

## The Romanesque Complex of SS. Trinità of Saccargia in Sardinia

Giulia BALDI

Dipartimento di Architettura, University of Florence, Italy

**Abstract:** The Basilica of Saccargia rises almost isolated in the middle of a wide valley and its sight, together with the adjoining ruins of the ancient monastery, is very impressive. The Romanesque architecture of Saccargia represents what remains of past ages during which the “pisano-pistoiese” styles were joined with Sardinian typical materials. At the beginning of the XII century, the old medieval country church was included in a wider structure with a single nave and a three apses transept. During the following decades the church was again lengthened and widened giving origin to a narrow and longer nave, very uncommon for the religious monuments of that period. The inside is enriched by very important paintings of byzantine influence that cover the major apse. The Basilica maintains intact all its fascination. This happens despite many vicissitudes that also made very difficult to carry out an accurate stratigraphic reading. The digital survey, operated using 3D Laser Scanner technologies by a team from the DiDA of Florence University in collaboration with the DiSTer of Cagliari University in 2013, produced a detailed description of the complex, a necessary base to create a 3D digital model and drawings for further studies. The survey allowed to understand limits and potentialities of the architecture, leading to a reflection on a restoration and a further musealization project, providing Saccargia with a renewed image but still connected with its history, safeguarding its architecture and maintaining its archaeological finds in their environment. The project aims to allow visitors to explore this heritage creating an ideal connection with the ancient Romanesque settlement. This paper shows the process carried out to design this solution for public access and learning, starting from an accurate digital survey and using digital tools to figure out the results of the proposal.

**Keywords:** 3D Laser Scanner, digital survey, Sardinia, Romanesque, Saccargia

### Introduction

The research presented here is a part of a thesis project called: *The Romanesque Complex Of Santissima Trinita' Of Saccargia In Sardinia*. In 2013 a collaboration between a team of the DiDA (departments of Architecture) of Florence University and the DiSTer of Cagliari University has allowed to begin an accurate study on the Romanesque complex of Saccargia (fig. 1) bringing on detailed analysis of all the structure, the materials and the history of this important cultural heritage. The survey has allowed to understand limits and potentialities of this architecture, leading to a reflection on a restoration and a further musealization project. The project is articulated around more steps: a deep comprehension of the territory and contest, analysing the environment and the past history of Sardinia, in particular the Romanesque period and its Churches; an accurate stratigraphic reading of the single building and monastery thanks to digital survey technologies; a series of studies and analysis of the architecture and its materials; at last it has been possible to work on all the collected data to elaborate a proposal for a restoration and a musealization project.



Fig. 1 – The Romanesque Complex of SS.Trinità of Saccargia. (Copyright: Giulia Baldi)

## The Romanesque in Sardinia

One of the most important aspects of cultural heritage and of tourist attractions of Sardinia is represented by the remains of the Nuragic civilization together with the ancient Romanesque style of the majority of its churches. The historical and artistic heritage of Sardinia is known for its many Romanesque churches placed on the territory and most of them well preserved: more than 150 intact churches testify what remains of past ages during which the *pisano-pistoiese* styles were joined with sardinian local materials, extracted from quarries on the Island, as limestone and basalt stone. The history of Art and Architecture of the Island are strictly connected to the political and historical events of the continent. With the decay of the Eastern Empire, Pisa and Genoa Maritime Republics allied with local forces, Sardinia experienced an important economic and cultural improvement, giving birth to new constitutions, new political relationships, wider spiritual boundaries and a qualitative revival of religious architecture. In this period we assist to the rise of “Judges”: small independent reigns, each one ruled by its own judge who held military and judiciary power. Around the end of the XI century, the island opens its boundaries to the West in order to balance the strong influence of the Maritime Republic of Pisa and Genoa, which had become more and more powerful and therefore had begun to interfere with the Sardinian government. For this purpose the Sardinian Judges begin to grant land and churches to the Church of Rome and their Monasteries (CORONEO 1993).

