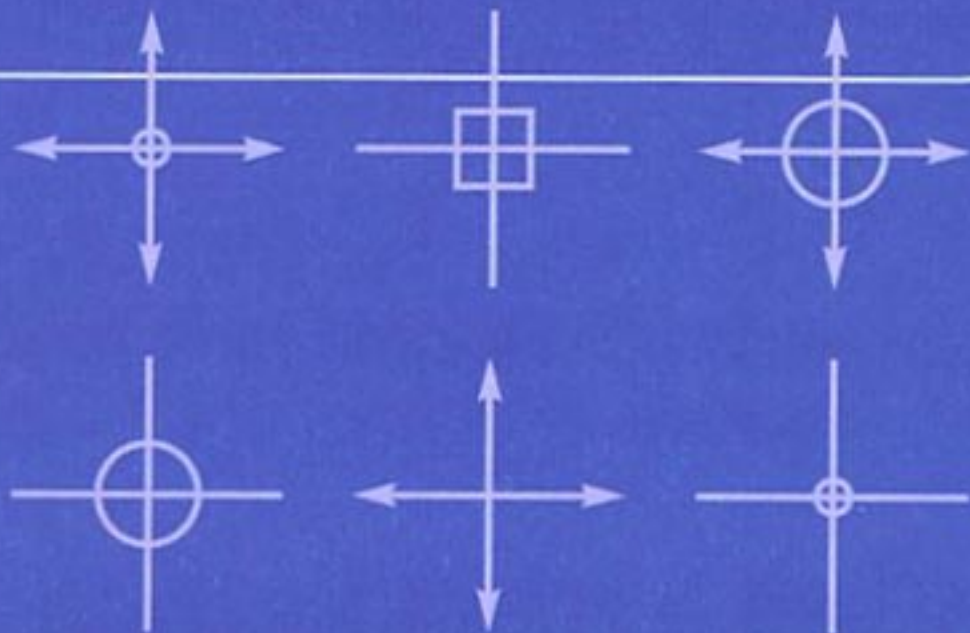


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**Kulturelles Erbe und
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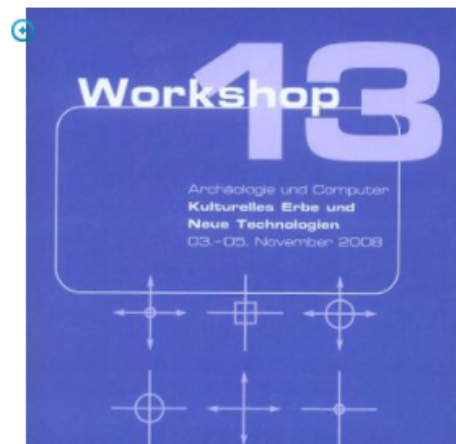
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New shares for Populonia project:

The last advanced surveys of Etruscan tombs from Populonia Necropolis documentation.

Paola PUMA

Università degli Studi di Firenze

Abstract: The development of integrated practices for the documentation of cultural heritage has been recently using advanced technologies for update surveys talking about both geometric and morphologic properties of heritage itself and oriented to the building of scheduled repositories for the next data managing. In this point of view it was recently focused the partnership between our research group¹ and the Soprintendenza per i Beni Archeologici della Toscana in the *Progetto Necropoli* -a documentation project for the valorisation and advanced fruition of the archaeological park of Populonia (Livorno)- to build the first record repertory of the most important villanovian necropolis in north Etruscan territory.

The conspicuous production of archive documents collected in several decades at the Soprintendenza per i Beni Archeologici della Toscana and the high level scientific literature existing on one the most relevant archaeological territories in central Italy didn't in fact be said to be organic, complete and homogenously conducted in front of finds in location.

The case of study

The copious graphic available documentation² indeed presents the Etruscan tombs of the San Cerbone necropolis in Populonia described by drawing depending by that time on need, on schedule and on development ordered as following excavation campaigns or depending on protection and maintenance actions.

This not disciplined schedule shows today the demand of extended coverage of structures documentation and of systematic managing of data. So the integrate approach to knowledge and documentation of heritage represented the scientific motive to formulate a new work strategy: the progress of studies on archaeological heritage settled on a systematic plan of knowledge, safety and valorisation cannot, in fact, prescind from the technological managing scheduled collection of every kind dates: measurement dates, dates about the morphological and material consistency of handworks etc.

Two survey campaigns carried out on the San Cerbone necropolis in 2007 represented the initial phase of a more systematic and comprehensive program of measurement documentation of finds.

