

## **The mensiochronology of traditional building elements as way to safe the authenticity of monuments and urban environments.**

Luigi Guerriero, Luigi Rondinella  
Restoration and Building Department of Architecture and  
Environment, II University of Naples, Italy  
S. Lorenzo street 3°, 81031, Aversa (CE), Italy  
[luigi.guerriero@unina.it](mailto:luigi.guerriero@unina.it)

**Abstract.** The following paper shows the method used to analyse the morphological and dimensional directions we need to define the chronology of building post-medieval components of Campania Felix, the big Italian coast region which goes from Naples to Sorrento, in the South, and to Capua, in the North. The dating of the distinctive elements of the building civilization of a territorial area allows the knowledge of the cultural interest in the fabric of a city (buildings which are the structure of historical centres and areas) and the qualification of each traditional (historical) building as unique element of human history.

Mensiochronological analysis is based on the statement of irreproducible construction materials, which can be investigated as individual identity, looking from this perspective at the irreducible complexity of the phenomena and historical courses and at the instability of the critic judgement (historical relativism).

According to the gnoseology linked to the recognition of the building phases each building – studied in its totality of materia signata - legitimates the saving of the stratifications, and contributes to the cultural qualification of the building property. If we look from this perspective at the post-medieval archeological investigation it gets an autonomus hemeneutical importance contributing to the structure of the real complexity.

In the last twenty years, the development of post-medieval archeology and the definition of the scientific statute of the startigraphy of the buildings have allowed the making of methodical studies regarding Modern Age building techniques. These researches (based on probabilistic analysis of a big number of samples of materials) have defined efficient methods to date walls, vaults, wooden floors, ceilings, fixtures, iron works and floorings.

The parameters used do not depend on the usual stylistic analysis, and they are very useful to the traditional building industry which is not connoted by solemn formal elements.

These studies have enlarged geographic and thematic investigations about the *bauforschung* of Campania, moreover they have prepared methodical collections of techniques and practices of a building yard since the end of Medieval Age till the beginning of the Twentieth century, underlying local patterns and marking, through detailed surveys, the parameters to date them, adding geolitical and ortographic differences of the region, that have offered to the building industry a particular variety of litotypes, to the changeable legal political social conditions, to the transformations of cinematic net and to the connected chance of transporting building materials.

## **Methodology**

What has first been done is the recognition of the sources about the building materials and its manufacture which is available in different areas of the region. The bibliographic research has involved geo-morphologic literature, local architectural studies and works, editions in Campania about similar national or international fatigues, tenders and price fees of Corps of Engineers, Civil Engineers, provincial delegation and municipal decurionate (local governments, provincial and municipal ladder).

Archival investigation has examined the status of the associations of masonry teachers, municipal rules (building rules), notarial deeds about religious and residential buildings and tenders of public works.

After measuring the perimeters of the sub-regional building areas on geolitical historical-administrative base, we have carried out methodical photographic metrical material surveys of their traditional manufacturing elements, on the base of important legal agreements, guaranting uniformity in getting and evaluating data and solving lexical problems through the writing of explanatory glossaries.

Therefore, we have classified morphological and dimensional patterns of a relevant number of traditional building elements, whose dating on philological base is confirmed by the stratigraphical analysis of architectural contexts they belong to.

We have underlined the placing, the geolitical and metrological characterization of materials (yellow tuff, grey tuff, limestone, sandstone, tiles) and their relating manufacture, elementary components of the mortar (binder and aggregate), the kind of the wall apparatus (composition and

dimension of the joints), alterations and probable protective stratus of each building apparatus.

As regards vaults, their metrological typification is based on the formal typology (barrel vault, cap vault, pavilion vault, cross vault,), the geometry (pointed or ogival vault, polycentric vault), the presence of distinguishing elements (groins, pendentives, ribs, horizontal panels), the filling of the typology (barrel vault, cap vault, pavilion vault, cross vault,), the geometry (pointed or ogival vault, polycentric vault), the presence of distinguishing elements (groins, pendentives, ribs, horizontal panels), the filling of the supports (earth, stony ground, amphora, cast masonry, concameration) and the equipments of the intrados.