## The Santissima Trinità Of Saccargia

The Basilica of Saccargia is one of the few monuments that still maintains intact all its fascination despite the many vicissitudes suffered because of the indifference of men, as well as the excess of attention (as far as restorations are concerned), not to mention that old buildings have always been considered places from

which to take already worked stones for the construction of other buildings. The Romanesque complex is located in the north-western Sardinia, in the town of *Codrungianos*, near Sassari, and its sight is very suggestive for the context in which it appears: set in the middle of a wide valley, bounded to the North by the basalt plateau of *Su Culoru* and to the South by limestone hills of *Florinas* and *Codrungianos*. The Abbey is almost isolated flanked only by the ruins of the monastery. Its strategic position was aimed to defend the territory and ensure safe trade relations and pilgrimage from the royal palace in Ardera to the harbour of Porto Torres. The Basilica was built in 1116 according to *Judge Costantino I* will, who granted to the Church a property which already included an ancient country church (SACER 10/2003). The nearby monastery was realized during the following centuries, but due to the abandon by the monks, it fell into decay and never recovered. The construction is in black and white limestone and basalt stones, placed regularly in the front side and in the bell tower. On the contrary in the other sides and in the apse the order is more free. Once inside, moving from a simple door with architrave, what impresses is the narrowness of the environment that is not noticed from the outside due to the harmonic set of ornamental façade superstructures. The sense of cold and cramped environment is given both by the lack of light that filters only through the few loopholes, and the view of the bare walls. The only decorative note is given by the frescoes covering the Major Apse. This frescoes are one of the rare tracks of pictorial facts dating back to the 13th century in Sardinia, and therefore of great value. The floor of the long narrow nave, ending in the three apses transept, is in stone and the cover consists of very dense wooden trusses. The monument we see today, certainly among the most studied, is the result of the survival of original form over the many restorations that have been made during the centuries till nowadays. In particular those led by *Dionigi Scano* at the end of the 19th century have produced countless changes to surfaces and to the structure of the Basilica. The first plant of the Church dates back to the first decade of the 12<sup>th</sup> century. To it belongs the first structure of the nave, covered by a wooden roof, the three apses transept and the tribune, made of white and black hewn stones. In the second Romanesque phase (1170-1180) the Basilica was lengthened reaching an unusual and very uncommon size for the Sardinian Romanesque architecture of the first half of the 12th century, probably influenced by a spatial conception of French origin. The northern side of the building shows the two moments: the first architectural phase is visible in the ancient walls of the transept; the second one, visible in the bell tower, and in basalt and limestone blocks of different thickness, arranged in rough and variable rows all along the whole side. This particular arrangement of the stones also characterizes the southern front; this is due to further restorations. Today the front façade of Saccargia (fig. 2) shows the characteristics desired by restorers of the 19th century, saturated with a late-Romanesque culture that bound them closely to the principles of the French Restoration School, headed by *Eugène Viollet-Le-Duc* (SCANO 1907). In the third phase, which can be placed around 1180-1190, it was built a porch with arches and columns resting on a base and covered by a vault roof. In the last phase, (late 14th century to early 15th) it was built the chapel of St. Maddalena alongside the North front of the transept. The adjoining monastery dates back to this very last phase. The archaeological excavations of the Abbey of Saccargia (over 3000 sqm), which began in 1992, have attested with certainty the presence of three cloisters or backyards (fig. 3). The monastic complex consisted of a cloister around which all the ecclesiastical life took place (fig. 4). Because of the many restorations made over the centuries until recently, it has been difficult to obtain a clear stratigraphic reading (SECHI A.I. 1953-57/1992). One of the main features of the Basilica is the material used, which occurs in all

the various construction phases: -Basic volcanic rocks (SiO<sub>2</sub>-valued variables between 50 and 54%) locally sourced, in basaltic composition, ranging from sub-alkali (~ 54% SiO<sub>2</sub>) to transitional (SiO<sub>2</sub> from 50 to 53%) classified on a chemical base according to *DE LA ROCHE et alii* (1980) as latiti and trachiandesites; -type of carbonate sedimentary rocks locally sourced (i.e. limestone). It has been also found the presence of other types of local and foreign sedimentary and metamorphic rocks (i.e. marbles etc.), in part due to recent restoration of the twentieth century. In addition to architecture and paintings, another important element of the Basilica of Saccargia is the sculpture, which can be considered one of the various monuments in the *Pisano-Lucchese* style in Sardinia. The very simple interior decoration contrasts with the complex and rich ornaments of the facade and the porch. The original capitals of the porch with winged demons were replaced with copies by *Dionigi Scano* (fig. 5). Through an accurate photogrammetric analysis it has been possible to understand the exact anatomy of the capitols, both the originals and the copies, so as to confront them in all their shapes, proportions and qualities (fig. 6). These copies are artefacts of poor workmanship quality: it lacks the freshness inventiveness, the aggressiveness of medieval monsters. The original capitals are located on the right wall of the nave. The medieval sculptor has created with particular attention the bodies of the little monsters laid on an almost disappeared vegetable wreath, with open jaws and sharp teeth well in sight, protruding ears, and with a fierce look of admonition. The capitals are dramatically eroded in the back, probably because those parts were originally exposed to the outside and therefore to the weather beaten.