The finds were selected by typology, following the criteria of choosing one tomb recognizing every kind, chamber/sarcophagus/hole tombs, and were measured 9 tombs (3 for the bassoon chamber kind, 2 for sarcophagus kind, 4 for walled tombs):

- Tomb with bassoon on cylindrical base: were measured the *Tomba delle Perline d'ambra*, the *Tomba dei Colatoi* and a third tomb in ruin state (all in quadrangular cellar, with dromos, and out of dome and bassoon);
- walled tombs: were measured the *Tomba del Bronzetto di offerente*, the *Tomba delle Tazze attiche* and two handworks in ruin state built in the same square;
- sarcophagus tombs: were measured two handwork (one with and the second without two sloping roof) near the tomb of Bronzetto di offerente.



Fig. 1 – The Necropolis of S. Cerbone tombs: the survey site.

Work methods and instruments

The survey was conducted with methodological integrate approach, mixing different methods: topographic survey for tombs reference to the general plan and for curved surfaces; quickly photogrammetry for all the parts where was possible to find accessible layers proper to the shot/rendering; direct survey where necessary for the high or different level of detail description.

The quickly photogrammetry survey was used in different cases depending on the tomb kind: for external facades and for horizontal treading floor, in walled tombs and in sarcophagus tombs; to

integrate the levelling from direct survey for the internal facades of *Tomba del Bronzetto da Offerente*, for lateral facades of the dromos in the *Tomba delle Perline d'ambra* or for the morphological survey of wall peaks in the other bassoon tomb.

The recourse to direct survey was too chosen depending on contest situation of the finds and their geometric and formal characteristics: for example for levelling of plan and elevation profiles to mix them to the photogrammetric survey.



Fig. 2 – Photo Aerial map of the site.

The results

The drawing repertory is completely managed by themes following the double set: quoted drawings and line morphological drawings, in 1:50 and 1:20 scale. Of every tomb have been rendered photoplan and the standard set of descriptive drawings: plans, facades and sections.

Starting from these survey drawings began following deepening about the formulation of an ipotesys of a new site design; two final thesis degree were discussed on *Survey for the new museum settlement: the Tomb of Perline d'ambra in Populonia*³ and *Etruscan walk: an archaeological route into the S. Cerbone necropolis*⁴.

The research results were presented into the 7° annual seminar *Materiali per Populonia*⁵ and during the Fiera del Restauro in Ferrara, by the multimedia platform *The survey and the digital representation for the documentation and the restore program on the archaeological heritage of S. Cerbone Necropolis in Populonia*.

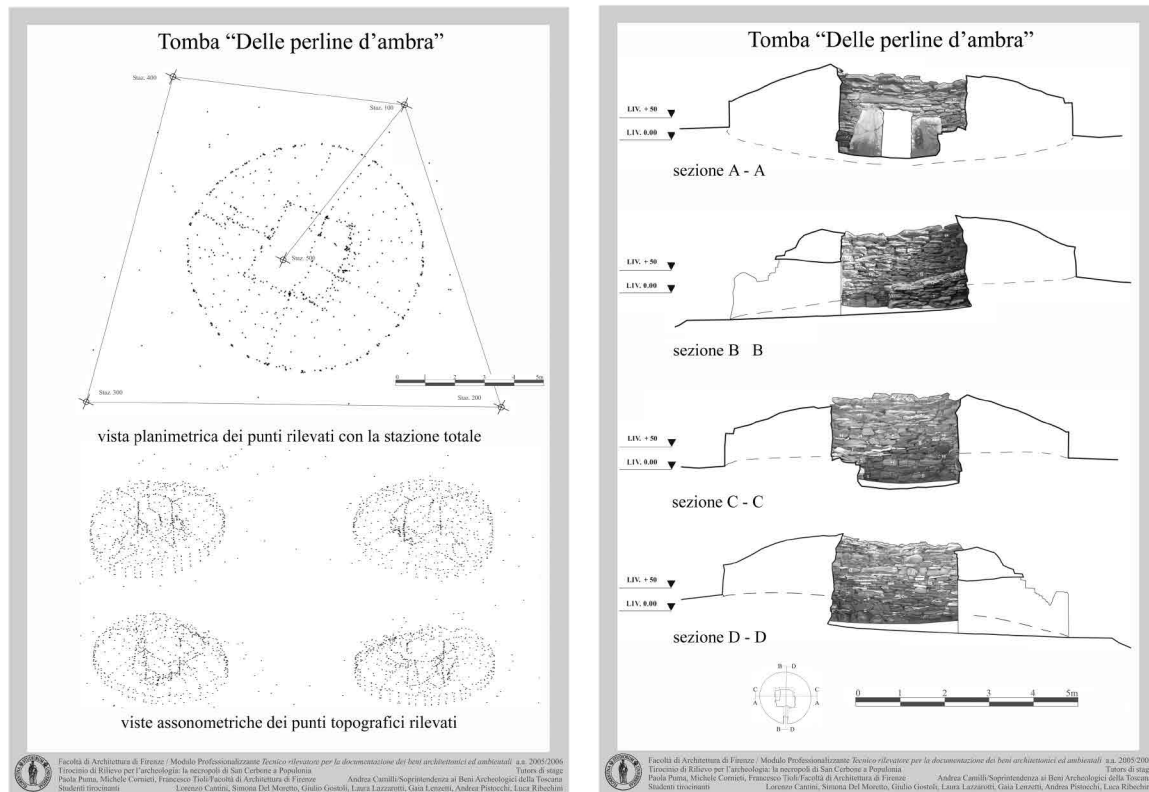


Fig. 3, 4 – The Tomb of Perline d'ambra: plan and section drawings.

