



*OS-Culture.org*

***“OS-Culture.org a CMS for archaeology:  
New communication possibilities for archaeological data”***

***edited by Tommaso Saccone and Cristiana Margherita***

## 1. INTRODUCTION

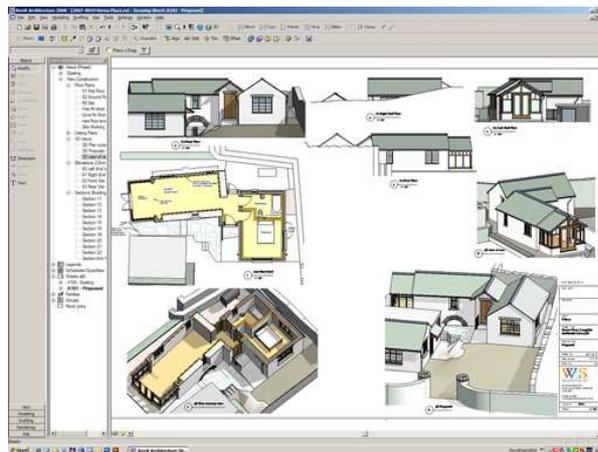
### 1.1 Premise

Over fifty years have passed since the first computers and IT tools were adopted in the archaeological field for study and research activities<sup>1</sup>.

In fact, in the 60s of the last century, Professor Maurizio Tosi with the archaeological mission (ISMEO - ISIAO) in Shahr-i Sokhta (Iran) began to use the first computers for the elaboration of databases for the organization of the archaeological *record* using the historical formats *.db3*.

Since then, technology has made great strides, in fact from table *.db3* we have moved to complex and articulated *Geo Databases* that can contain terabytes of heterogeneous data, all geo referenced and in constant relation between them.

Soon, tools such as 3D modelling, the development of GIS and BIM (Fig. 1), for the study of the territory, will also give great impetus to the methodology of archaeological documentation thus aligning with the European directives that manage spatial planning and public works. To understand how much Italy is backward on this point, just think that the BIM tools for project management of large public works will come into force in 2019<sup>2</sup> by the will of the European Community.



**Figura 1.** Example of the BIM elaboration

([http://carnevalenrico.altervista.org/Immagini/icona/Icone%20Lezioni/6\\_1/revit.jpg](http://carnevalenrico.altervista.org/Immagini/icona/Icone%20Lezioni/6_1/revit.jpg)).

---

<sup>1</sup> Mariani L., 1979.

<sup>2</sup> Dlgs 163/2006 al Dlgs 50/2016 e al Correttivo Dlgs 56/2017.

There are two questions that have been the starting point of this project:

- How to acquire, process and communicate this vast and heterogeneous core of data?
- How to archive this data to make it immediately reusable?

We have tried to answer these questions by developing a tool for archiving and communicating the archaeological and cultural data "*O (prerative) S (ystem) -Culture.org*" (Fig. 2), a CMS useful to communicate the complexity of archaeological data thanks to digital technologies.

The idea for this project was born in 2012, in collaboration with Professor Maurizio Tosi, who would soon retire, and who wanted to find a way to make the data acquired during his career accessible.



*Figure 2* Logo of *OS-Culture.org*.

To date *OS-Culture.org* has been used to organize: part of Professor Tosi's personal archives and for the management and communication of archaeological data and information from the Italian Archaeological Mission in Armenia and the Caucasus (MAA-ISMEO) and from the Institute of Archeology of Yerevan - Armenia (IAE NAS RA). The choice to create a CMS arises after studying the developments of the European project "*Michael: Inventario Multilingua del patrimonio culturale*

*européo*<sup>3</sup>, a large archive shared between museums and collections from all over Europe.

Unfortunately, once the funds were finished, the project had to stop at the current version, not allowing to implement the material relating to Italy that does not reflect the real situation.

Following the Bachelor thesis<sup>4 5</sup> of Tommaso Saccone, one of the curators of this project, it was decided to continue working with *open source software* to keep production costs low and at the same time have the possibility to modify the source code, so, if necessary, to adapt the *software* to the needs of the *OS-Culture.org* project.