Fig. 2 – Front side of the Basilica of Saccargia. (Copyright: Giorgio Verdiani)



Fig. 3 – Central cloister of the monastery. (Copyright: Giulia Baldi)



Fig. 4 – The ruins of the ancient monastery (Copyright: Giulia Baldi)



Fig. 5 – The original capitol with winged demons, kept inside the church. (Copyright: Giorgio Verdiani)

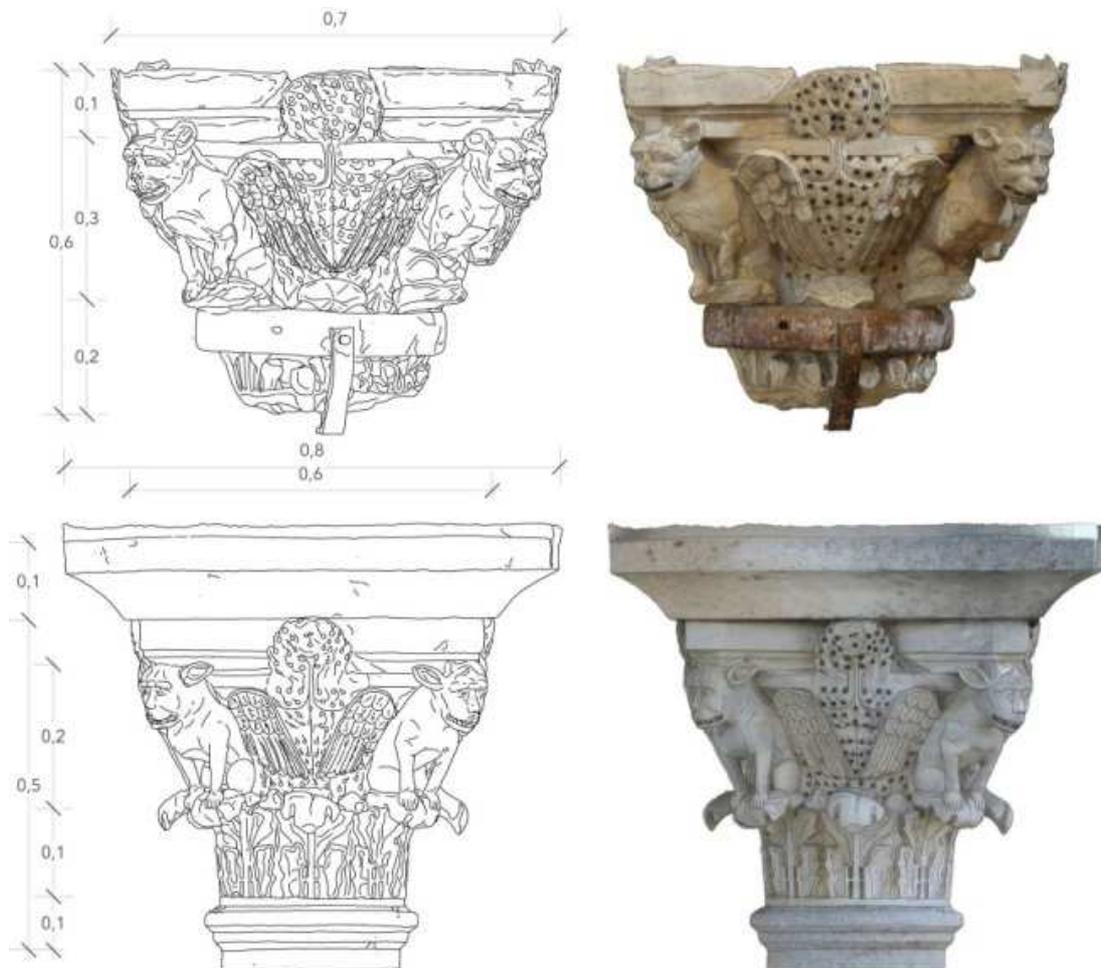


Fig. 6 – Study of the capitols proportions. Copy and original. (Copyright: Giulia Baldi)