The survey of the Tomb of the Perline d'Ambra ⁶

The *Tomb of the Perline d'Ambra* is a rather complex architecture from the geometric point of view, both for its formal mould and the state of degradation in which it was found. Externally it is presented as a building formed by a cylindrical base in masonry that supports a pseudo-dome covered by soil. Internally a square plan cell is connected with the outside through a dromos.

Given the geometrical characteristics of the object and the time available a topographical survey integrated with quickly photogrammetry of photographic images has been preferred.

From the vector drawing of the points pertaining to the determined portion of space, the profile of the plan is emerged, so is the section and the elevation. The obtained result is a series of drawings assigned for the restitution in 1:20 scale.

The survey of the Tomb of the Bronzetto di Offerente ⁷

The *Tomb of the Bronzetto di Offerente* became known in 1957 during the research works for the scraps of the metalwork of the iron. On the four angles of the room - with a double sloped roof which had to host two funeral beds - there were four acroterions, whose remains are conserved at the Archaeological Museum of Florence. It is assumed that in the third century B.C. the aedicule was violated by the Etruscans themselves, who burst into the tomb, took away the objects and transported the skeletons to the nearby sarcophaguses.

In order to render the plan, the internal sections and the elevations of the tomb, direct survey has been applied.

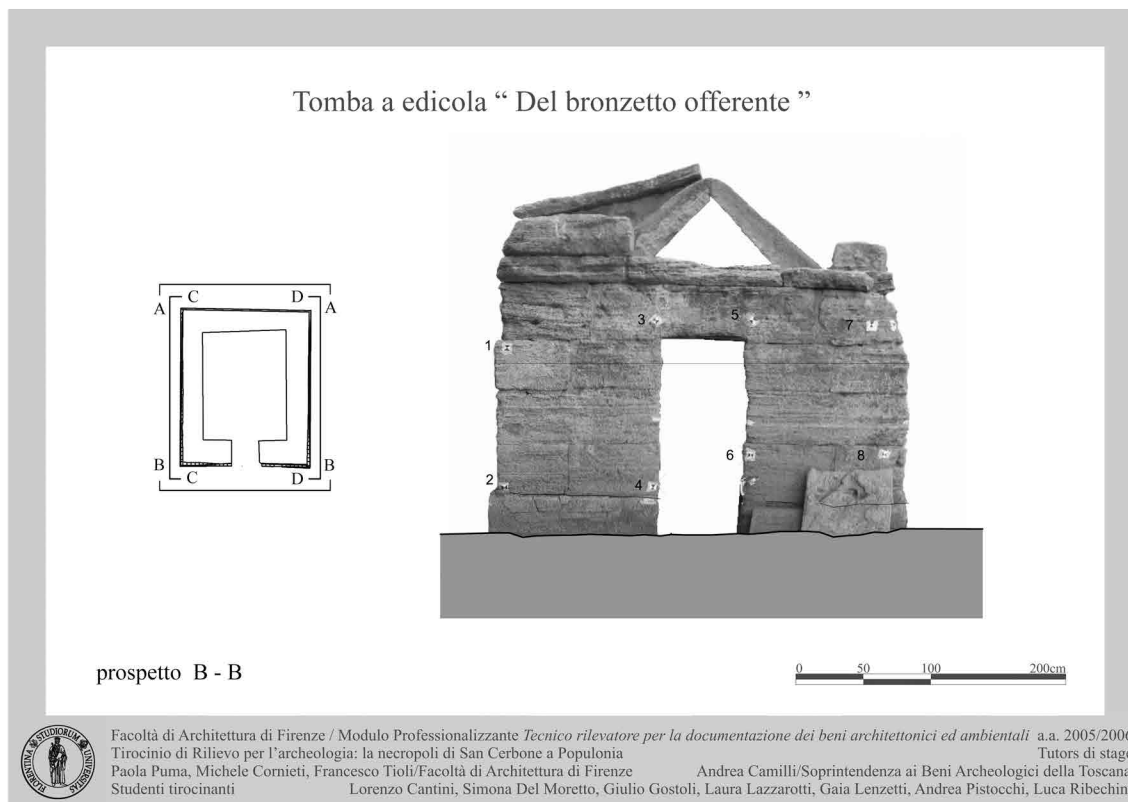


Fig. 5 – The Tomb of Bronzetto di offerente: elevation ortho-rendering drawing.