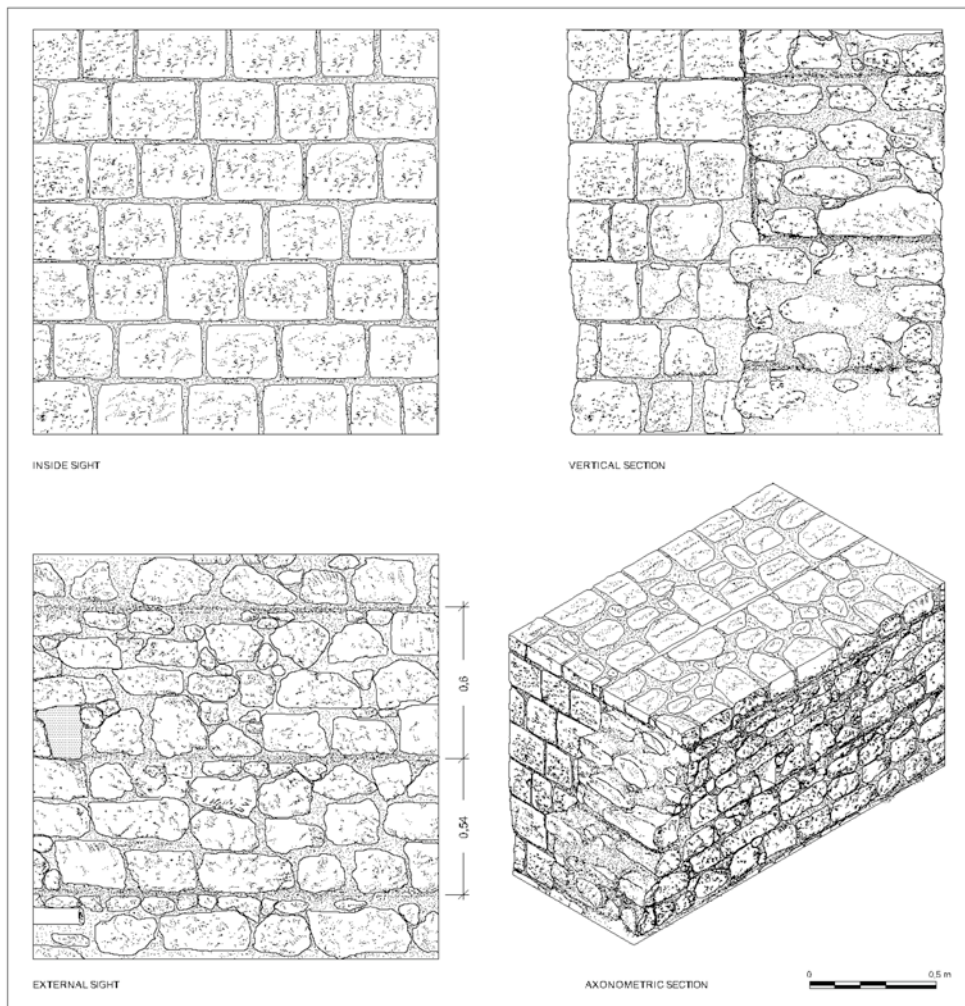


Figure 1. “A cantieri” yellow tuff masonry (XVII sec.) strengthened with “a blocchetti” masonry (XIX sec.).

As regards floors, we have made metrological studies of the main frame, related to the typology (simple, double or complex), the morphology of the beams (round beams, makeshift or right-angled sawed beams), the type of bearing (joist or wooden or stone brackets) and the dimensions (archway, wheelbase, section). Then we have studied the typology of the secondary frame (made of cutaway masts, “chiancarelle” or sawed tables, “solarini”) and its related dimensions (length, section), the test of probable stratum of levelling of melted material and the untiled rocky land (made up of lapillus, pumice, etc).

As regards ceilings, the distinguishing parameters are the placing of the pitches, the kind of main structure (limping beams, king trusses, complex trusses) and the relating constitutive elements (round, makeshift, sawed beams), the dimensions (length and chain section, struts, pendant posts, king posts), the connecting system (fixed joints, nails, metal rings) and the kind of bearing (joists and wooden or stone brackets).

As regards secondary frame, we record its morphology (round or squared elements) and dimensions (lengths, section of purlins and “ginelle”).

As regards flat roof tiles, we have noticed their typology (pantiles and grooves, flat roof tiles and pantiles, flat roof tiles, gutter tiles, etc.) and dimensions.

Metrological distinguishing elements of the frames are the kind of grounding and the placing of the bearing frame of the movable sashes, the dimensions of the studs and their beams, the shape and the dimensions of the external plankings and the placing of probable pedestrian sashes.

As regards hardware closing and shelters (gates, gratings, stairs and balcony banisters) we have releaved shape and dimensions of the horizontal and vertical bolts and welding elements (nails, screws, screw bolts, fillets, weldings).

