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## 3D DIGITISATION AND RECONSTRUCTION OF A CAPITAL IN NORTH-WESTERN GAUL: INTERIM RESULTS ON THE CITY OF ALET

Yann Bernard<sup>a,\*</sup>, Jean-Baptiste Barreau<sup>a</sup>, Catherine Bizien-Jaglin<sup>b</sup>, Laurent Quesnel<sup>a</sup>, Loïc Langouët<sup>b</sup>, Marie-Yvane Daire<sup>a</sup>

<sup>a</sup> Laboratoire Archéosciences UMR 6566 CReAAH, 35000 Rennes, France. [yann.bernard@univ-rennes1.fr](mailto:yann.bernard@univ-rennes1.fr); [laurent.quesnel@univ-rennes1.fr](mailto:laurent.quesnel@univ-rennes1.fr); [jean-baptiste.barreau@univ-rennes1.fr](mailto:jean-baptiste.barreau@univ-rennes1.fr); [marie-yvane.daire@univ-rennes1.fr](mailto:marie-yvane.daire@univ-rennes1.fr);

<sup>b</sup> Centre Régional d'Archéologie d'Alet, BP 60 35413 Saint-Malo, France. [langouet.loic@wanadoo.fr](mailto:langouet.loic@wanadoo.fr); [catherine.bizien-jaglin@wanadoo.fr](mailto:catherine.bizien-jaglin@wanadoo.fr)

### Abstract:

The City of Alet is an important archaeological site in Brittany because it was in the late Iron Age the capital of the Coriosolites. The remains, scattered today in a neighbourhood of Saint-Malo, are highly heterogeneous. Because of its great archaeological interest, it has become since 2015 the subject of experimentation in digital archaeology. From 3D scanning and Ground Penetrating Radar experimentation, we started a 3D reconstruction of city including several levels of uncertainty and fuelling archaeological thoughts, the results of which are still in discussion.

**Key words:** coastal and island archaeology, 3d scanning, ground penetrating radar, 3d reconstruction

## 1. Introduction

### 1.1. Archeological context

The archaeological excavations carried out between 1971 and 1985 by L. Langouët (1987) at the foot of the promontory of Alet, ancient settlement previous to the modern town of Saint-Malo (Brittany France) (Fig. 1), helped to locate the Roman port of Reginca which is mentioned in the 'Peutinger Map', a medieval copy of an ancient road document. Located at the junction of several river and sea routes, the site of Reginca occupies a prominent place in the Normano-Breton Gulf, which is extended by the Rance and stands as a major traffic artery to penetrate far into the inland region. The artefacts found during the excavation, show diverse and sometimes remote origins which attest commercial activities throughout antiquity.

### 1.2. Framework context

In close cooperation with the research team CeRAA (Centre Régional Archéologique d'Alet), leader of the archaeological researches on the site of Alet, the Common Cultural Connections (CCC's) recently provided an opportunity to develop an interdisciplinary approach on the 3D digitalisation of the site and first reconstruction developments. The aim of the CCC' project is to enhance understanding of the shared cultural heritage of the three European partner regions through an innovative mobile exhibition (Daire and Momber 2014); then, the reconstruction of the Alet

ancient port was developed as an illustration of the late prehistoric and roman sailing roads and contacts along the Channel-Atlantic façade of Europe.



Figure 1: Google Earth view of the modern town of Saint-Malo.

### 1.3. Diversity of the data sources : The benefits of an interdisciplinary approach

The specificity of the Alet ancient city case study is the diversity of complementary sources of data available: underwater and terrestrial archaeology, historic sources (texts, ancient maps, photos and drawings), geophysical surveys and monitoring, environmental studies, etc. Each of them, taken independently, was not sufficient to draw a complete and accurate view of the past of this site. But, by combining the data, it became then possible

\* Corresponding Author: Yann Bernard, [yann.bernard@univ-rennes1.fr](mailto:yann.bernard@univ-rennes1.fr)

to propose a historic re-construction of the roman city, built on precise evidences completed by some hypothetical reconstructions.

