SURVEY OF ARCHAEOLOGY AT POMPEII (ITALY)

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ABSTRACT

The objects of reality to be visualised can be very different in respect of size, form or structure. When many details have to be represented (for example in application to architecture or archaeology: texture of walls, materials, colours, etc.), the direct use of digital images, ortho-corrected and referenced, as a tool for metric descriptions can be most valuable. Besides, photogrammetric and surveying techniques are very interesting as a support for scaled reconstruction of the object, avoiding any contact with it.
The work deals with a few applications of spatial reconstruction and visualisation, with photogrammetric imagery draped as a texture over DSMs or planes; the objects, to be documented, are buildings and painted walls in the so called "Casti amanti" excavation, an "insula" inside the "Regio IX" of the ancient Roman town of Pompeii.

1. INTRODUCTION

The charm of the ancient Roman settlement of Pompeii, that is the thing which makes it an unique site in the world for history and art , is the possibility to live again, walking along its worn roads, the daily life of the past, as it was stopped by the catastrophic event . As well known, in 79 A.C. the Vesuvius' eruption flowed over this land: everything was covered by ash, lapilli and the town vanished from reality.
After centuries of forgetfulness, casual findings around the middle of 1700 started the investigation. From then, only three parts over five have been excavated in the urban area (66 ha), including the most of public buildings and a few private mansions. Archaeologists, according to road network, have subdivided the whole built-up area in nine regions (named Regio) and each of them in "insulae" (Fig. 1).
New excavations are still in progress as for buildings, their rooms, gardens, walls, rich in pictorial decorations with brilliant colours, as world-wide famous Pompeian red. The scenes depict mythological , heroic, religious, imaginary subjects and can be regarded among the most important of antiquity. Magnificent mosaics complete wonderfully the ornament of the houses, from very simple ones to real masterpieces, for materials, colour and figurations.
The inventory of the site could nowadays be developed through referenced orthoimagery and vector-raster Cad techniques, increasing also in this sector the use of 2D photorealistic visualisations and 3D virtual reality modelling (Colombo, 1996; Hoele et al., 1996).
The new approach improves automation and cost saving, both in collection and in managing data, being archived.
Therefore, the creation of Monument or Site Information Systems becomes more feasible; all this seems to be in agreement with the growing conception of cultural heritage as a resource, also economical, for a country.
The most significant aspects of representation are thus connected, above all, to computer-vision evolution (Gruen, 1994): for instance, morphology description could be developed especially by computer-science in form of an expert system, let, instead, semantic interpretation of details to manual procedures.
It is obvious that parameters, as resolution and accuracy, will have an important role in raster processing. These considerations point out the existing conflict between metric requirements needed in reconstructing a visualisation model for architecture or for archaeology and the amount of involved storage, above all when RGB colours become really more effective.
The latter aspect is still a constraint for every working process on imagery.
In addition to raster form of perception (geometric model), the representation of thematic details (that is, bounds of pictorial figures, zones of material decay, splitting patterns for the structure, cross-sections, a set of local information on the object) can be outlined as a vectorial layer (symbolic model), in a general reference system
Besides, the collected Digital Surface Model, related to different rooms and walls or the whole building, should become the tool for mesh generation in texture mapping and in orthoimaging, for reconstructing geometric relations among the elements, for visualising spaces and volumes.
This model is now performable either via a manual collection or, at best, through a semi-automatic operation, with the contribution of digital processing of the images and correlation techniques.
Points of interest can be extracted fastly from the photos and then connected in object space as a TIN, according to well-known methods.
However, the reliability of their location increases really only whether more images than the classical stereo pair are adopted.
Site Information System represents therefore the basis for knowledge of a cultural heritage, both for past-present situation (history assessment, morphology, disease or pathology) and for future prospects (recovery, restoration, preservation, investigation on relationship between site and environment or land).
International literature for archaeology, already points out interesting experiences on recording raster-vector data for representation of elements and their features (Ogleby, 1995).