In order to connect the external measurements with the internal ones it was necessary to integrate the direct survey with the topographical one through the survey of points on the inner walls of the tomb, visible from the topographic station; thanks to the two previously located stations for the general survey of the study area, it was possible to deduce the measurements of some significant points on 3 elevations in order to gain the useful metric data for the realization of the relevant ortho-images.

The survey of a sarcophagus tomb ⁸

The analyzed building is a sarcophagus tomb dating back to the archaic period (VII - V cen. B.C.), composed of four sandstone slabs placed on the floor and two slabs of the same material tilted to form the roof. During the survey operations a research in detail has been carried out which is supported by a photographic documentation on the field, suitable to the successive reprocessing and graphical transference in digital format.

With traditional methods all the necessary points for the measurements have been located. For the measurements in elevation the method of section survey (by direct measurement; *coltellazioni* in Italian language) has been applied, using, as done for the measurements in plan, the levels of the mentioned surfaces.

The operations of detail dimensioning have been executed with systems of direct survey as well.

The direct survey has been at last integrated with the quickly photogrammetric survey: on the study sketches of the elevations there have been determined the necessary photographic shots for the next phase of orthogonal drawing with automated instruments.

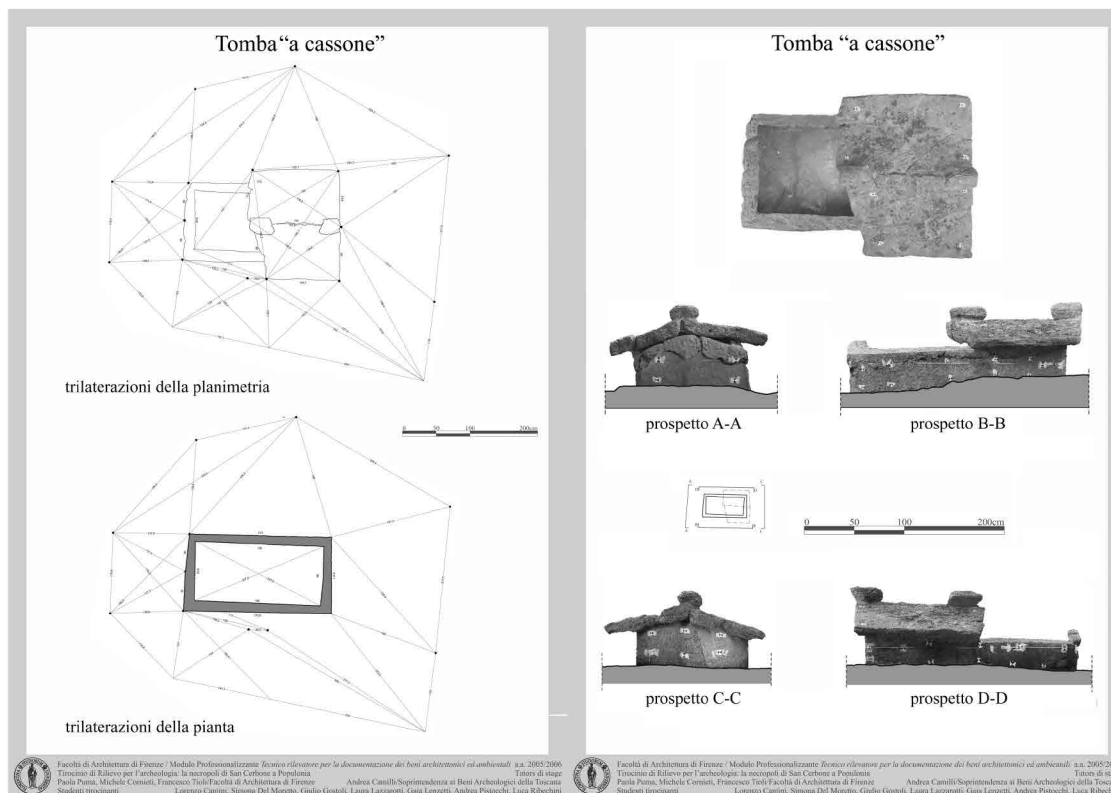


Fig. 6, 7 – The survey of a sarcophagus tomb: plans and elevation ortho-rendering drawings.

The survey of a razed tomb ⁹

Around the building, assumed only as the remains of a tomb, a horizontal artificial surface of reference has been determined; the measures have been all captured according to this surface, through direct survey.

For the plan survey of detail some control points have been applied on the plan and on the elevations, as reference points helping to carry out the internal and external measurement. These points offer a detailed geometric model of the physical object.

