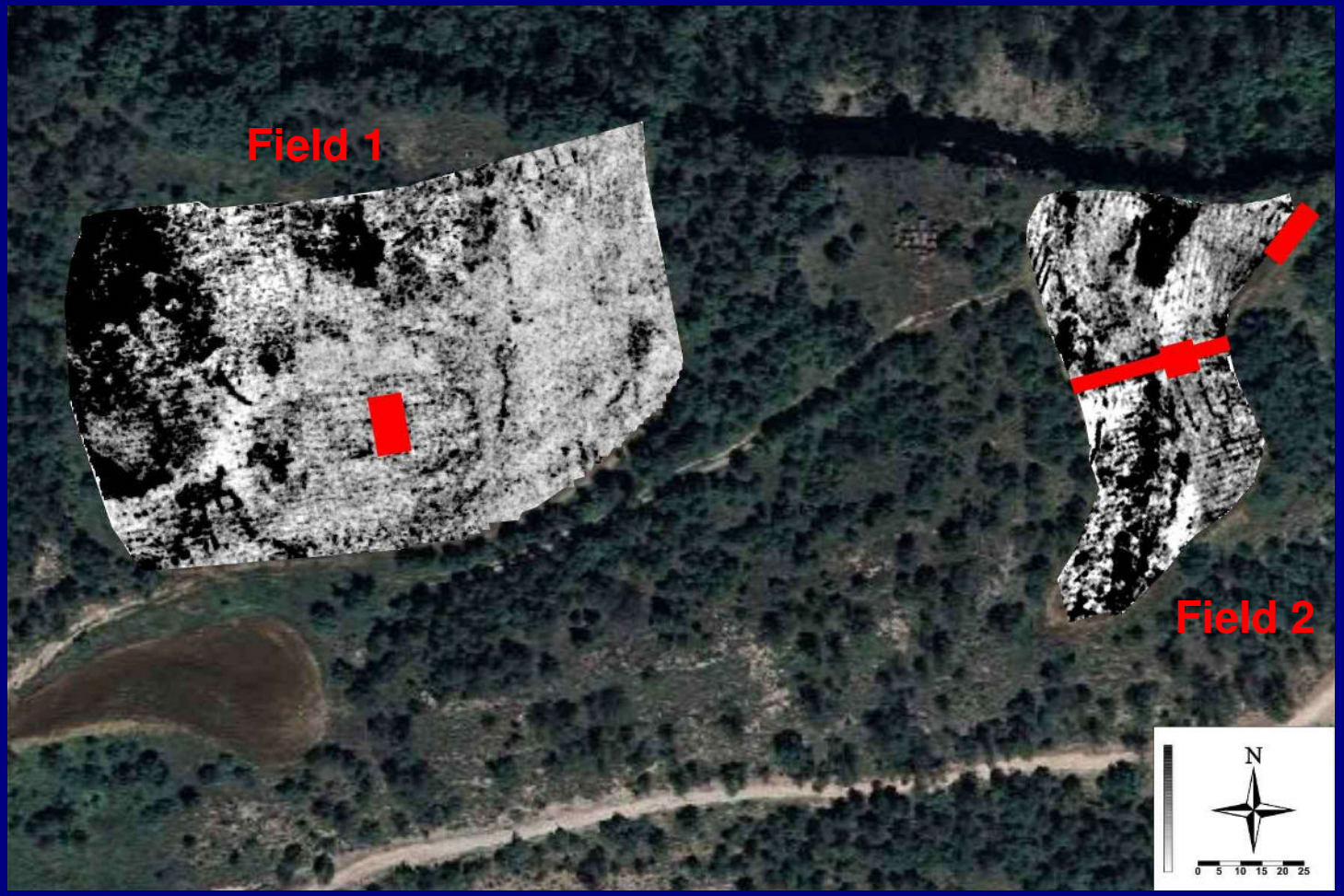
Log analysis with ISATIS



3 excavation areas

The excavations of the main building and near the defensive wall were extended

A new area was opened based on geophysical results



GPR results on the ICC 2008 aerial photography

Field 1

The excavation of the main building is extended to half of its total surface.