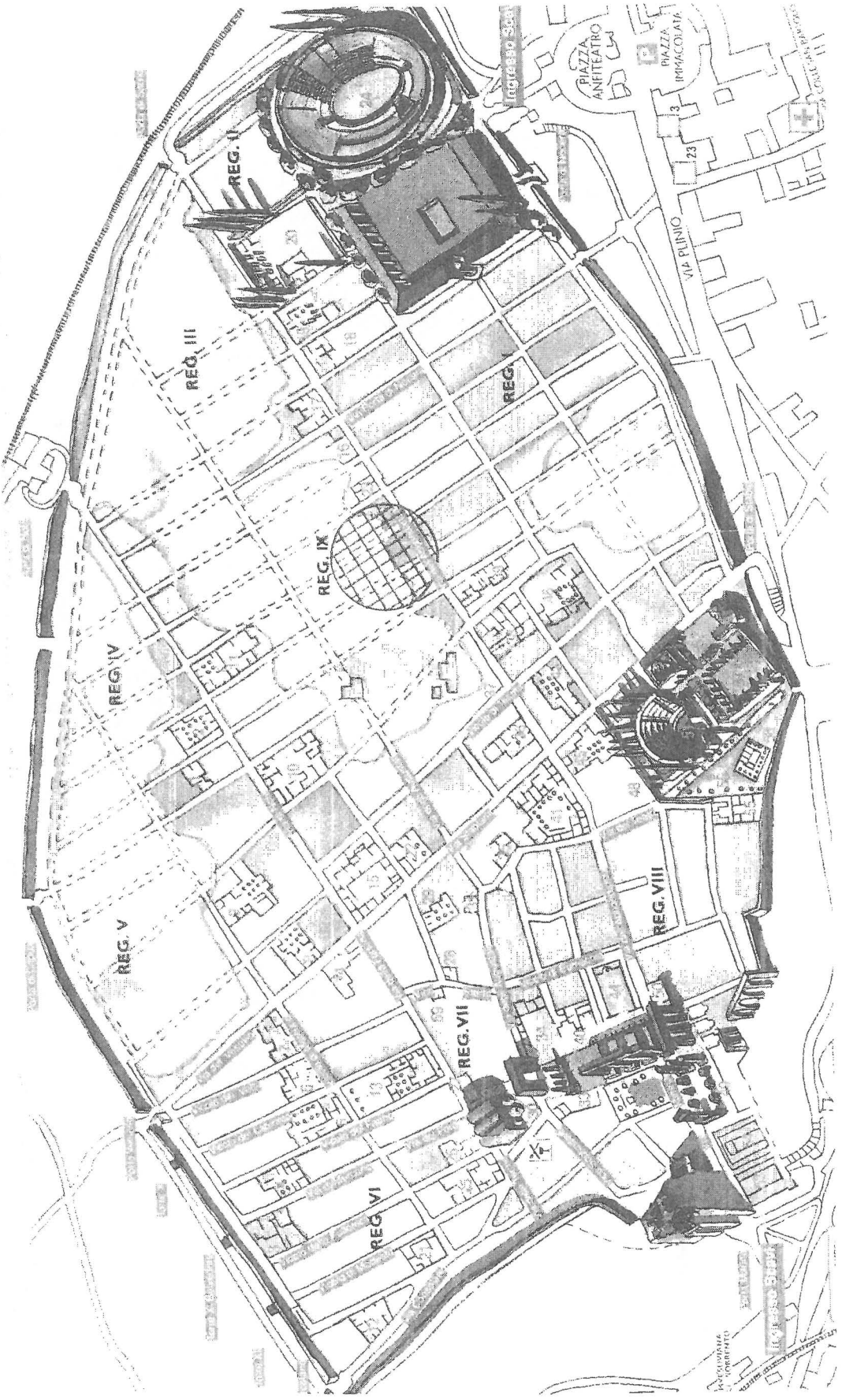

Fig. 1 - Pompeii: map of Roman town, with Regio IX and location of "Casti amanti" excavation

