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Contribution of large scale geophysical survey to analysis of the evolution of the western boundary of the city of Allonnes (Sarthes, France): Integration of Google images, the Napoleonic cadastre and large magnetic surveys

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Key words: Magnetic survey, Aerial survey, Napoleonic cadastre, Google image.

How is it possible to comprehend the anthropogenic evolution of landscapes? A. Levy, in his book about urban morphology, states that “the concept of the layouts’ morphology covers how these layouts are distributed within the space of the whole city according to the various stages of urban growths and their expansion procedures”. Thus, the urban binomial (couple) networks/frames perfectly explains the construction process of the towns’ composition. Mapping of Allonnes’ urban composition demonstrates the importance of this morphological reading. Indeed, it is striking to see how successive waves of urbanization can be oversimplified in this way. From the ancient city to the contemporary one, several phases of urbanization remain legible.

The expansion projects of the modern town to the west have focused attention on this still agricultural area. “La ZAC de la Buissonnière” is part of the area threatened by the growth of the town. Examination of aerial photographs shows several enclosures in these plots. INRAPs’ archaeological trial trenches, on the other side of the road, have iden-

tified a Roman necropolis. Is this route part of an ancient track or not? Does the Roman necropolis continue further to the west? Have we reached the limits of the Western Roman city? What was the nature of the occupation of this area before and after the Roman period? Within the framework of the ANR CeltecoPhys program, motorised geophysical instruments make possible the development of a method of prospecting, which can be associated with other known surveying techniques. Fifteen hectares were magnetically surveyed in two days. The apparatus used (AMP for Automatic Magnetic Surveying), coupled with a dGPS and onboard computer, allows the map of magnetic anomalies to be viewed immediately and the area to be surveyed may thus be adjusted if necessary as the survey progresses. Combining these geophysical surveys with other sources such as: photographs, aerial surveys, Geoportail (French topographical maps on-line), Google imagery and cadastres, we can analyse the evolution of cadastral frames from antiquity to present day, geocoding them together, including the buildings on

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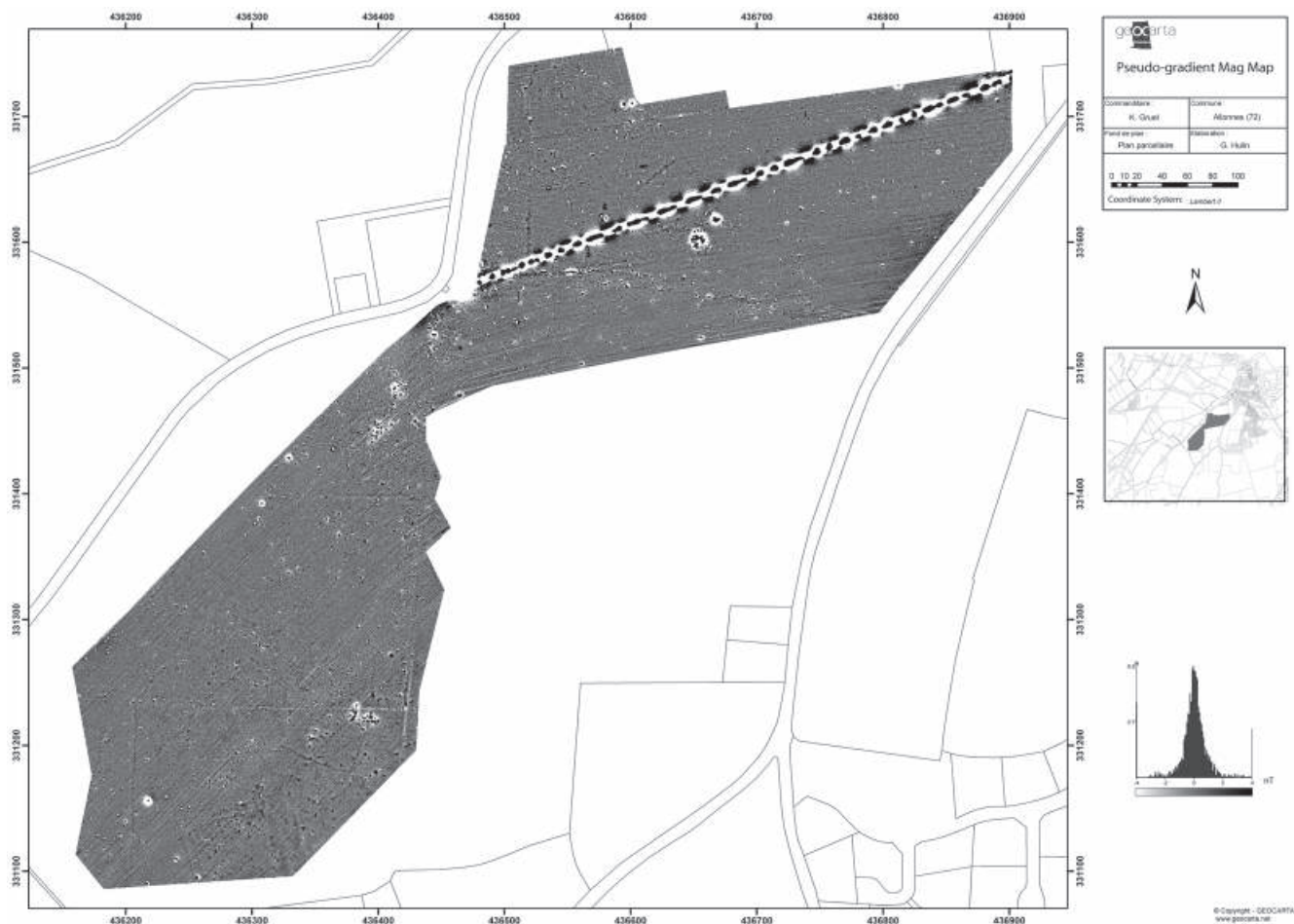