All the choices made for the realization of the web platform have been carried out considering some factors, necessary for the development of a functional tool for the communication of cultural contents:

- Simplicity of use (consultation and writing);
- Simplicity of installation on first or second level personal domain;
- Simplicity of data transfer due to change Host or Server;
- Replicability of the project;
- Minimum maintenance of the system;
- Constant update of the software component;
- Ability to perform Backup;
- Need to guarantee the confidentiality of the contents inserted;
- Limited cost thanks to the use of *open source software*;
- Easy setting of multilingual contents;
- Possibility to manage the following formats: images (JPG - TIF - PNG), movies, PDF, Google maps, KML & KMZ, Shapefile - GeoDatabase, PowerPoint presentations, 3D models, 360 ° photos, tables, texts;
- Condivisione delle pagine *web* mediante i canali *Social* dell'utente;

---

<sup>3</sup> <http://www.michael-culture.org/>.

<sup>4</sup> Saccone T., 2011.

<sup>5</sup> In this Bachelor thesis, the candidate compared the GIS *software* with a paid license (ArcGIS 9.2) and an *open source* license (Q-GIS). During this work it has been shown that the two *software* in principle are the same.

- Ability to browse 3D content in augmented reality;
- Ability to manage any electronic market;
- Possibility to consult the access statistics and compare them with a previous period;
- Excellent positioning within search engines (*SEO*);
- Constant relationship between author and content.

## 1.2 Communicating the archaeological data through the Web: *OS-Culture.org* - Archives of the Archaeologist

*OS-Culture.org* is a system designed in 2012 to solve the need to organize and share archaeological data and historical-artistic information concerning the personal archive of Professor Maurizio Tosi.

It was decided to create the "Fondo Tosi", the personal archive of the teacher, consisting of an incredible collection of archaeological, photographic and multimedia information related to the professional and personal life of the Professor.

The project stems from the need to computerize, sort and share this vast archive, which Prof. Maurizio Tosi, has kept at the University of Bologna. The same methodology of data acquisition and management has been applied to the Italian archaeological mission in Armenia and the Caucasus since 2016.

The IT structure of the website has been developed using the *Joomla 3 software*<sup>6</sup>, one of the CMS "Open Source" easier to use, characterized by a very large number of plug-in, which allows us to organize and share, effectively, our web processing.

The final goal of *OS-Culture.org* is to offer an instrument, from simple and immediate use, that allows the complete management of the archaeological documentation process, always maintaining the authorship of the data.

---

<sup>6</sup> <https://www.joomla.org>.

## 2. METHODS

### 2.1 *OS-Culture: the plug-ins that compose it*

The plug-ins used to create the OS-Culture.org web platform are as follows:

- *Editor JCE*: this text editor makes sure that the CMS can be used by everyone, you do not need any special computer skills, in fact, to edit web pages do not need to know any programming language;
- *Editor Code Mirror*: is an editor that allows us to write the contents directly by writing the html code;
- *Social Buttons*: allows the visitor to share the page on which he is via his *social* channels (*Facebook, Twitter, Google+* and *Linkedin*);
- *Akeba BackUp*: is a set of tools that allow the backup of both the site and the associated database. This *plug-in* saves every backup in a pre-established folder of the system, in case of serious problems it is possible to restore the CMS by recovering one of the previous backups. Also, to perform these steps it is not necessary to know any programming language;
- *Google Analytics*: is used to analyze the accesses and traffic of your site;
- *ARI Slideshow*: serves for sharing animated slides;
- *Flickr*: it is a tool to integrate single images or entire sets by importing them directly from your *Flickr* profile<sup>7</sup>. Thanks to the use of the API made available by *Flickr* and to the relative *Token* key it is possible to integrate and display the images of your profile even if we have uploaded them as private on the *social* channel.

### 2.2 GIS & Archaeology<sup>8</sup>

---

<sup>7</sup> *Flickr* is a *social network* created by *Yahoo* for sharing images, even at very high resolution. Unlike other social networks, like *Instagram*, it does not resize images (<https://www.flickr.com/photos/97303473@N02/albums>).

<sup>8</sup> Bianchini M., 2008; Bogdani J., 2009; Francovich R., Nardini A., Valenti M., 2001.

In archaeology, the representation of stratigraphic complexity using GIS *software* has had a fair application only in recent years.

The use of geographical information and its representation on the territory through maps has revealed over time an irreplaceable tool to know, describe, control and visualize various aspects of the surrounding world<sup>9</sup>.

The geographical data, described with the GIS *software*, has very specific characteristics compared to the other types of information. In fact, the information that it contains is characterized by a specific position in space and time.

The decision to adopt GIS and *WebGis* tools, for the systematic organization of excavation data, is spontaneous. In fact, the use of these systems guarantees, first of all, the constant georeferencing of the data and, second of all, a permanent correlation of the information organized in the system. These rules of constant relationship are defined by the different tables associated with the various vector elements and guarantee the possibility to perform searches (queries) of different complexity on our data.