The detail survey – both plan and in elevation - has been realized through the section surveys, carried out on significant surfaces with constant rate (distance between points), that give us also the ground course in detail.

The survey of a tumulus tomb ¹⁰

The examined case consists of the remains of a tumulus tomb without basement, of moderate dimensions, lacking completely the pseudo-dome that would have had to form the roof structure.

The internal masonry structures of the cell are interrupted exactly in the sitting points of the pseudo-vaulted structure, where the recourses of the masonry are made thicker because at this height begins the superimposition of the less thick stone slabs that would have had to form the support of the roof itself. The summit of the angles of the cell itself with constructive elements similar to dome bases is significant of this configuration.

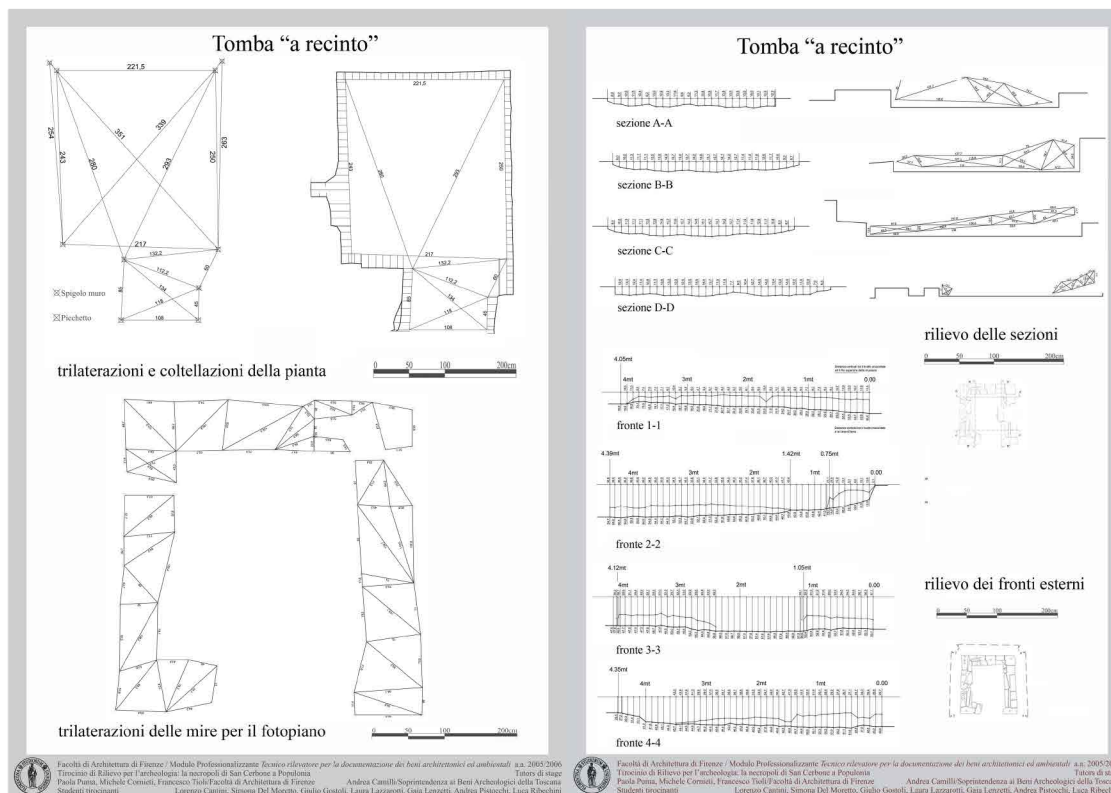


Fig. 8, 9 – The survey of a razed tomb: measured plans, sections and elevations.

The complexity of the object to survey, due to the dimensions and the irregularities of the surfaces to represent, has immediately evidenced the necessity to abandon the canonical systems of survey in favor of the use of a topographic station for the topographical survey to integrate with quickly photogrammetry.

The survey of the Tomb of the Colatoi ¹¹

The building taken under investigation is the Tomb of the Colatoi. It has a pseudo-dome structure without basement, with tumulus located on the same level of the cell, pertaining therefore to the typology of the "high tumulus" tombs. Externally it is covered by a layer of clay that makes it waterproof. In order to get to the tomb one should pass through a low dromos, composed by an uncovered external part, and an internal part, that leads directly to the room; currently the two parts are divided by a wooden frame, recently installed. Internally the tomb presents an almost quadrangular plan, with edge beams that characterize the place for three funeral beds. The pseudo-vault, up to the present conserved in perfect state, has been realized with small dimension slabs arranged on tilted surfaces towards the exterior of the construction.

The survey of the building has been carried out through various integrated methods: on the middle point of the bottom wall, the reference level has been fixed, brought outside with the use of an alignment, which has allowed the construction of the polygon, which was subsequently measured; moreover radial measures have been taken that would have allowed to describe the morphology of the tumulus.