## The Digital Survey

The digital survey, operated using a phase shift *3D CAM/2 Faro Photon Laser Scanner* produced 43 scans taken from different positions, that analyses the architecture and the environment, collecting data of its shape and creating high density point clouds. 22 of these 43 scans have been taken from the outside around the building. The remaining 21 have been taken inside the Basilica, along the nave, in the three apses, the side chapel and in the adjoining spaces of the church (fig. 7). The survey has been operated in full panoramic mode, exploiting the characteristics of this 3D laser scanner unit, which is capable to scan 360 degrees on the vertical axis and 320 degrees on the horizontal one. Once obtained all the necessary scans, and then the various point clouds it has been possible to recompose them together in one final three-dimensional model, from which get the various two-dimensional drawings necessary for further studies. First of all the use of *Faro Scene 5.0.1* software has been necessary to transform and export scans points from .fls files to .ptx files, in order to pass them to *Leica Geosystem Cyclone 6.0.3* software for merging and Registration. The *Leica Geosystem Cyclone 6.0.3* software has allowed working on the 43 scan stations, providing a series of tools necessary to align and precisely merge the point clouds acquired into a single cloud (process called Registration). For each .ptx imported files a ScanWorld has been generated. The following step has been to create single Model Space for all the 43 obtained ScanWorld and copy each cloud on their own ControlSpace. A cloud to cloud Registration has been done defining four or five common targets on each point clouds. This operation was carried out merging point clouds one couple by one, aligning them, calibrating the error and freezing the Registration to reach a total ModelSpace with a single final high density point cloud, composed by 806.095.460 points (fig. 8). Once obtained this final ModelSpace the cloud has been divided into layers both for inside and outside of the Basilica, the Monastery, and the surrounding environment. Necessary screenshots for bi-dimensional analysis and design study has been produced using Reference Plane and Cut Plane. With *Leica* program it has been possible to see the structure of the building in *Elevation Map* mode (fig. 9) after the setting of 20 repeated colours and distributed according to altitude (*Topo 1 Setting- Start: 0,00 m, Delta: 0,100 m*). A third software has been used to improve the resolution of the 3D Model from which capture other screenshots. *Pointools Pod Creator* software has allowed to export .ptx files to .pod files and to finally export them to .ptl files using *Bentley Pointools Edit Pro 1.5* program. With the use of *Bentley Pointools Edit Pro* software, cutting plane and specific settings, it has been possible to obtain a better graphic resolution of the 3D digital model in order to make more high definition snapshots (fig. 10). Those snaps have been later transferred into the two-dimensional *Vectorworks 2009* processing software for the graphic production of plans, elevations and sections of the entire architectural structure. *Adobe Photoshop CS3* has been the last software used for the material restitution of each graphic drawing through a matching with the photos taken during the survey, and as well as to obtain an improved and perfected final result.



Fig. 7 – 3D CAM/2 Faro Photon Laser Scanner. (Copyright: Giorgio Verdiani)