The use of GIS *systems* should not be the purpose of the research, but as a functional step, useful for data management<sup>10</sup>.

This topic is fundamental for all those who wish to work in the archaeological field, for these reasons, we have tried to insert the possibility of visualizing this type of elaboration inside *OS-Culture*.

The ideal tool for the *online* management of cartographic elaborations would be a server dedicated only to the management of geographical data. This solution is the most reliable but also the most expensive, which involves important knowledge of programming and management networks, as well as a reasonable cost of *hardware*.

To keep costs down, we opted for the use of GIS *Cloud*<sup>11</sup>, a *clouding system* dedicated to GIS. The latter is a real *Web GIS* with a paid license. The trial version, which was used for sharing GIS *systems* hosted on *OS-Culture.org*, places limitations in terms of the number of polygons we can draw.

---

<sup>9</sup> Mignani M, 2008.

<sup>10</sup> Valenti M., 2000; 2004.

<sup>11</sup> <https://www.giscloud.com/>.

### 2.3 3D modelling & Archaeology

There are several methods to obtain three-dimensional models<sup>12</sup>, some metrically correct and others not: for extrusion and revolution, scanning with laser scanner<sup>13</sup> and photo scanning<sup>14</sup>.

For the *OS-culture* project we decided to use *Structure from Motion* technique. This latter is a 3D modelling technique that refers to the process of processing three-dimensional structures from sequences of two-dimensional images (Fig. 3). This technique is the evolution of two-dimensional photogrammetry and consists in the elaboration of a 3D model with very high-resolution textures.

The starting point for performing this processing is a set of photographs. The costs of the photo scanning *software* are accessible, and processing takes several hours, depending on the *hardware* characteristics and the definition of the images used.



*Figure 3. Sinaw, Tomb of the warrior (Sultanate of Oman 2014)*

*Editing by Tommaso Saccone.*

---

<sup>12</sup> Distefano M., Ripanti F., 2013.

<sup>13</sup> D'Andrea A., 2011; Peripimeno M., 2005.

<sup>14</sup> Fiorini A., 2012.

Thanks to the study and application of this technique it was possible to perform the surveys of the Italian-Armenian archaeological mission of 2017 in Solak without making drawings in the field. In fact, from the photographs it was possible to produce the following elaborations:

- Navigable 3D model with photographic *texture*;
- Orthogonal photographs 40,000 pxl on the long side;
- Digital terrain model;
- Section profiles;
- Planimetric survey;
- Material graphic reconstruction.

The same methodology was also adopted for the survey related to the projects carried out by the undersigned in *Armenia: Kotayk survey project*<sup>15</sup> 2017 and *Vayots Dzor project* 2017.

All these elaborations can be integrated within *OS-Culture* both 3D OBJ format, and image galleries or movies exported from the 3D model.

## 2.4 Digital technologies and excavation data management

The development of digital technologies has changed the quantity and quality of archaeological data acquired on site, but this revolution has not, however, translated into an evolution of the communication tools used for the communication of archaeological data.

During the elaboration of *OS-Culture.org*, the GIS technologies and structure-from-motion modelling were analysed in detail, determining a methodology of data acquisition on field that is functional for archiving via web platform.

This methodology was applied during the missions in Armenia and Georgia 2016/2017 with excellent results:

---

<sup>15</sup> Dan R., 2015; 2016.

- **Alphanumeric documentation:** the excavation documentation is acquired using a database (DB) for each mission. The DB contains a table for each type of sheet: US / USM, Ceramics, Objects, Individuals. All the cards have at least one field in common with all the others, generally this field is the US, which allows to combine the alphanumeric data with the cartographic data. The development of technologies related to mobility allow the compilation of the various DBs directly on site;
- **Topographic measurement:** the production of the reliefs was carried out using 3D photogrammetric programs using a structure from motion technique, with the consequent processing of HD orthophotos (40,000pxl on the long side), DEM, floor plans, section profiles, elevations and vector drawings. For the storage of *meshes* it was decided to use *Sketchfab*<sup>16</sup>, in this way the models were made accessible to all collaborators in an immediate way through the CMS. Concerning the management of topographic points, a text file was used on the field, for its immediate editing possibility with any text *editor* and the simplicity with which the *.txt* format can become a *shapefile* compatible with GIS *software*;
- **Photographs:** all the excavation images have been acquired in RAW format to have more control over the file and its post-processing. The tools used to produce the photos are a *DJI Phantom 3 Advance*<sup>17</sup> drone with a 14-megapixel sensor and a *mirrorless Sony a5100*<sup>18</sup> with a 24.3-megapixel sensor. Each image was edited using Camera Raw in Photoshop. Once the editing work is finished, only the RAW file is archived by deleting the associated JPG.