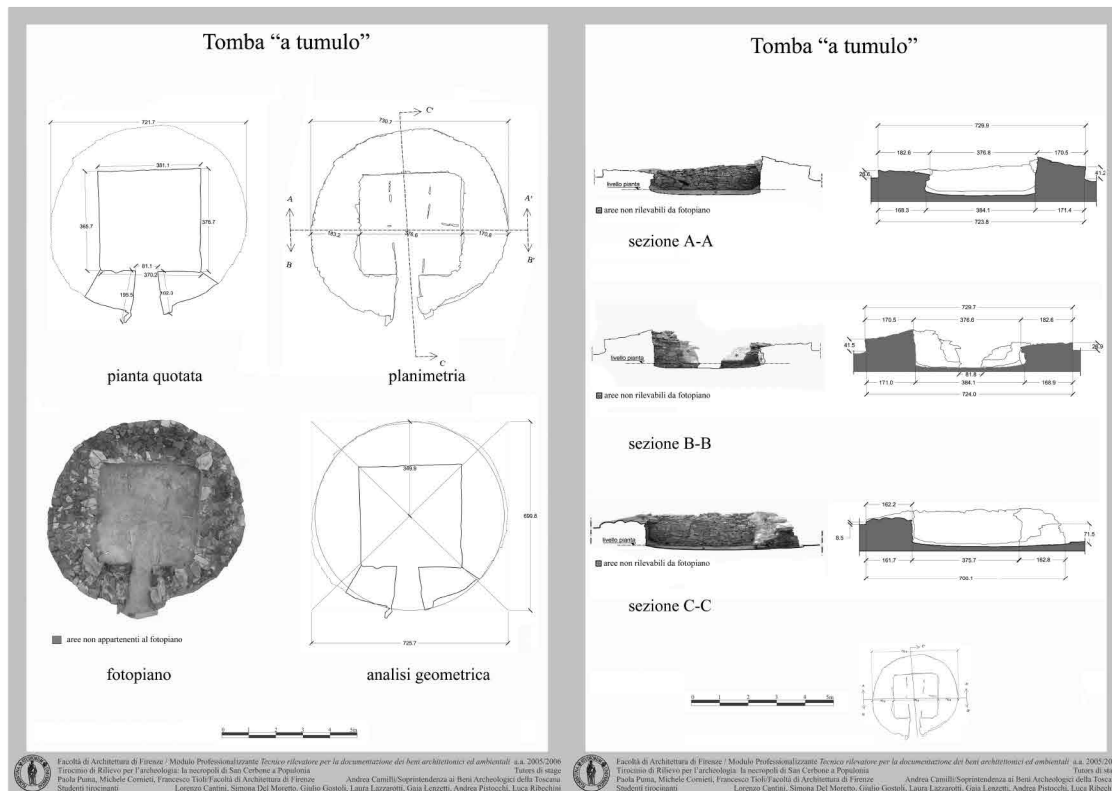


Fig. 10, 11 – The survey of a tumulus tomb: plans and internal sections.

The survey of the Tomb of the Tazze Attiche ¹²

This building is not yet, at the moment, certainly classified as a tomb, having numerous elements that would perhaps remind of sacral uses.

After the elaboration, in the phase of campaign, of the study sketches, in order to start the photogrammetrical survey the landmarks have been fixed; one of them, thanks to the opening on the south-west elevation, would mark with continuity the external and internal elevations, therefore to facilitate the job in the phase of rendering. Later some control points have been installed (whose distance has been determined through measurements) respecting the conformation and the differences of the building levels.

Because of the presence of a rounded strip that runs along all the external elevations, and therefore an area not able to be processed by the software due to lack to be reduced to a plane surface, it was necessary to integrate the photogrammetrical survey with the direct method.