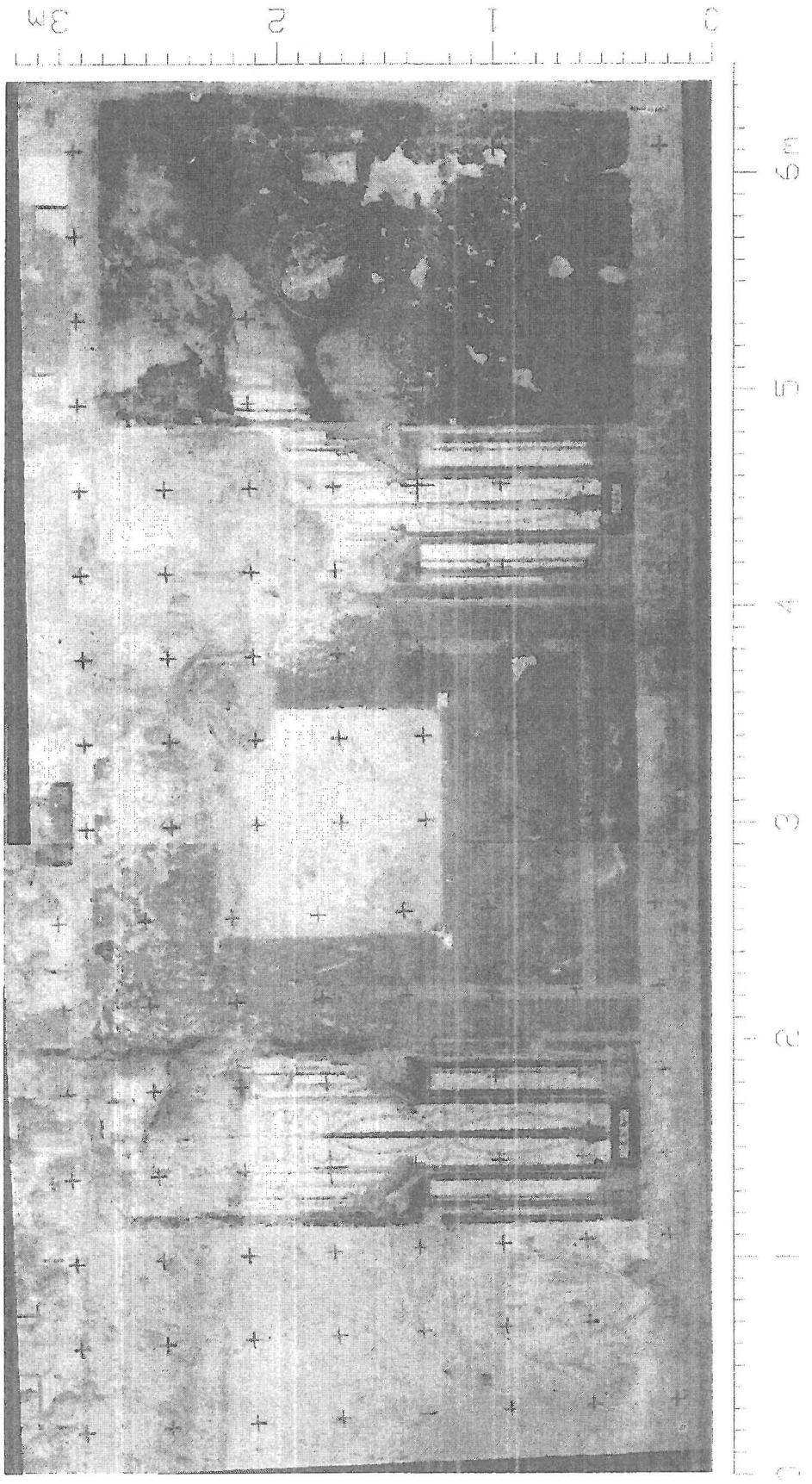

Fig. 2 - Main dining room of the mansion: mosaicking of raster rectifications for a painted wall; see pictorial figures in perspective view (on left) and a scene with "Caste lovers" (on right)

2. NEW EXCAVATIONS AT POMPEII

A photogrammetric survey of the archaeological site of "Casti Amanti", whose activity started in 1987, was requested by the researchers as a graphical documentation for inventory, data understanding and classification.

The excavation program carried out during these years has regarded two buildings: the northern one was a private mansion, the southern an ancient bakery.

Only a sector of the first area has been excavated till now, that is the part related to rooms overlooking the internal garden.

The walls of this building present fine pictorial decorations, with warm colours; main dining room, above all, shows fine frescoes and a marble mosaic (I century A.C.) at the middle of the floor.

The photogrammetric approach was carried out starting from analogue colour photos, taken by a film Rollei's camera (6006 model); the average scale of images, established at 1:80, allows visualisation (raster plus vector) to be performed up to a 1:10 scale (Colombo et al., 1995-96).

The photos were digitised by scanning; the sampling resolution was established at 1000 d.p.i., with a true-colour radiometry; storage requested around 13.8 MB (for uncompressed TIFF files only).