Near the defensive wall

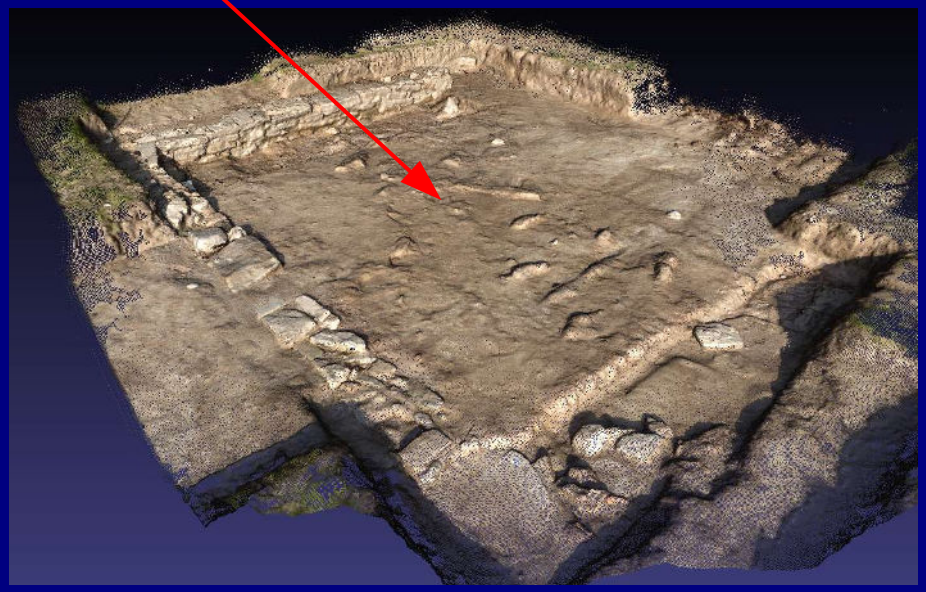
A earlier phase of occupation and new rooms were found.

A new area is opened

A large section is opened in field 2 based on the geophysical results.

A habitation that was described by GPR results and that showed high thermo-alterations in the magnetic gradient map was found.

Burned wood beams are found in situ.



Consolidation of the investigation project

The potential of the site is confirmed and the usual problems management should be solved (land property, sackings, accessibility, security, stocking of material).

More traces of destruction of the settlement by fire were found

Though the exploration of the surroundings gave first results, it was not conclusive due to vegetation problems.

The constructive structures were partially described and specific processes have to be applied.

A great amount of data was collected. Research lines and priorities must be clearly defined.

DATA MANAGEMENT

1. Produced data
2. Covered areas
3. Data integration
4. Perspectives

Excavation was he main tool to confirm the potential of the site

Colored areas approximately proportional to the produced amount of data

Aerial Photography
Visible and/or infrared1957, 1986, 2008, 2009, 2010,

Battlefield archaeology
2 metal detecting surveys with tracks and way-points for he collected material

Topography
MNT 15x15m, LIDAR 2x2m, GPS RTK 0.75x0.25m, SL 0.10x0.10m

12 Logs

Archaeology
Reference points
Maps and sections
Photogrametry
Material
Material database
Sediments samples
Coal samples

Geophysics
Magnetic
GPR
EMI
Interpretations
Experimentation
Collaborations

Other technologies help with the exploration in extension

Colored areas approximately proportional to the covered areas

Aerial Photography
Visible and/or infrared1957, 1986, 2008, 2009, 2010,

Topography
MNT 15x15m>LIDAR 2x2m>GPS RTK 0.75x0.25m>SL 0.10x0.10m

Metal detectors
2 campaigns with tracks and collected material

Geophysics
Magnetic
GPR
EMI

12 Logs

Archaeology

Assembling data and results

Several reference systems were used in the first campaigns.

Absolute reference points had to be defined in order to work in an unique reference system.

Once georeferenced, the correlations between the different data sets can be studied and methodologies for data integration or combination can be advanced.

The objective is to improve the archaeological interpretation and to propose a model.

The reference points were used during the last archaeological campaign with a total station in order to produce results in absolute coordinates.

Material, drawings and photographies were georeferenced during the field work.

Reference and Excavation points on the ICC 2010 aerial photography

Projections for the coming years

Regional Context

Easiest paths through the Lluçanès through spatial analysis: From the Pyrenees to Lleida, from Vic to the Bagès, access to the seafront.

Local area

Accessibility and Control areas of the Lluçanes. Easiest paths between known areas and random points. Extensive and intensive metal detectors exploration after cleaning the vegetation. Geophysical prospection in selected areas.

In the settlement

Visibility from Puig Ciutat. What areas have to be controlled to avoid blind spots. Advanced process of the available geophysical data. Repeating magnetic acquisition in field 1. Resistivity prospection. Woods exploration. GPR low frequency acquisition

Excavation Units

Integration of metal detectors during excavations: can we locate small metal artifacts in situ? Paleoenvironment analysis (soil, coal, seeds, fauna). Conservation and restoration of metal and pottery objects....and eventually some more excavations...

Thank you for your attention

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