## 2.5 OS-Culture and data organization

Since this project began, the problem has been posed of the material handling of files and their conservation. In fact, very often supports such as CDs or DVDs over time deteriorate becoming no

---

<sup>16</sup> <https://sketchfab.com/Di.Re-Cultura/models>.

<sup>17</sup> <https://www.dji.com/phantom-3-adv>.

<sup>18</sup> <https://www.sony.co.uk/electronics/interchangeable-lens-cameras/ilce-5100-body-kit>.

longer legible or usable, thus losing the data stored in them. Fortunately, in recent years many solutions have been developed, even inexpensive, for data storage.

The ideal solution for data management is a network *Nass*, which guarantees secure data retention. Moreover, on these devices it is possible to set periodic backup sessions on remote servers, and thanks to the use of RAID1 setting it is possible, in case one or more disks break, automatically rewrite the missing data on the new disks, thus making data loss virtually impossible.

The use of a network *NASS* allows you to create a personal clouding system and shared folders, moreover the system administrator can protect files at the same time thanks to the access rules.

For this project it was not possible to use a network *Nass* for economic reasons, for these reasons the saving of the documentation occurred on external memories. Moreover, a further copy of this data has been kept on a 4 TB HD inserted as secondary storage on the workstation used for the aforesaid work.

All Mission participants have the possibility to access archived data using *Team-Weaver*<sup>19</sup>, a free *software* useful for managing remote *Desktop* and *file sharing*, even if this system has two major problems:

- To allow access to data, the workstation must always be switched on;
- A good internet connection is required to download large data.

## 2.6 *OS-Culture.org* and its relationship with the *open source* world

The "*OS-Culture.org*" project embraces and firmly believes in the "*Open Source*" philosophy, for this reason after two years of testing, the license to which we have released the product is the *Creative Commons BY 2.0*.

Since 2012, every part of the CMS has been tested using data collected during the projects carried out by the Minerva Association<sup>20</sup>. In this way, the CMS has been tested in relation to more complex cultural contexts such as cities or museums.

---

<sup>19</sup> <https://www.teamviewer.com/>.

#### 4. THE RELATIONSHIP BETWEEN ARCHEOLOGY AND OPEN DATA

"The open data is data freely accessible to all, whose restrictions are the obligation to cite the source or to keep the database always open. *Open Data* refers to the wider discipline of *Open Government*, i.e. a doctrine based on which public administration should be open to citizens, both in terms of transparency and direct participation in decision-making. Moreover, it is based on an ethics like other "open" development movements and communities, such as *open source*, *open access* and *open content*<sup>21</sup>".

The archaeologist has the duty and responsibility to communicate what he documents in the most direct and complete way possible, considering the technologies and the possibilities of re-using the data dictated by globalization. The Internet has revolutionized data communication in a domineering way.

Especially in archaeology, adopting an "open" and shared management of what has already been published would give an incredible boost to research. Since archaeology is destructive action, it is a duty today to give access to data that is as complete as possible.

Italian archaeology, except for very rare case, tends not to communicate anything more than what is published in specialized magazines. The 99% of the material remains unprecedented and therefore inaccessible. In fact, very often decades can pass before archaeological evidence is studied, and this leads to a progressive loss of data.

#### 5. APPLICATION CASES OF *OS-CULTURE.ORG*

##### 5.1- Useful links

<http://www.os-culture.org/iran/>

<http://www.os-culture.org/iran/index.php/en/shahdad>

---

<sup>20</sup> Before releasing the project, we have tested the CMS, managing the data acquired from all the Minerva Association projects: [Ravenna](#), [Rimini](#), [Firenze](#), [Maiolo \(RN\)](#), [Poggio San Marcello \(AN\)](#), [Lido Silvana –Pulsano \(TA\)](#).

<sup>21</sup> [https://en.wikipedia.org/wiki/Open\\_data](https://en.wikipedia.org/wiki/Open_data).