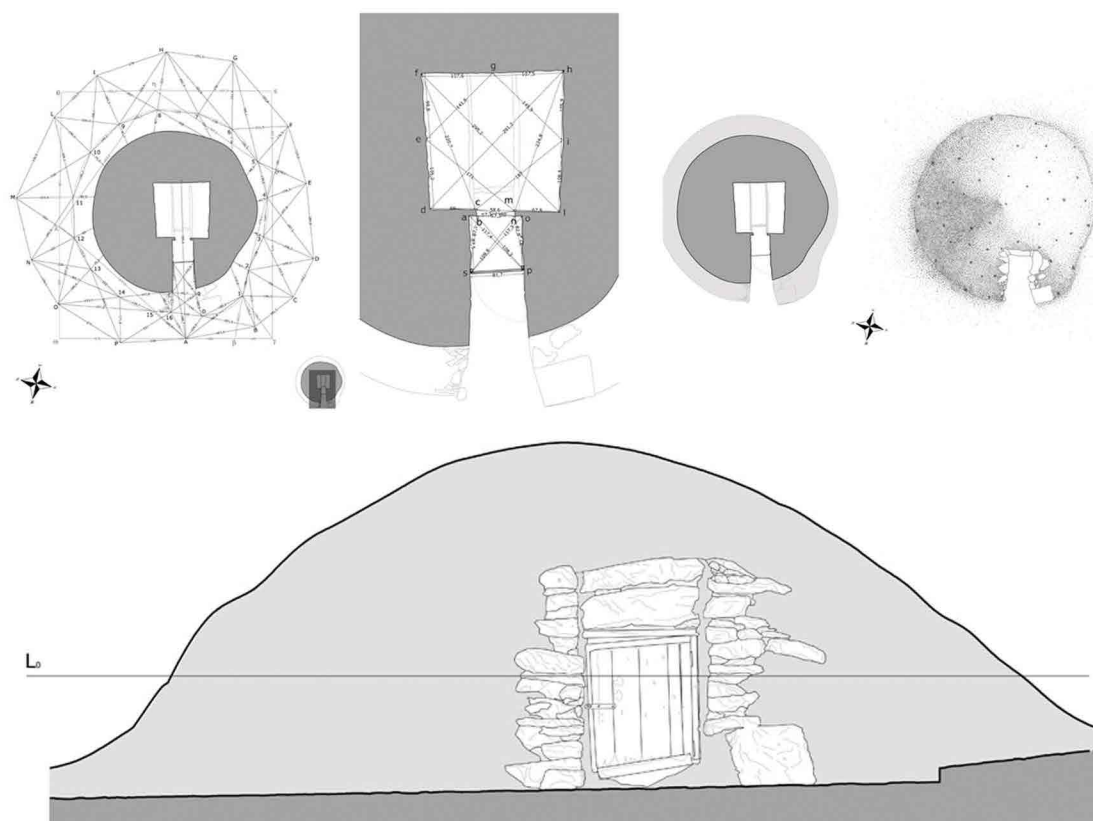


Fig. 12 – The Tomb of Colatoi: measured plans and entrance elevation drawing.

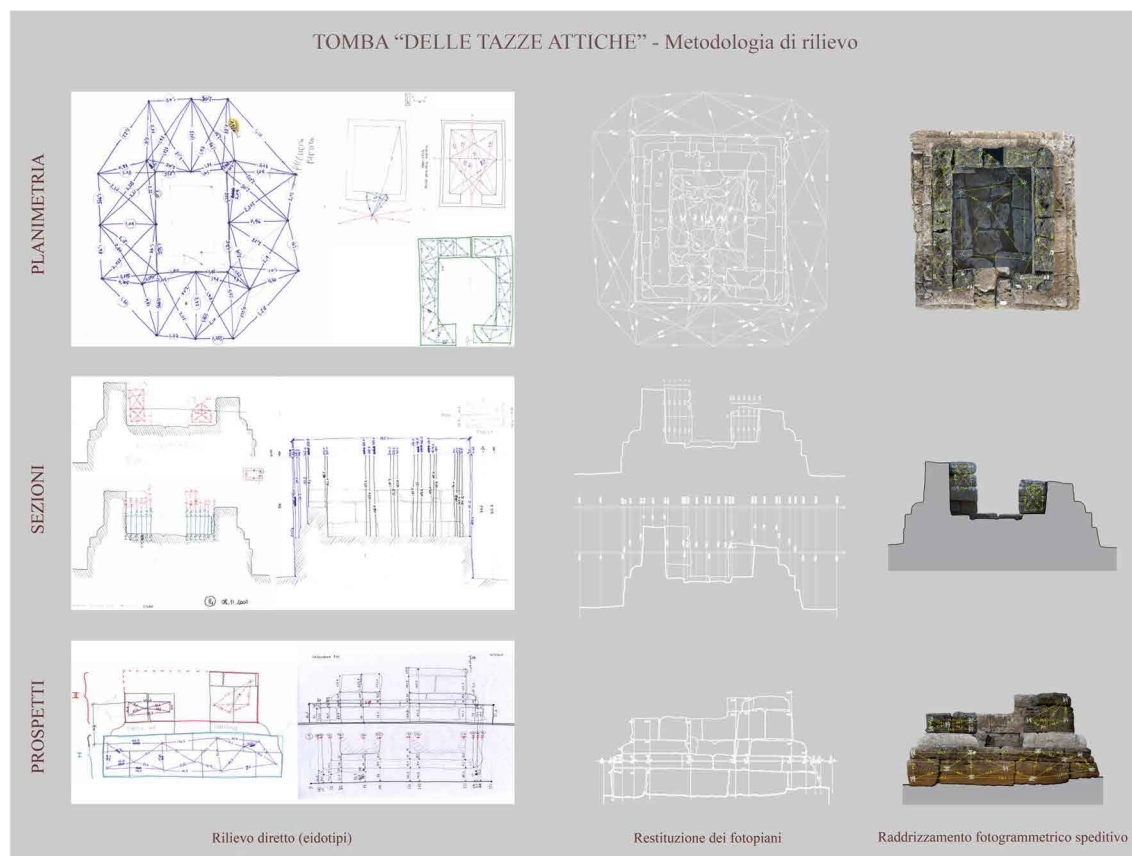


Fig. 13 – The tomb of Tazze attiche: the method phases of survey and rendering work.