Imaging for the walls of dining room, as a mosaicking of elementary scaled rectifications, was produced in a general way, as said, after image enhancement and with the support of computer-graphics techniques to manage and join raster and vector data (Fig. 2, on previous page).

For example, the Roman emblem on the floor of the dining room highlights a skilful manufacturing and a fairly good state of preservation (colours, material, and so on). All this makes it an important trace of the past civilisation.

The floor of the room was photographed in a stereo manner through a semi-metric camera, being located on an overhanging scaffolding. With the support of a well-arranged set of control points, a 3D model of the mosaic was generated, together with vectorial forms of presentation (Figs. 3, 4).

Besides, a DSM (Digital Surface Model) of the object, measured on an irregular grid, describes real topography of the polichrome decoration; therefore, a spatial visualisation was at last produced, with raster orthoimage overlaying it (see Colombo et al., 1996).

The second building of excavation, instead, is a commercial site.

The finding of devices for corn grinding, bread preparation and baking, let it be supposed as an ancient bakery, open to the Abbondanza's road, one of decuman axes crossing Pompeii from East to West.

Among its rooms, a stable was discovered together with the skeletons of donkeys and mules, employed for grindstone motion at that time.

The photogrammetric survey of this archaeological sector has regarded a lot of walls, with their decay and splitting pattern (Fig. 5).

Especially the structure of the oven, with its fine stonework, was analysed.

A DSM was generated for the front, by applying a stereo collection for points and breaklines; automated solutions, via image matching, are now in development for all zones of no occlusion or texture uniformity.

A visualisation in draping was performed as a spatial result; that is, orthoimaging and perspective viewing, with raster representation spreaded over wire model, together with a thematic plotting (Fig. 6).