## 2. 3D Laser and magnetic surveys

### 2.1. 3D laser survey

In January 2015 and in the context of the WDCAH project (Barreau *et al.* 2013 and 2014), several archaeological structures (on the terrestrial and intertidal domain), previously excavated by the CeRAA team were scanned (Fig. 2). The scans were performed with a Focus3D X 330 particularly on the remains of an old retention pond which allowed, thanks to an ingenious pumping system, to provide potable water to the City.



**Figure 2:** 3D laser survey of the seashore (doc. Y. Bernard).

### 2.2. Ground Penetrating Radar

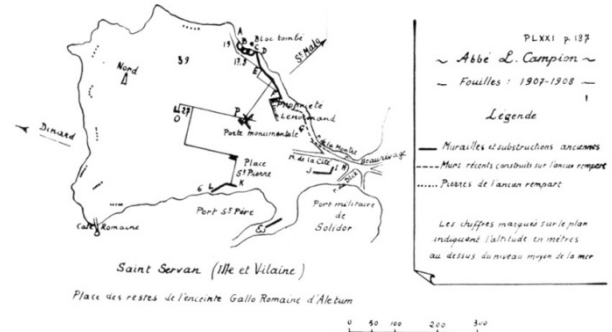
Alongside terrestrial scanning, we also tried, in June 2015, to detect buried remains. We used a Stream EM which is a multi channel Ground Penetrating Radar solution dedicated to utility locating and mapping (Conyers 2012). The results, difficult to read because of bomb craters from the Second World War, are studied and evaluated (Fig. 3).



**Figure 3:** Area covered with the G.P Radar (doc. ABEM France).

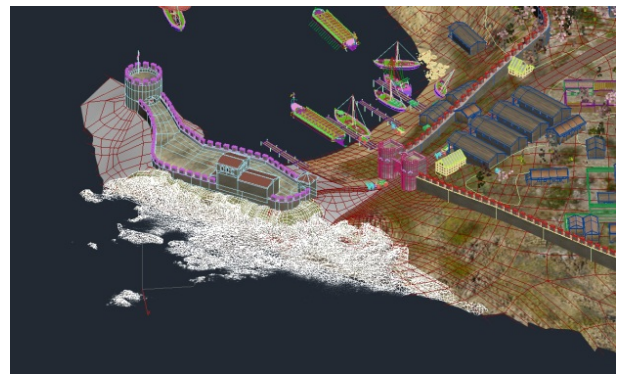
## 3. 3D Modeling

With the large volume of textual data and images (Fig. 4) from several decades of archaeological research, a 3D reconstruction work could begin. This was done with 3ds Max 2015/VRay 3 and involved both buildings that vegetation.



**Figure 4:** Map of the remains of the Alet urban boundary walls drawn by Abbé L. Campion in 1908 (Dos 1969).

The digitisation of the remains has been also integrated (Fig. 5). The alluvial cordon failure, known by archaeologists, was also considered for the reconstructions (Fig. 6 and 7).



**Figure 5:** Mesh resulting from laser survey of the seashore archaeological features included in 3D model (white object) (doc. Y. Bernard, CNPAO, CCC's project).



**Figure 6:** 3d reconstitution of the Ancient city and port of Alet, before the break of the alluvial cordon during the 4th cent. AD (doc. Y. Bernard, CNPAO, CCC's project).