Figure 1: Superposition of Cadastre and magnetic map (scale =-4 to 4 nT/m).

the outskirts of the city. Napoleon's cadastre was georeferenced and vectorized and found to coincide precisely with linear anomalies in the magnetic surveys. So, it is possible to control the topographical accuracy of the Napoleonic cadastre, and only some positions of frame borders need to be corrected. Two land parcels predated the Napoleonic cadastre. A wide double-ditch enclosure was found and can be followed both over the Google images and over the magnetic images. Further west, several enclosures are visible. Following the geophysical survey, a re-examination of aerial photographs, taken at different time of the year, provided additional information about the continuation of these structures in the adjacent plots. Many discrete magnetic anomalies are clearly visible; some of them are anthropogenic and will have to be checked by archaeological excavation. Some may correspond to tombs. However we are outside of the Roman city. The shape of these enclosures is closer to medieval structures or even proto-historic. No surface arte-

facts have been found to help clarify the chronology. But, while uncertainties remain, it has nevertheless been possible without excavation to show that the area has been occupied since antiquity, to precisely frame the borders of land units and to determine the plans of some of the dwellings.

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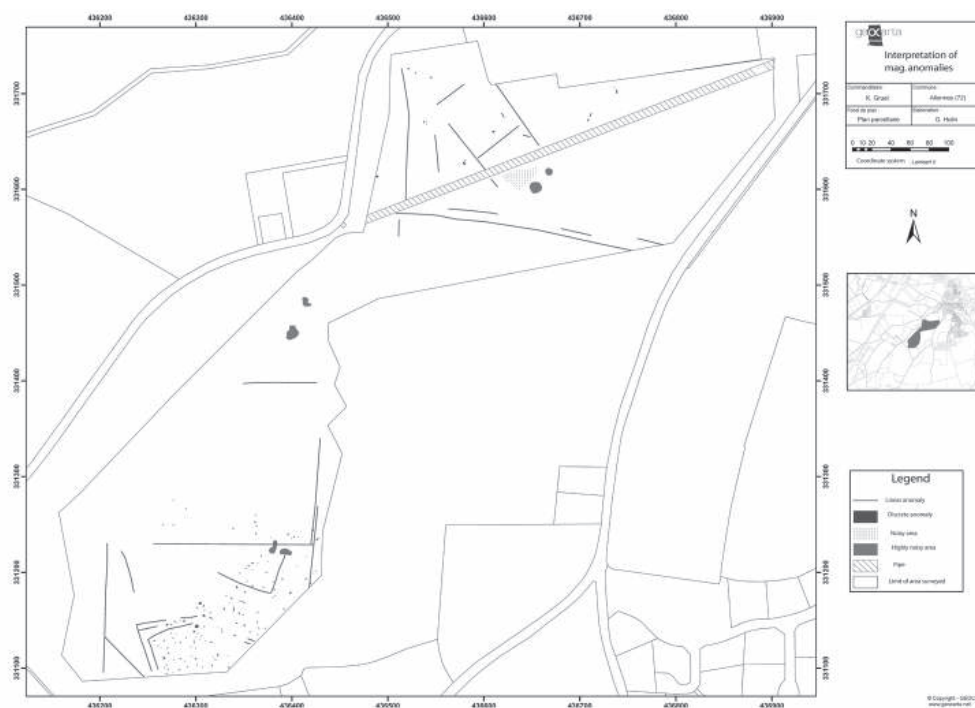


Figure 2 (see color plate): Interpretation of magnetic map.