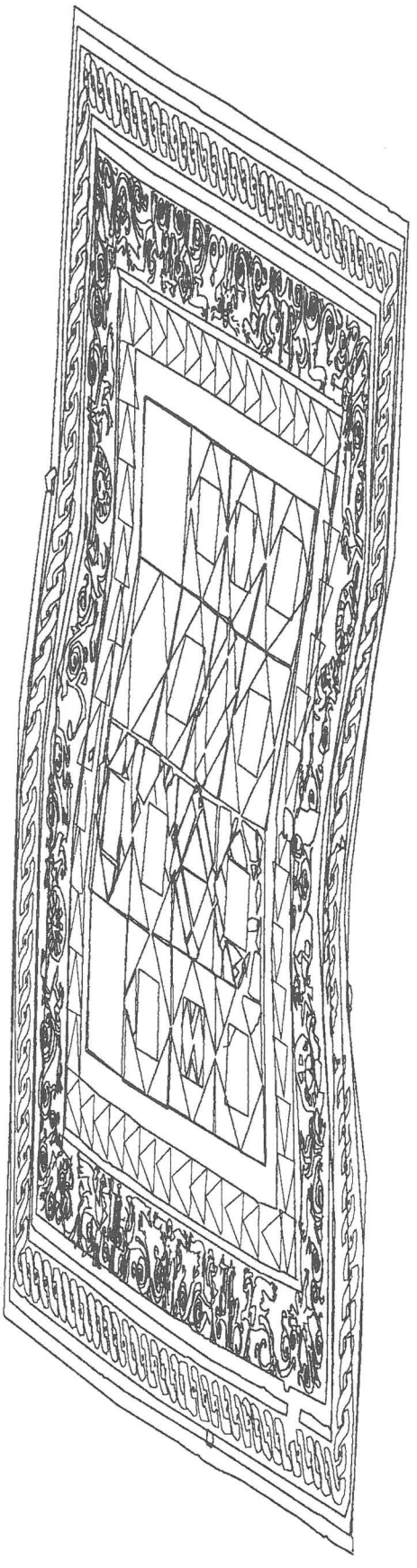

Fig. 3 - 3D view of the mosaic over floor

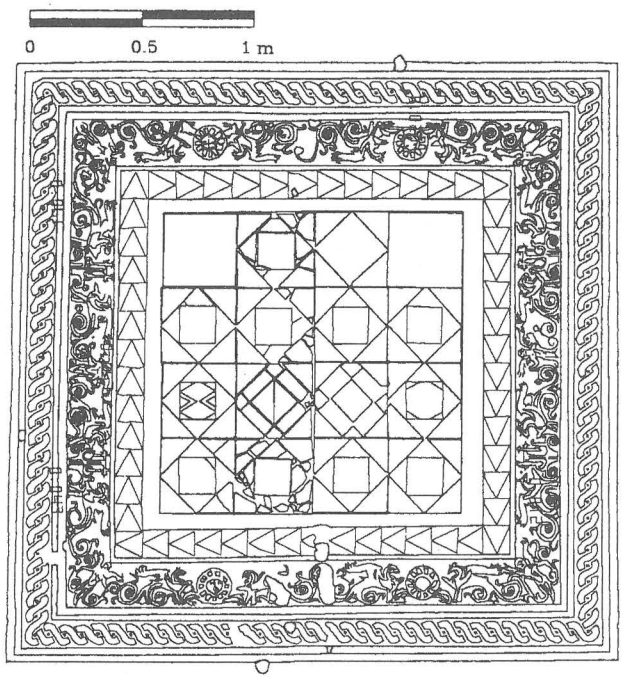

Fig. 4 - Vectorial printout of marble mosaic

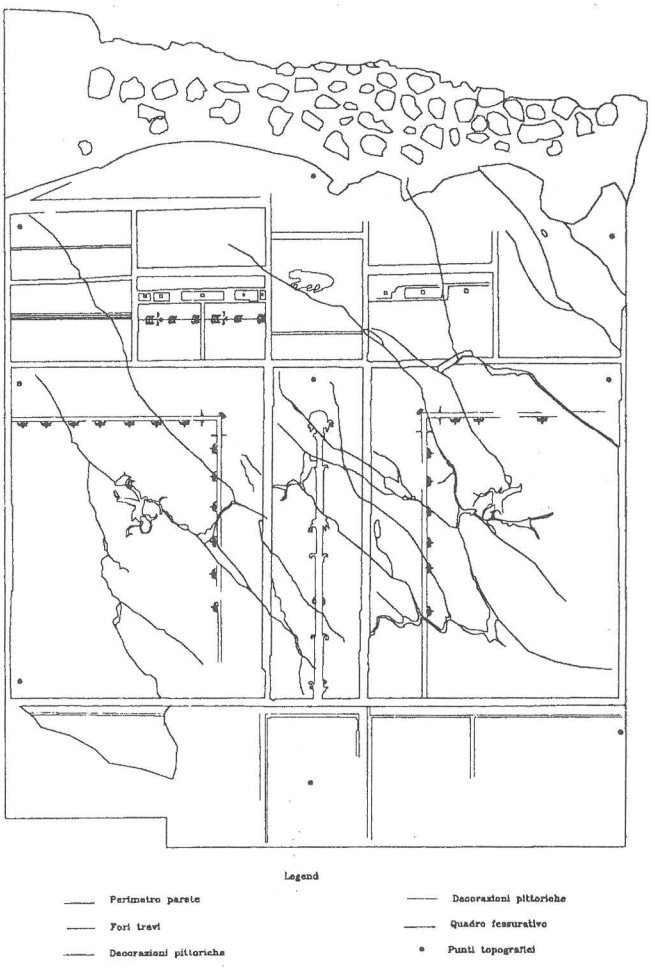

Fig. 5 - Outline of decay and splitting pattern for a wall

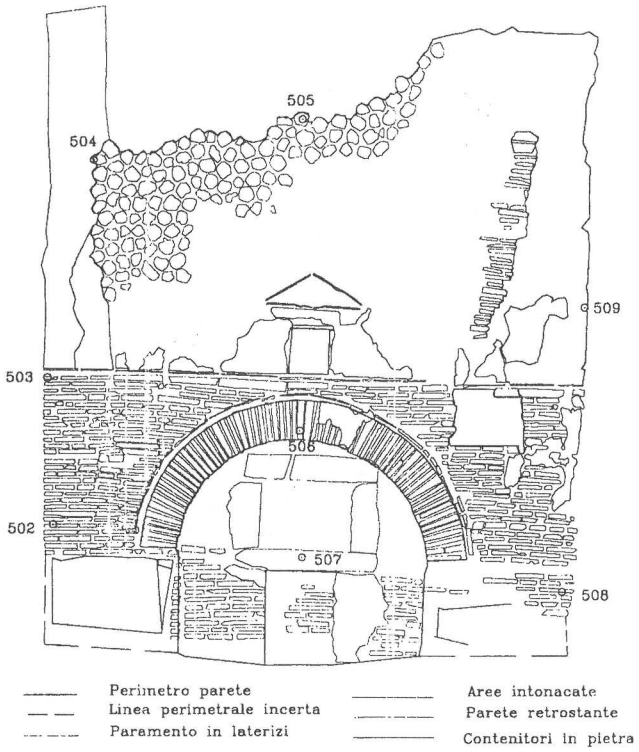

Fig. 6 - Thematic plotting of the oven front

Afterwards, an archaeological path has been produced through reconstructed buildings; a preliminary survey of rooms was carried out for the location of volumes and then a texture mapping of the orthoimages was performed, according to concepts of virtual reality modelling (Fig. 7).