<http://www.os-culture.org/iran/index.php/en/shahr-i-sokhta>

<http://www.os-culture.org/iran/index.php/en/tepe-hissar>

<http://www.oman.os-culture.org/>

<http://www.oman.os-culture.org/index.php/ra-s-al-hamra>

<http://www.oman.os-culture.org/index.php/ra-s-al-jinz>

<http://www.oman.os-culture.org/index.php/sinaw>

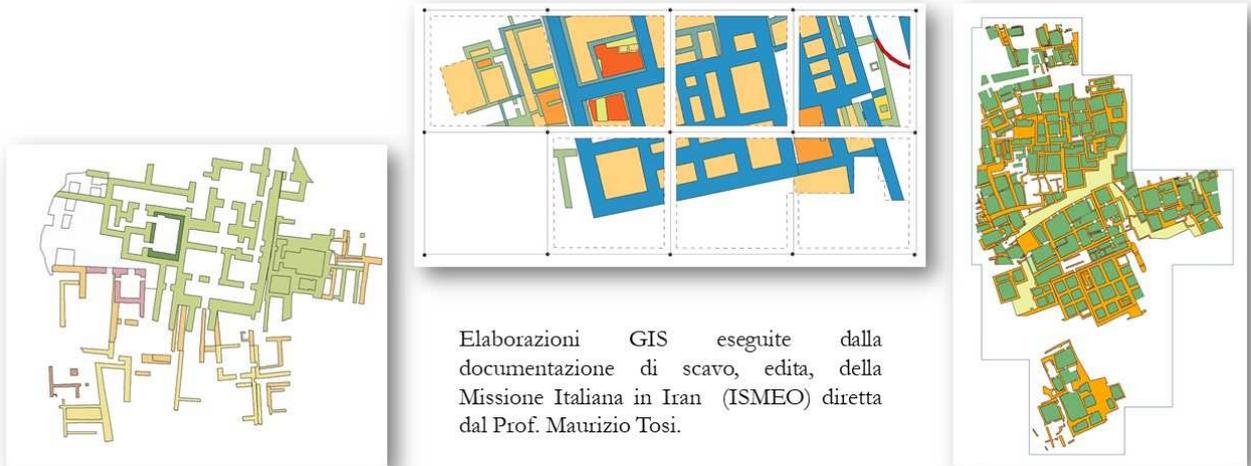
<http://www.oman.os-culture.org/index.php/survey>

<http://www.iae-nas.com/>

<http://www.iae-nas.com/index.php/karashamb>



## Shahr-i Sokhta – Web GIS



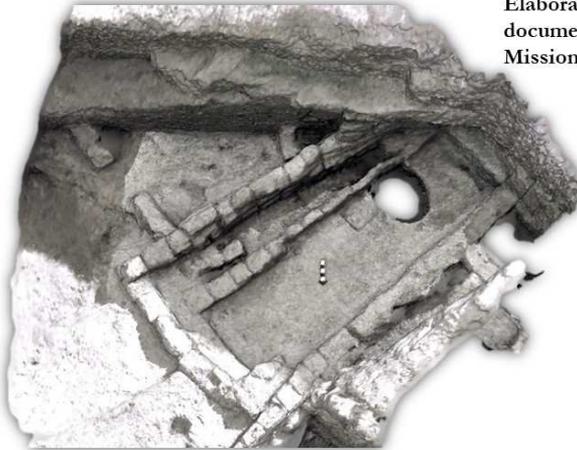
Editing by Tommaso Saccone

Accedi ai Web GIS - <http://iran.os-culture.org/index.php/en/sis-gis>

**Figure 4.** *Shahr-i Sokhta GIS* (<http://iran.os-culture.org/index.php/en/shahr-i-sokhta>).



## Tepe Hissar – Web GIS & 3D Test



Elaborazione GIS eseguite dalla documentazione di scavo, edita, della Missione Italiana in Iran (ISMEO).

Test 3D eseguito da diapositive scansionate. (SfM)



Editing by Tommaso Saccone (ISMEO)