In the same way, we have noticed materials, dimensions and installation systems of internal floorings (brick edge course, simple or majolica-tiled terracotta work, beaten lapillus flooring, “veneziana” sown flooring, marble concrete chips) and external flooring (calcareous cobblestones or blocks, lavic stone blocks or “scardoni”, brick floor).

## Results

The masonry walls, made with yellow tuff stones, in the Neapolitan area in Italy in the period from the first half of the XVI century and the XX century, can be divided in three fundamental typologies according to chronological indicators regarding morphological and dimensional aspects: “a cantieri”

masonry, used in XVI and XVII century, “a bozzette” masonry, used in XVIII century and “a sacco” masonry used in XIX century and in the first half of the XX century (Fiengo, Guerriero 1998).

During Spanish vice-reign (XVI-XVII century), Neapolitan yellow tuff masonry was always realized as “a cantieri” typology; with stone

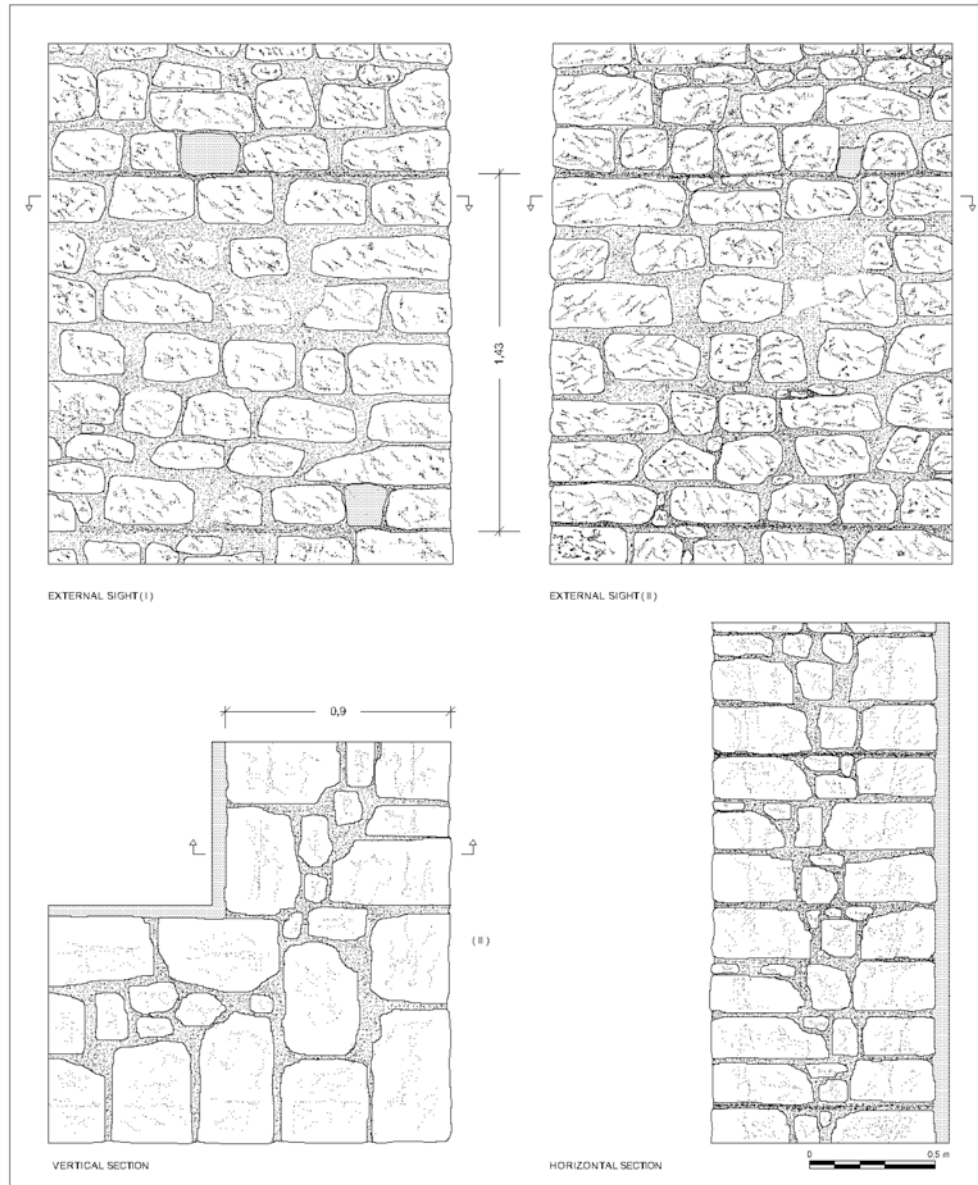


Figure 2. “A bozzette” yellow tuff masonry cantonal (XVIII sec.).

elements confusedly disposed on thick mortar beds. The used mortar was a sort of concrete since it was made of lime mixed to rubble and small rough stone elements.