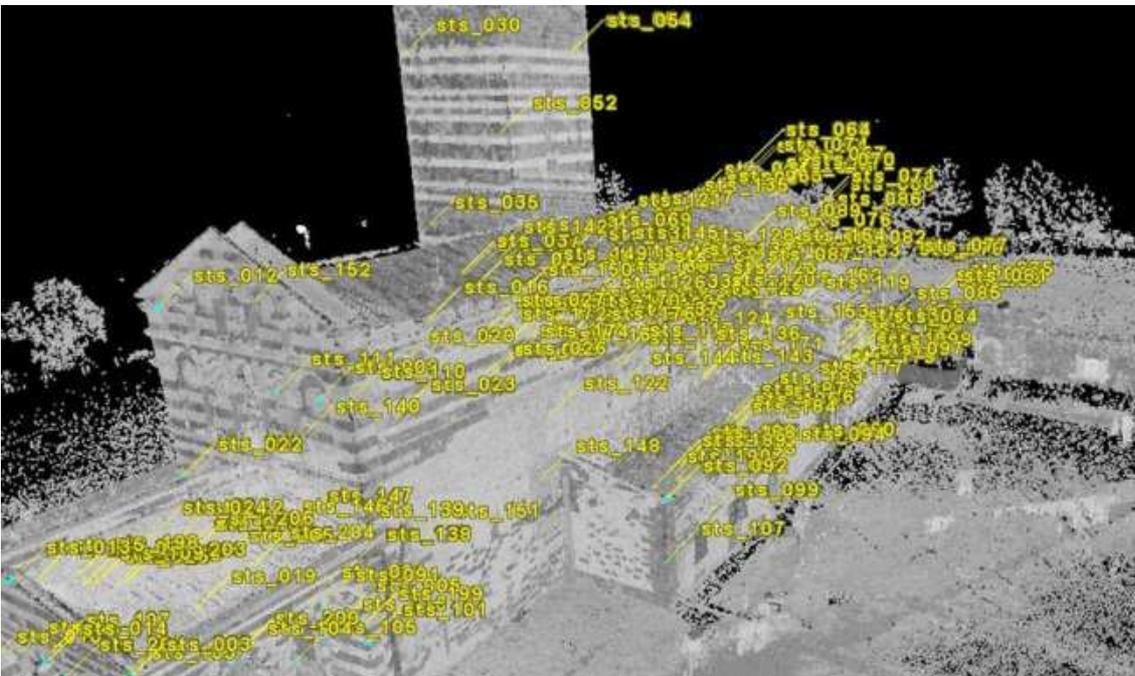


Fig. 8 – Leica Geosystem Cyclone Software 6.0.3. Alignment of clouds. (Copyright: Giulia Baldi)

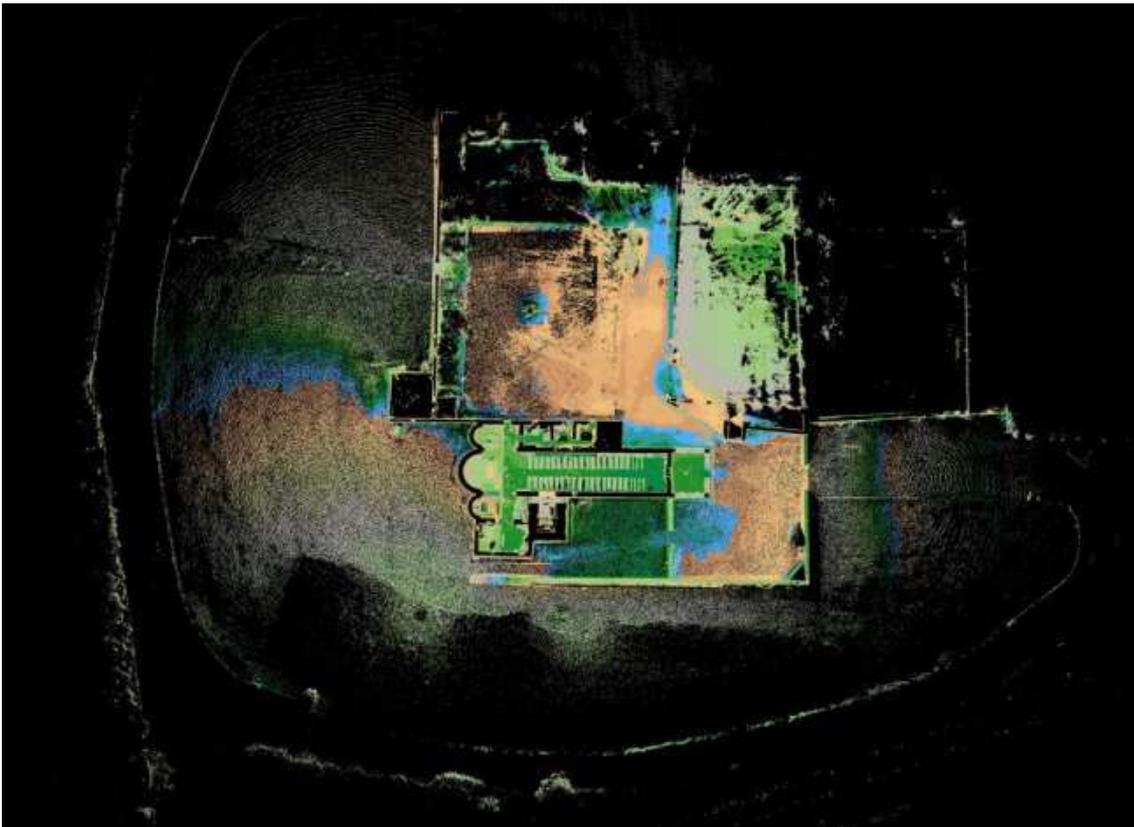


Fig. 9 – Plant with colors according to altitude. The processing took place with Leica Cyclone software 6.0.3, in *Elevation Map* mode (START:0, 000m, DELTA:0, 100 m); TOPO 1 setting (20 colors repeated). (Copyright: Giulia Baldi)