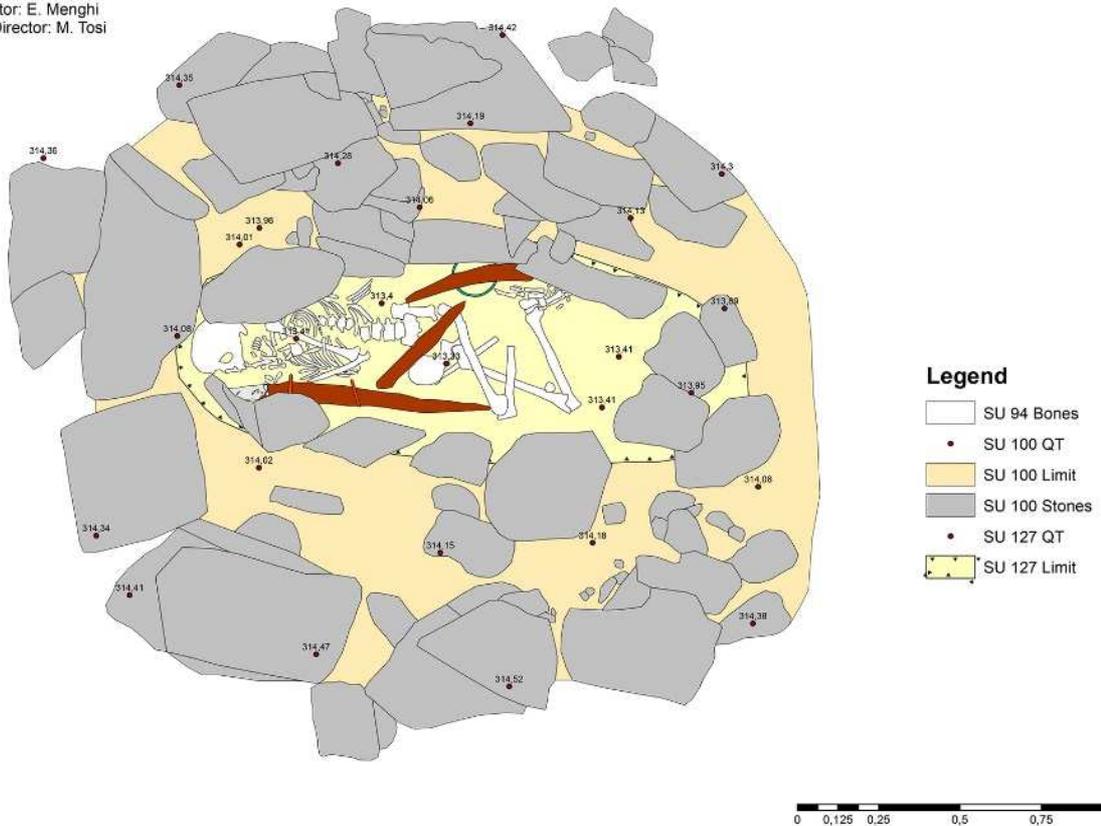
Accedi al Web GIS - <http://www.iran.os-culture.org/index.php/en/tepe-hissar>

*Figure 5. Tepe Hissar GIS (<http://www.iran.os-culture.org/index.php/en/tepe-hissar>).*

## SNW-1 Sultanate of Oman 2014 - Excavation at Sinaw-Barzaman Graveyard

Grave 58: SU 94; SU 100; SU 113; SU 127

GIS Editing: T. Saccone  
Field Director: E. Menghi  
Scientific Director: M. Tosi



*Figure 6. The tomb of warrior (Sultanate of Oman).*

## 6. DISCUSSION AND CONCLUSION

### 6.1- The failure of "*private*" management of archaeological data

If we look back and analyse monographic and essay production in archaeology or cultural heritage in Italy, we note that there has not been that technological and innovation leap that has characterized much of the scientific and production process.

As already mentioned, the process of acquisition and organization of archaeological work has changed thanks to information and technology. This technological leap has not yet manifested itself, in fact in the communication nothing has changed since the 80s to today.

Sporadic and very rare are examples of shared management of archaeological data, in fact, the few people who apply open data management in Italy are seen as visionaries.

Obviously, the problem isn't technological, in fact, it is at least a decade that the technologies necessary to develop shared access systems are usable, what is missing seems rather the will. This feeling is developed equally in both the world of university research and in the world of public administration.

Nowadays, the paper, no matter how beautiful and prestigious is, is no longer suitable for collecting the complexity of the archaeological data produced by the new digital tools. In the last five years we have had a very high increase in the performance of computers that has translated into the management and manipulation of a multitude of geographical, vectorial, graphic, photographic, multimedia and three-dimensional data. Furthermore, the amount of data managed will obviously increase further in the coming years. This requires careful analysis of standardization of formats and data storage. Obviously, in the short term digital publishing will not completely replace paper, but in this period the internet can become a functional support for scientific communication.

This idea of digital production as an aid to scientific communication is at the base of the collaboration with the Archaeological Mission in Armenia and in the Caucasus. In fact, it will be internet that will give access to high resolution tables, 3D models and information that will be published in the press articles for 2018.

Another great theme on which it is necessary to reflect is the re-use of data. To date the data, once published, remain very often forgotten on the PC or in a *hard disk*.