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¹ Project leader: doct. Paola Puma; coordinatoors: phd Francesco Tioli, phd Massimiliano Masci, phd Michele Cornieti, phd student Carlo Battini; fellow workers: Mariasole Bernicchi, Silvia Burbi, Lorenzo Cantini, Zeno Da Ros, Simona Del Moretto, Simona Filidei, Giulio Alfio Gostoli, Laura Lazzarotti, Gaia Lenzetti, Valentina Madaghiele, Andrea Pistocchi, Luca Ribechini, Marianna Staccioli, Alessandra Viceconti.

² Starting from the excavations drafts by Antonio Minto, going back up to the first half of XX century, and following all the next specialized literature until the conspicuous work from Fedeli in 1980's.

³ Final degree thesis by Giulio Gostoli, Supervisor Paola Puma, Assistant supervisor Andrea Camilli; Faculty of Architecture of Florence, 2008.

⁴ Final degree thesis by Marianna Staccioli, Supervisor Paola Puma, Assistant supervisor Andrea Cavilli; ; Faculty of Architecture of Florence, 2008.

⁵ The 7° annual seminar happened in Florence, in the Faculty of Architecture headquarter, on 2 may 2008, with the participation of: Soprintendenza per i Beni archeologici della Toscana, Università degli Studi di Milano, Università degli Studi di Pisa, Università degli Studi di Bologna, Università degli Studi di Roma La Sapienza, Università degli Studi di Roma 3, Università degli Studi di Siena.

⁶ The survey carried out in june 2007 by Giulio Gostoli.

⁷ The survey carried out in june 2007 by Lorenzo Cantini, Andrea Pistocchi.

⁸ The survey carried out in june 2007 by Simona Del Moretto, Laura Lazzarotti.

⁹ The survey carried out in june 2007 by Gaia Lenzetti.

¹⁰ The survey carried out in june 2007 by Luca Ribechini.

¹¹ The survey carried out in november 2007 by Mariasole Bernicchi, Sivia Burbi, Simona Filidei, Valentina Madaghiele.

¹² The survey carried out in november 2007 by Zeno Da Ros, Marianna Staccioli, Alessandra Viceconti.

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CZYŻEWSKI, Łukasz Andrzej	KULITZ, Iman	SIMON, Arleyn
DE LAET, Véronique	KUTTNER, Eva	SIRBU, Valeriu
DI GIACOMO, Giacomo	LAZĂR, Augustin	SORO, Laura
DI TONDO, Sergio	LÜBKE, Christian	STEFAN, Dan
DIMC, Franc	LUKASEDER, Walter	TALLOEN, Peter
DITARANTO, Imma	MARTENS, Femke	THENIUS, Christiane
DOBAT, Erik	MASCHEK, Dominik	TIEFENTHALER, Michelangelo
DUTESCU, Magdalena	MAYER, Irmengard	TIEFENTHALER, Michelangelo
FANTINI, Filippo	MOM, Vincent	TOTSCHNIG, Ralf
FANTINI, Filippo	MOSSER, Martin	TRAXLER, Christoph
FARIN, Gerald	MUŠIČ, Branko	TSCHANNERL, Marcel
FERSCHIN, Peter	MUŠIČ, Branko	USAI, Alessandro
FISCHER AUSSERER, Karin	NEUBAUER, Wolfgang	UYTTERHOEVEN, Inge
GACH, Anita	OSREDKAR, Radko	VAN LANEN, Rowin J.
GACH, Anita	PAKKANEN, Jari	VERDIANI, Giorgio
GIETL, Rupert	POBLOME, Jeroen	VERSTRAETEN, Gert
HANKE, Klaus	PREGESBAUER, Michael	VITAL, Rebeka
HARMADYOVÁ, Katarína	PUMA, Paola	WAELEKENS, Marc
HIEBEL, Gerald	RAJTÁR, Ján	WALKSHOFER, Sandra
HOLLWEGGER, Florian	RAUSCH, Andreas	WEINLINGER, Günther
HUMER, Franz	REINITZER, Sigrid	WURZER, Gabriel
INDRUSZEWSKI, George	RESCHREITER, Hans	