Fig. 10 – Pointools Edit Pro Software. Snapshot. (Copyright: Giulia Baldi)

### Concept and Project Proposal

The survey allows to understand limits and potentialities of the architecture, leading to a reflection on a restoration and a further musealization project. In order to start a defined and clear project proposal it has been necessary not only an architectural analysis, but also an analysis of the entire area: identifying those

that are the main points of interest and the potentialities of the territory but also the shortcomings and faults. The final concept that comes out from the reading and the interpretation of the entire analyzed materials is connected to the will to create an exciting long-protected, paved open air path through the ruins of the monastery, together with a covered museum area composed by a series of spaces used to protect and safeguard the archaeological remains, as well as for educational, recreational, cognitive and interactive activities. The visitors are given the opportunity to get in touch with the reality of the Romanesque Basilica, its monastery and its history, involving and fascinating him all along its path. A study on the layout of the ruins, their orientation, has led to the development of a system of paths and walkways through and over the ruins of the monastery connected both to the Church and to the entrance of the Museum (figs. 11-12-13). The visitors will have the opportunity to follow paths at ground level or to rise up to three meters high, protected by special steel balustrades, to admire the excavations and the ancient remains from each side, catching in this way every detail of the beautiful Benedictine Complex. This proposal aims to allow visitors to explore this important Cultural Heritage creating an ideal connection with the ancient Romanesque settlement.



Fig. 11 – Render. The open air path through the ruins of the monastery. (Copyright: Giulia Baldi)



Fig. 12 – Render. The path and the covered museum area. (Copyright: Giulia Baldi)



Fig. 13 – Render. The inside of the museum area. View towards the Church. (Copyright: Giulia Baldi)

## Conclusions

The decision to undertake the study of the *Romanesque Complex of the SS. Trinità of Saccargia* comes out from the will and the need to recover a very important Cultural Heritage for Sardinia, that has been for too

long overlooked and under-appreciated. The very detailed and complex survey, combined with all the data and documents analysed and the use of various digital software has led to an increase in the level of the knowledge of this architecture. The proposal of a conservative intervention is born spontaneously as a solution of all that emerged during the study. The final aim is to reach a solution that can be effectively carried out in order to give Saccargia a renewed image but still connected with its history, safeguarding its architecture and maintaining its archaeological finds in their own environment.