Rubble were obtained by breaking stones using wedges and mallets, or directly “mannara” (a kind of axe with rectangular head and cutting surface parallel to the handle). Resulting elements presented irregular external surfaces. The stones were called "spaccatoni", "spaccate", "spaccatelle" and "pietre rustiche", depending on shapes and sizes, which were very variable.

Furthermore distinctive characters of the Spanish age masonry are the characteristics and the size of the stone elements, the disposition of the stones and the distance from two consecutive quite horizontal mortar beds.

After June 1688 earthquake, an extensive consolidation and a partial rebuilding of the architectural heritage of the Neapolitan area were carried out. In this period a constant innovation in the construction technologies was recorded and the new typology of “a bozzette” masonry was created. In XVIII century the “bozzette” stones (characterized by all worked faces except the internal one and by a height between about 12 and 18 cm) were used to realize external facades of the walls, while internal mass was realized with roughly worked stones.

Masonries used in the XVIII century were characterized by a progressive refining of the stone production technologies but by a progressive decreasing of the mortar quality.

In the XIX century, during Napoleonic Age and the second Borbonic period until 1840, masonries, were realized with blocks, sketched out with the “mannara”, 18-25 cm in height, disposed along rows presenting variable thickness of mortar joints. Curtain ashlar had squared external edge, flat external faces and roughly sketched out internal faces in order to improve the conjunction with the internal mass (realized with stone, stone fragments and mortar). In this masonry (the so-called “a sacco” typology) it is possible to recognize stones with different height-length ratio of the external face.

After 1840 (when a royal law introduced the decimal metric system), the same kind of blocks were continued to be used, even if worse sketched out, until 1950, when mechanised systems to extract tuff and the block dimension were introduced.

Since the late Nineteenth Century chestnut wood in particular, rarely oak, beech and fir wood (imported by other areals) have been used for floors and ceilings. The names of their components depended on their dimensions, which were expressed in inches (an inch corresponded to about 26,5 cm).

From the research we have realised that the squared beam floors connected to plankings or caisson ceilings are only in very important

residential buildings dating back to 16th – 17th centuries.

In traditional masonry we have chestnut round beam floors among which there are “chiancole” or “solarini”. The shutters do not generally have wooden joists or plaques and there are no metal “bulzoni” or similar elements. Along the centre line the beams are usually connected to a major batten fixed with nails and metal bindings. The chronological indicators enucleated for the floors belong essentially to the beam board and the finishing of the intrados.

The most used ceilings in Campania are made of simple trusses made up of round chestnut beams, assembled with simple joints, reinforced by wooden “gattelli” and metal hinges, which have a secondary frame of