I believe instead that a multitude of information could be reused in different areas, both from the point of view of protection and the promotion of the territory. To date there are very few archaeological missions that really translate into a real enhancement of the territory, this is another of the answers that we want to provide through the technologies related to *OS-Culture.org*. Thanks to a responsible sharing of the excavation data, the territory and the social fabric that inhabits it can have an incredible return of image.

## 6.2- Conclusions

If we exceed this sense of distrust of the shared data management, internet probably could be one of the tools that would help the archaeologist to store data and to make them public.

Through the "*OS-Culture.org*" project, an attempt was made to develop a low-cost tool that would allow the complexity of archaeological research to be communicated: from excavation to the construction site, to laboratory study, to publication.

We think that in archaeology we need a cultural revolution that convinces scholars and professors to publish their research in a reasonable time, especially when the latter are financed by public funds.

Very often the lack of funds is just an excuse used to hide the lack of willingness to communicate data and information related to the cultural heritage of the Italy. The same feeling of protectionism is carried forward also in the field of public archaeology, where the Superintendents turn out to be the only owners of the data.

An interesting idea would be to involve the cooperatives and companies that materially perform the archaeological excavation work in the acquisition of data through a centralized *Geo - Portal* on the regional territory, allowing a reuse of data by the Territory and its local authorities. A job like this would streamline the work of archaeological companies and Superintendencies. Companies would have advantages and savings in the production of excavation documentation. The Superintendents, however, would have a considerable saving in the management of the archives of the cultural heritage of the Nation.

## 7. BIBLIOGRAPHY

BIANCHINI M., 2008. *Manuale di rilievo e di documentazione digitale in archeologia*, Aracne Editrice, Roma.

BOGDANI J., 2009. GIS per l'archeologia, in Giorgi E., *Groma 2: in profondità senza scavare*, Bologna, pp. 439-452.

CARANDINI A., 1981. *Storie della terra. Manuale di scavo archeologico*, Bari.

CATTANI M., 2008. Il percorso della conoscenza: applicazioni in archeologia tra ricerca e divulgazione, in De Felice G., Sibilano M.G., Volpe G., *L'informatica e il metodo della stratigrafia*, Edipuglia, Atti del workshop (Foggia 6-7 giugno 2008), pp. 25-37.

CLEUZIOU S., TOSI M., 2007. In the Shadow of the Ancestors. The Prehistoric Foundations of the Early Arabian Civilization in Oman. Muscat.

DAN R., 2015. The Kotayk Survey Project: Preliminary Report on 2015 Fieldwork Activities, Roma.

DAN R. 2015. From the Armenian Highland to Iran. A Study on the Relations between the Kingdom of Urartu and the Achaemenid Empire. Roma.

DAN R. 2016. The Kotayk Survey Project (KSP): Preliminary Report on 2016 Fieldworks Activities, Roma.

D'ANDREA A., 2011. *Il rilievo archeologico con il laser scanner: luci e ombre*. Fabrizio Serra Editore, Pisa-Roma.

- Distefano M., Ripanti F. 2013, Ricostruzioni, 3D e narrativa: strategie diversificate per la comunicazione dell'archeologia, in *Archeologia e Calcolatori* (Suppl. 4), ArcheoFoss, Atti del VI Workshop (Roma, 11-13 giugno 2012), pp. 174-180.
- FIORNI A., 2012. Tablet PC, fotogrammetria e PDF 3d: strumenti per documentare l'archeologia, *Archeologia e Calcolatori*, 23, 213-227.
- FRONZA V., 2009. *L'informatica e archeologia medievale. L'esperienza senese*, Edigiglio, Firenze.
- FRANCOVICH R., NARDINI A., VALENTI M. 2001. La piattaforma Gis dello scavo nella gestione di un'area cimiteriale, in Brogiolo G., *II Congresso Nazionale di Archeologia Medievale*, pp.28-36.
- MARIANI L., 1979, Problems and methods in resource mapping for the palaeoeconomic study of the Hilmand Valley in protohistoric times, in *South Asian European Archaeologist, Proceedings of the Congress*, Berlin, pp. 13-27.
- MIGNANI S., 2008. *Manuale ArcGis*, Dario Flaccovio Editore, Palermo.
- MEDRI M., 2003. *Manuale di rilievo archeologico*, La Terza Editore, Bari.
- PERIPIMENO M., SALVADORI F., 2005. *Modellazione tridimensionale. L'applicazione delle tecniche 3D laser scanning ai reperti archeologici ed architettonici*.
- RENFREW C. e BAHN P., 2016. *Archaeology: Theories, Methods, and Practice* (Sixth Edition), Thames & Hudson Ltd, London.
- SACCONI T., 2011. *Software Gis a confronto: il caso della Pieve di Santa Reparata, Terra del Sole (FC)*. Tesi di laurea triennale.

