

**From plan to volume: the need for archaeological analysis in 3D modeling**  
**Par J.-Cl. Margueron et J.-O. Gransard-Desmond**

Foreword

Before talking about why archaeological analysis is fundamental before any tentative of restitution, I would like to draw your attention to the fact that the work which follows is the fruit of the reflexion of professor J.-Cl. Margueron (Emeritus Professor of the École Pratique des Hautes Études I<sup>Ve</sup> section in Paris and Honorary Director of the mission of Mari - Syria). My intervention is due to the fact that I worked on the Red House of Mari, about which I will speak later, and that professor Margueron could not present this communication himself.

**1.** Slides 1 to 4

Without archaeological and architectural analysis, one does nothing but build walls or imagine volumes that nobody can argue the existence of. This way of working is not only specific to our predecessors, since today we still find examples which are still too often the rule rather than the exception.

**2.** Using 2D or 3D technique to understand how buildings were before is not sufficient, in particular when these buildings were not built of stones but in wood or in mudbrick like the architecture I will use later in this communication, and no more remains to the archaeologist but the foundations, or the level of occupation. We need a work methodology prior to any reconstitution work.

Before taking the example of the Red House of Mari (Syria), it is necessary to present the logical bases of our reflexion. Then more quickly I will present two other examples in order to show that what we propose is not only for simple domestic housing, nor for just housing itself.

Slide 5

Because a construction is made by human beings, the measurement of this construction is the one of the human beings. So, over the question of dimensions, a certain number of requirements should not be forgotten:

- protection (against the external environment)

- circulation (of the people)
- lighting (where the light comes from)
- breathing (ventilation)
- management of the residues of activity.

#### Slide 6

If we forget this basic data, there is no longer question of a building as place of life, but of a coffin.

In addition to these constraints, the architect must respect the elementary laws of physics.

So, a construction must take in account:

- Equilibrium of the edifice
  - ✓ Vertical loads
  - ✓ Structural lines
- Objective to achieve
- Relation between superstructure and infrastructure

#### Slide 7

Knowing that, the archaeologist will start by analyzing the archaeological clues, then the architectural clues, taking into account the previous constraints. The whole data will be inventoried and the archaeologist will estimate or reappraise the degree of credibility of each piece of data, the totality of work being put in competition with other examples, if these exist.

- Archaeological analysis
  - ✓ Height of the preserved walls
  - ✓ Volume of ground between the walls
  - ✓ Presence of artifacts between the walls
  - ✓ Presence of artifacts on the ground
  - ✓ Taking the destruction mode into account
- Architecture analysis
  - ✓ Equilibrium of the edifice according to the used materials
    - Vertical loads
    - Structural lines
  - ✓ Objective to achieve
  - ✓ Relation between superstructure and infrastructure

→ Data list and degree of credibility of each one

### 3. The example of the Red House of Mari (Syria)

#### Slides 8 and 9

Presentation of the plan to show that the house made in mudbrick is integrated inside an urban space and that for this reason, it is in contact with other buildings, except on 1 side which opens onto the street.

The house is composed of an oblong room by which the visitor penetrates and where he can see a staircase, a space equipped with a drainage of water giving onto another room, itself equipped with a drainage giving onto a sump situated in the street. Always in the oblong room, a door closing from the interior gives onto a central space serving 3 other rooms. The unit measures from 11,50 to 11,75 m out of 10,50 to 11 m.

#### Slide 10

It is necessary to stress that, at the time of the discovery in 1954, the height of the preserved walls were 2 m minimum.

#### Slide 11

In 50 years, the erosion has got the better of this rare conservation. However, this conservation has its importance compared to the volume of the collapsed superstructures which correspond to one of the archaeological clues in favour of the existence of a floor upstairs. Indeed, the minimal height of the house must be estimated at 4,40 m, which is too high for a house on only one level.

#### Slide 12

From the plan, the architect of A. Parrot, J. Brusson, had put forward two hypotheses of rebuilding: A and B.

But it is starting from the analysis of the archaeological discoveries (quantity of the ground of burying, freeing the site, hinge bearing) and of the analysis of architecture (thickness of the walls of foundation, layout of spaces in relation to the lighting, staircase, control of the access, drainage of waters, nature of the ground of the central space) made by professor J.-Cl. Margueron, that the other hypotheses: C, D and E, could have been proposed, to finally retain only option D: slide 13.

The reasons for that are numerous and were presented in an article dedicated to a first analysis of the Red House. Without reconsidering all the criteria, let us quote some strong clues:

- For the cover of central space
  - the absence of drainage in this space whereas such a device was found

in the room n°2

- the nature of the ground of the central space in mud floor not making it possible to support strong rains

➤ For the existing floor upstairs

- the thickness of the walls of foundations

- the volume of collapse found between the preserved walls

- the presence of a staircase

- the site of the hinge bearing situating the door closing the access to the central space.

### Slide 13b

It is interesting to see that the cover of the central space had already been envisaged by the architect J. Brusson, but also that no other opening elsewhere than to the central space site had been considered, what set out the problem of light and air circulation. In the same way, the presence of a floor upstairs had not been evoked.

## 4. Diapo 14

Another example: room 220 of the Palace of Mari.

The interest of the archaeological analysis is even more obvious in this example to understand room 220 of the Mari Palace. Indeed, it is the analysis of the distribution of the fragments of paintings found in the rubble of the room which made it possible to understand that the central zone poor in fragments compared to the sides, had a logical reason: this area corresponds to the site of an opening in the wall of the room, an opening which is not found in the rise preserved in the bottom level and which it was thus necessary to consider on the floor upstairs. We have to stress that if this criterion is powerful, it does not determine the whole analysis of the circulation in the palace, but put itself in the logic of a multitude of other clues which we will not detail here.

## 5. Slide 15

The architecture concerned with this methodology is not only the housing which is only one specific case of all what concerns buildings in general. Other constructions must be analyzed in this same way, in particular when nothing else remains but the foundations, or a very low rise. This method can be used for any type of architecture:

- house, palace, temple...

- storage place and warehouse
- bridge
- viaduct...

We will only take one example more, that we will not detail, the one of the Tello bridge in Iraq.

## 6. Slides 16 and 17

The first study of these remains began at the end of the Twenties and finished in 1997. After being identified like an hypogeum, a reservoir, or the water regulator of a reservoir, and in spite of the hypothesis of a bridge proposed by Mr.-Th Barrelet in 1965, it is following an analysis based on what we have just set out, that these remains could be identified like those of a bridge above a canal of the city, by professor J.-Cl. Margueron. This example shows the importance of the analysis before any reconstitution and shows that this method is not only relative to the housing.

## 7. Conclusion

### Diapo 18

Before any attempt of reconstruction, we absolutely need to do :

- a complete archaeological analysis with an analysis of all rubble data
- a complete architecture analysis with an analysis of the foundations

Then only in this case: erection in 3D.

So that implies a collaboration between the archaeologist, aware of the architectural question, the architect, and the data processing specialist where the first two manage the work of the third one.

It is only thanks to this collaboration that 3D modeling could be effective and usefull for archaeological research.