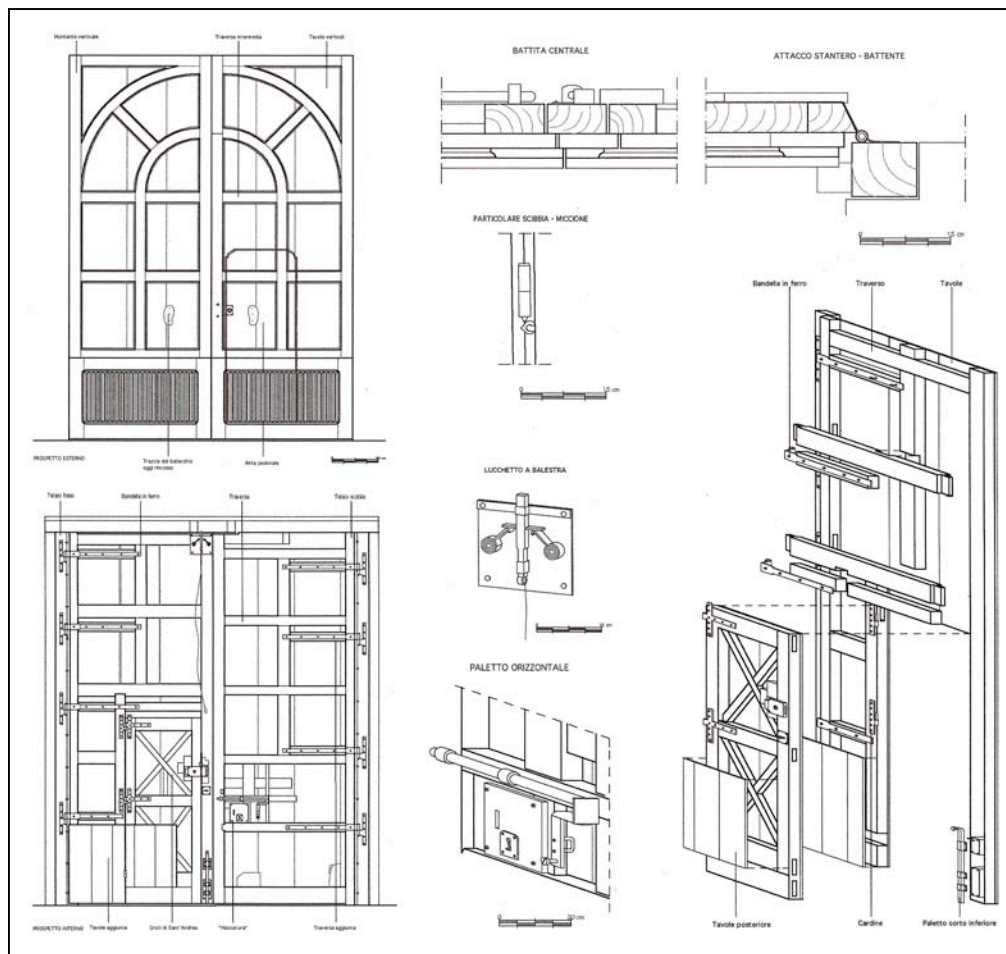


Figure 3. Chestnut entry door with XVII sec. rail and muntin and XIX sec. external side

“ginelle”, on which there were brick pantiles and ducts, whose dimensions depend on their date and place of moulding. In this way it is possible to identify the trusses dating back to 16th, 17th, 18th century and the beginning of 19th century, and at last, the second half of 19th century and the early 20th, according to chronological classes of about a century.

The researches have allowed us to define the parameters to date entry doors, shop doors and landings, inner doors, modern and contemporary wooden balconies and windows. The most important result is given by the identification of the stratified patterns of doors and windows, which are often rimodulated on the external side of the door knockers saving the existing frame. If we use the parameters identified during our study, it is possible to date the traditional fixtures which are in the area we are studying according to chronological classes of about 50 years.

“Forge iron tools” of Campania constitute a big repertory that can be traced back to “restraint” elements (chains, tie beams, bands), “linking” elements (wooden pegs, nails), “shelter” elements (gates, banisters, railings), and “rigging” or “closing” elements (connecting systems and locking of frames). They can be dated according to shape and dimensions of each component, allowing the knowledgment of 17th, 18th and early and late 19th century elements, and at last of the early 20th century.

At last, the dimensions of the constitutive elements give the chance to date, approximately, the terracotta stone floor pavings made by the end of XV to about the half of XX century.



*Figure 4. Balcony with forged iron bolts (XVIII sec.).*



## **Conclusions**

The research shows as during Modern and Present Age and till the diffusion of Industrial Production Systems the statement, which belongs to Medieval archeology, of a progressive change of building techniques, is valid and generations. In this way the traditional masonry is revived by the generic, ahistorical category of “popular” and “ageless” building and it goes back to its reality of stratified historically limited stuff.

Finally, our study suggests as the preservation of the identity of urban and territorial environments must be based on the strict saving of each element which contributes to the cultural qualification of the sites, starting from the smallest building elements, which oppose to the massifying homologation that pervades our time and saving the equilibrium of human environment.

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## REFERENCES

- Fiengo, G. and Guerriero, L. (1998) *Murature tradizionali napoletane. Cronologia dei paramenti tra il XVI ed il XIX secolo*, Napoli: Arte Tipografica
- Fiengo, G. and Guerriero, L. (2003), *Atlante regionale delle tecniche costruttive tradizionali. Lo stato dell'arte, i protocolli della ricerca. L'indagine documentaria* (Atti del I e del II Seminario Nazionale), Napoli: Arte Tipografica
- Manfredi, Calderoni, Lenza, Guerriero, Cordasco (2007), *Experimental tests on post-medieval and modern tuff masonry walls*, in Proceedings of Tenth North American Masonry Conference, Omnipress, Madison: 921-932. Wisconsin, USA.