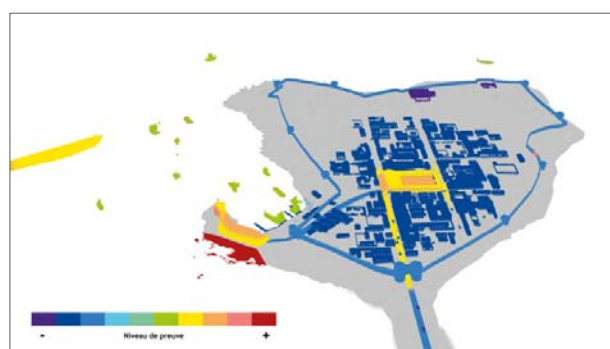
In addition to our reconstitution, we used a graphical representation of the amount of historical/archaeological evidence of elements represented (Fig. 8). The scale of colors is adapted from the project Byzantium 1200 (Öner and Berger 1998) and from a table which represents the



grade of evidence for the representation of elements in virtual archeology (Resco and Figueiredo 2014).



**Figure 7:** 3d reconstitution of the Ancient city and port of Alet, after the break of the alluvial cordon during the 4th cent. AD (doc. Y. Bernard, CNPAO, CCC's project).



**Figure 8:** Ranking of the reconstitution this rendering shows the city as color coded according to the grade of historical/archaeological evidence (doc. Y. Bernard, CNPAO, CCC's project).

## 4. Conclusion and future works

### 4.1. 3d model as a dynamic compilation of knowledge

The 3d reconstitutions developed from a wide range of data synthesize the state of knowledge at any given time. The sense of affirmation caused by the photo-realistic rendering can be qualified by the graphical commentary system highlighted above. 3d files that make up the scene can be modified to adapt to new contributions and scientific discoveries.

### 4.2. Future works: the 3D reconstruction applied to ancient/roman armorican cities

The Alet case study presented above has to be considered as a preliminary work, essential in the improvement of the methodological process. Our aim is now to develop such approach in a wider geographical and cultural scope, covering the territory of Armorica (i.e. Western France area during the Roman Empire); our objective will be to propose 3D reconstruction of the main roman cities, in order to allow comparative approach within the very large frame work of the Roman Empire territory.

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## References

- BARREAU, J.B., GAUGNE, R., BERNARD, Y., LE CLOIREC, G. and GOURANTON, V., 2013. The West Digital Conservatory of Archaeological Heritage project. Proc. of Digital Heritage Int. Congress 2013, Vol. 1, pp. 547-554
- BARREAU, J.B., BERNARD, Y., PETIT, Q., BEUCHET, L., PETIT, E., PLATEN, V., GAUGNE, R., LE RUMEUR, J. and GOURANTON, V., 2014. Combination of 3D scanning, modeling and analyzing methods around the castle of Coatfrec reconstitution, 5th International Conference EuroMed, pp. 418-426
- CONYERS, L.B., 2012. Interpreting Ground-penetrating Radar for Archaeology. Left Coast Press. 220 pages.
- DAIRE, M.Y. and MOMBER, G., 2014. What is the Common Cultural Connections Project? Available: [http://commonculturalconnections.maritimearchaeologytrust.org/uploads/images/Posters/CCC\\_Leaflet\\_Teachers\\_act4.pdf](http://commonculturalconnections.maritimearchaeologytrust.org/uploads/images/Posters/CCC_Leaflet_Teachers_act4.pdf).
- DOS, A., 1969. Cinq campagnes de fouilles archéologiques à la Cité d'Alet à Saint-Servan-sur-Mer. Annales de Bretagne Vol. 76, No. 1, pp. 229-245. DOI : 10.3406/abpo.1969.2515
- LANGOUËT, L., 1987. Les fouilles archéologiques de la zone des cathédrales d'Alet. Saint-Malo : Dossiers du Centre Régional d'Archéologie d'Alet. 140 pages.
- ÖNER, A.T. and BERGER, A. 1998. Byzantium1200 project. Available : <http://www.byzantium1200.org>
- RESCO, P.A. and FIGUEIREDO, C., 2014. Escala de evidencia histórica | Scale of historical evidence Available: <https://parpatrimoniointecnologia.wordpress.com/2014/07/21/escala-de-evidencia-historica-scale-of-historical-evidence>.