## References

- KADOLPH, S. J. (2007) *Textiles*. 10th ed. New Jersey: Pearson Prentice Hall.
- ARCHEOLOGIA MEDIEVALE, cultura, insediamenti territorio. Volum XXVI.
- ARGAN G.C. (1968) *Storia dell'arte Italiana*. Voll. I-III. Florence.
- BENEVOLO L. (2008) *L'architettura nel nuovo millennio*. Bari.
- BOITO C. (1989) *Il nuovo e l'antico in architettura*. Milano.
- BOTTERI M. *Guida alle chiese medioevali di Sardegna*. Sassari.
- CORONEO R. (1993) *Architettura romanica dalla metà del Mille al primo 300*. Nuoro.
- CORONEO R: (1993) *Storia dell'arte medievale in Sardegna – Introduzione allo studio*. Nuoro.
- COLUMBU S., VERDIANI G. (2013) , *Digital Survey and Material Analysis Strategies for Documenting, Monitoring and Study the Romanesque Churches in Sardinia, Italy*. Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection Volume 8740 of the series Lecture Notes in Computer Science pp 446-453, Springer,
- DE LA ROCHE H., LETERRIER J., GRAND CLAUDE P.& MARCHAL M. (1980) A classification of volcanic and plutonic rocks using R1-R2 diagram and major element analysis. Its relationships with current nomenclature. *Chem.Geol.*, 29, 183-210., (C.N.R.S.). Vandoeuvre-lès-Nancy, Francia.
- DELOGU R., (1953) *L'architettura del Medioevo in Sardegna*. Roma.
- (2001) *Diari di Scavo dell'Alta Soprintendenza Archeologica per le province di Sassari e Nuoro*.
- FARA F. (1992) *De rebus sardois, libri III-IV*, in 'Opera' a cura i E.Cadoni. Sassari.
- GOMBRICH E.H. (1966) *La storia dell'arte raccontata da Ernst H. Gombrich*. Torino.
- JODIDIO P. (2005) *Architecture Now*. Koeln.
- MALTESE S. (1962) *Arte in Sardegna dal V al XVIII secolo*. Roma.
- MELONI G., DESSI FULGHERI A. (1994) *Mondo rurale e Sardegna del XII secolo. Il Condaghe di Barisone II di Torres*. Napoli.
- POLI F. (2008) *Saccargia, L'Abbazia della SS.Trinità*. Sassari.
- PORCU GAIAS M. I parte. *La Basilica di Saccargia: il Monumento e la sua Storia*. Sassari.
- PORCU GAIAS M. II parte. *La Basilica di Saccargia: il Monumento e la sua Storia*. Sassari.
- PRINA F. (2009) *Storia dell'architettura romanica*. Milano.
- RUGGERI TRICOLI M.C. (2007) *Musei sulle rovine – Architetture nel contesto archeologico*. Milano.
- SABA A. (1927) *Montecassino e la Sardegna medievale: note storiche e codice diplomatico sardo-cassinese*. Badia di Montecassino.
- SACER (10/2003) *Note su antichità e storia di Sardegna*.

SACER (11/2004) Note su antichità e storia di Sardegna.

SCANO D. (1907) Storia dell'arte in Sardegna dal XI al XIV secolo. Cagliari.

SECHI A.I. (1953-57/1992) Ritrovare Saccargia, Documento grafico-storico della Basilica Romanica "la SS. Trinità".

SERRA R. (2004) Sardegna preromanica e romanica. Milano.

SERRA R. (1992) La Sardegna. Cagliari.

SERRA R. (1990) Pittura e scultura in Sardegna dall'età romanica alla fine del '500. Nuoro.

SPANO G. (1857) Bullettino archeologico sardo, III, 5 (saggio di F.Fiori Arrica). Cagliari.

TOESCA P. (1927) Il Medioevo. I-II. Torino.

USAI N. (2013) SS Trinità di Saccargia a Codrongianos. Sassari.

VIRDIS A. (2014) Romanesque and territory construction materials of Sardinian medieval churches: new approaches to the valorization, conservation and restoration. Conference on cultural heritage and new technologies. Vienna.

ZANETTI G. (1968) I Vallombrosani in Sardegna. Sassari.

<http://www.parcoarcheologicocarmignano.it/museo>

<http://www.rheinzink.it/prodotti/coperture/>

[http://it.wikipedia.org/wiki/Basilica\\_di\\_Saccargia](http://it.wikipedia.org/wiki/Basilica_di_Saccargia)

[http://it.wikipedia.org/wiki/Giudicato\\_di\\_Torres](http://it.wikipedia.org/wiki/Giudicato_di_Torres)

[http://www.reginamundi.info/santuari/Santuario\\_saccargia.asp](http://www.reginamundi.info/santuari/Santuario_saccargia.asp)

<https://www.facebook.com/pages/Basilica-SS-Trinit%C3%A0-di-Saccargia/91719598438>

<http://www.sardegnaicultura.it/j/v/253?s=17842&v=2&c=2488&c1=2126&t=1>

<http://www.joachimsauter.com/en/work/timescope.html>

<https://artcom.de/en/project/timescope/>

[http://www.minersoc.org/pages/Archive-MM/Volume\\_62/62-4-487.pdf](http://www.minersoc.org/pages/Archive-MM/Volume_62/62-4-487.pdf)

#### **Imprint:**

Proceedings of the 20th International Conference on Cultural Heritage and New Technologies 2015 (CHNT 20, 2015)

Vienna 2016

<http://www.chnt.at/proceedings-chnt-20/>

ISBN 978-3-200-04698-6

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie

Editorial Team: Wolfgang Börner, Susanne Uhlirz

The editor's office is not responsible for the linguistic correctness of the manuscripts.

Authors are responsible for the contents and copyrights of the illustrations/photographs.