Software 3DStudio (Autodesk), a powerful tool for rendering, Autocad and the photogrammetric digital system StereoView (Nikon - Italy) were involved in developing these tasks.
Further experiences are still in progress to automate the approach to 3D geometry and to a photo-realistic visualisation of monumental site; a package Microstation (Bentley) will be utilised in addition to Autodesk's procedures.
Vector-raster printout of this work, has been performed with an Epson Colour Inkjet Device (720 dpi resolution).

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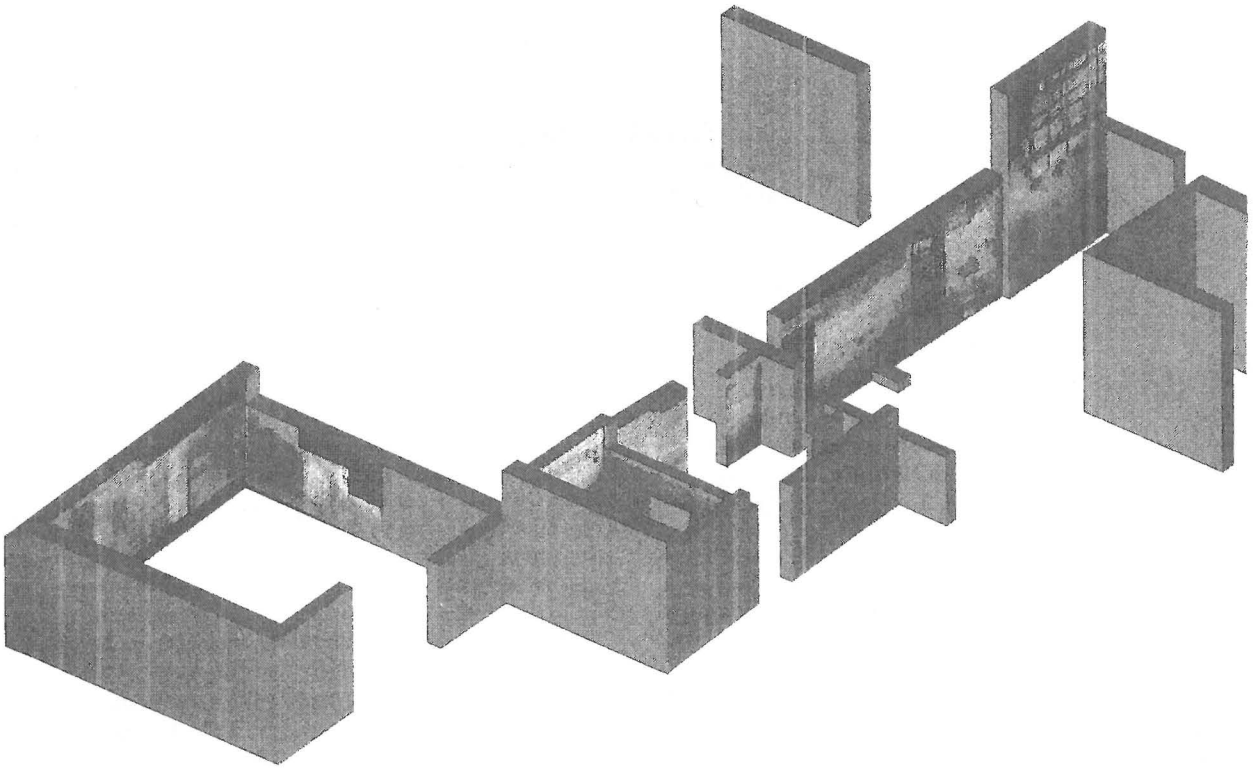

Fig. 7 - Archaeological path through the site, reconstructed as a virtual reality modelling (detail)

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