SALVATORI S.; TOSI M., 2008. *The Archaeological Map of the Murghab Delta III. The Bronze Age and Early Iron Age in the Margiana Lowlands: Facts and Methodological Proposals for a Redefinition of the Research Strategies*, British Archaeological Reports, Oxford.

SEMERARO G., 2008. Accedere allo scavo archeologico. Sistemi (e problemi) di elaborazione dei dati, in *L'informatica e il metodo della stratigrafia*, Edipuglia, Foggia, pp. 40-53.

TOSI M. 1972, *Iran, l'alba della civiltà*, Provinciali Spotorno, Milano.

TOSI M. 1983, Excavations at Shahr-i Sokhta 1969-70, in M. Tosi, *Prehistoric Sistan 1*, (*IsMEO Rep. Mem.* XIX, I), Rome, pp. 73-125.

TOSI M., 2002. Essays on the Late Prehistory of the Arabian Peninsula, Roma. Introduction", in Cleuziou S., Tosi M., Zarins J., *Essays on the Late Prehistory of the Arabian Peninsula*, (Serie Orientale Roma XCIII), Roma, pp. 9-27.

VALENTI M., 2000. La piattaforma GIS dello scavo nella sperimentazione dell'Insegnamento di Archeologia Medievale dell'Università di Siena. Filosofia di lavoro e provocazioni, modello dei dati e "soluzione GIS", *Archeologia e Calcolatori*, 11, pp. 93-109.

VALENTI M., 2004. Modello dei dati e trattamento del dato sul GIS di scavo, *Archeologia e Calcolatori*, Siena, 15, pp. 341-358.

## 8. SITOGRAPHY

<https://it.wikipedia.org/wiki/DBase>

[http://carnevalenrico.altervista.org/Immagini/icone/Icane%20Lezioni/6\\_1/revit.jpg](http://carnevalenrico.altervista.org/Immagini/icone/Icane%20Lezioni/6_1/revit.jpg)

<http://www.joomla.it/presentazione-joomla.html>

<http://www.michael-culture.org/>

<https://www.joomla.org>

[https://it.wikipedia.org/wiki/Plugin\\_\(informatica\)](https://it.wikipedia.org/wiki/Plugin_(informatica))

<https://www.flickr.com/photos/97303473@N02/albums>

<https://www.giscloud.com>

<http://www.rendercad3d.com>

<http://www.archicultura.it/>

<https://sketchfab.com/Di.Re-Cultura/models>

<https://www.dji.com/phantom-3-adv>

<https://www.sony.co.uk/electronics/interchangeable-lens-cameras/ilce-5100-body-kit>

<https://www.teamviewer.com/>

<http://os-culture.org/index.php/ravenna-cultura-e-turismo>

<http://os-culture.org/index.php/rimini-turismo-cultura>

<http://os-culture.org/index.php/firenze-arte-e-cultura>

<http://os-culture.org/index.php/montefeltro-di-pietra>

<http://os-culture.org/index.php/valorizzazione-del-patrimonio-culturale-di-poggio-san-marcello-an>

<http://os-culture.org/index.php/valorizzazione-di-lido-silvana-pulsano-ta>

<http://www.iran.os-culture.org/index.php/en/shahdad>

<http://www.maa-ismo.com>

<http://www.iae-nas.com>

<http://os-culture.org/index.php/fondo-tosi>

[www.sketchfab.com/Di.Re-Cultura/models](http://www.sketchfab.com/Di.Re-Cultura/models)

[https://it.wikipedia.org/wiki/Dati\\_aperti](https://it.wikipedia.org/wiki/Dati_aperti)

<http://www.mappaproject.org/>

<http://archeologiamedievale.unisi.it/miranduolo/lo-scavo/documentazione/web-gis>

<http://www.beniculturali.it/mibac/export/MiBAC/sito-MiBAC/MenuPrincipale/Trasparenza/Open-Data/index.html>

<http://www.unesco.beniculturali.it/index.php?it/121/open-data>

<http://iran.os-culture.org/index.php/en/shahr-i-sokhta>

<http://www.iran.os-culture.org/index.php/en/tepe-hissar>